Sarbajit Chaudhuri
Ujjaini Mukhopadhyay

Foreign Direct Investment in Developing Countries

A Theoretical Evaluation

Springer

Foreign Direct Investment in Developing Countries

Sarbajit Chaudhuri • Ujjaini Mukhopadhyay

Foreign Direct Investment in Developing Countries

A Theoretical Evaluation

Springer

Sarbajit Chaudhuri
Department of Economics
University of Calcutta
Kolkata, West Bengal
India

Ujjaini Mukhopadhyay
Department of Economics
Behala College
Kolkata, West Bengal
India

ISBN 978-81-322-1897-5 ISBN 978-81-322-1898-2 (eBook)
DOI 10.1007/978-81-322-1898-2
Springer New Delhi Heidelberg New York Dordrecht London

Library of Congress Control Number: 2014942650

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

This book is dedicated to Shilabati Chaudhuri.
She is no more, but her memories remain.

Foreword

With the inflow of FDI in developing countries picking up at a remarkable pace throughout the world, and the respective governments showing overwhelming enthusiasm in attracting FDI, it becomes necessary to ascertain the pros and cons of such inflows. Generally, it is believed that FDI is beneficial for a developing country and it may push the economy to higher growth orbits. However, developing countries are characterized typically by dualism and a host of market imperfections. In this situation, the favourable effects of FDI can hardly be guaranteed. In fact, a number of trade and development economists contend that FDI may lead to deterioration of welfare of the host country in the presence of tariff protection. It is important to determine the effects of FDI not only on overall welfare but on the labour market and other socio-economic issues.

Many of the above issues have been studied empirically by different researchers. Nonetheless, a detail theoretical analysis is vital to enable a clear understanding of the interactions of FDI with other variables, particularly in the presence of other types of liberalization policies. Though these issues have been addressed by different researchers in different papers, a comprehensive book dealing with the analytical and theoretical explanation hardly exists. This book will hopefully fill the gap since it incorporates the effects of FDI after introducing different kinds of distortions that developing countries are rampantly plagued with, like imperfections in the labour market, capital market and product market. It considers the cases where FDI enters the export sector as well as the import-competing sector. Other characteristics typical in developing countries like labour market segmentation, with the existence of skilled/unskilled labour, male/female labour and child labour have also been taken into account. Thus, although not exhaustive, the authors try to integrate FDI within most of the existing economic systems to find out its much-debated role in developing economies. The book is expected to be helpful not only to students and researchers but will help policy makers as well.

The senior author of the volume is a prolific researcher who has extensively published in reputed journals on these issues. Sustained commitment to this type of research is reflected in the extensive and intensive coverage of the book. The volume, in my opinion, will be a significant addition to the existing literature.

Reserve Bank of India Professor of Industrial Economics Sugata Marjit
Centre for Studies in Social Sciences, Calcutta (CSSSC)
Kolkata, India

Preface

Foreign direct investment (FDI) is traditionally considered in development literature as instrumental for economic growth of countries, particularly the developing ones. It acts as a panacea for breaking out of the vicious circle of low savings–low income and facilitates import of capital goods and advanced technical knowhow. The worldwide globalization drive in leading to liberalization of foreign capital regimes has resulted in a spurt in the presence of multinational corporations. The growth rate in absorbing FDI has been so fast during the recent years that in 2012, the developing economies have attracted more FDI flows than the developed economies accounting for 52 % of global FDI flows (UNCTAD 2013).

With FDI gaining so much prominence in the backdrop of liberalized investment policies, the welfare of developing economies ought to be significantly affected. Besides, these countries are subjected to phenomenal multi-dimensional impact on a host of other economic, social and environmental variables. The remarkable enthusiasm among developing countries to attract FDI, coupled with empirical results often contradicting the general contention of favourable effects calls for a close inspection into the diverse aspect and consequences of FDI on the host economy. A *theoretical* analysis of the different facets of FDI is indispensable, especially for formulation of appropriate policies for foreign capital.

In this book we attempt to delve into the complex interaction of FDI with different other factors. While FDI boosts up the efficiency of domestic producers, it impinges on the labour market affecting wages, unemployment levels, and wage inequalities on the basis of skill and gender; it also has important implications on the socio-economic issues like child labour, agricultural disputes over special economic zones (SEZ) and human capital formation through externalities. The empirical evidences with regard to most of the effects of FDI are highly mixed and reflect the fact that there exist a number of mechanisms that interact with each other producing opposing results. We try to provide the theoretical underpinnings behind the inherent contradictions and show that the final outcome depends on a number of country-specific factors like endowments of other production, technological, and institutional factors.

We give an outline of the established doctrines relating to FDI and elucidate on the newer ones to trace the nature and direction of desirable policy parameters that may be relevant in the present scenario. We incorporate the effects of FDI within the traditional Heckscher-Ohlin model and introduce different kinds of distortions that developing countries are rampantly plagued with, like imperfections in the factor markets and product market and presence of non-traded goods. We consider the cases where FDI enters not only the export and import-competing sectors but also the intermediate and services sectors. Other characteristics typical in developing countries like labour market segmentation, with the existence of skilled/unskilled labour, male/female labour and child labour have also been taken into account. Thus, although not exhaustive, we have tried to integrate FDI within the important existing economic systems to find out its much-debated role in developing economies.

Although a number of theoretical articles relating to FDI have been published in different journals, very few books address all the issues and dimensions related to FDI comprehensively in a simple theoretical and formal framework, as we do here. The major part of the book is based on Chaudhuri's own, and sometimes collaborative, research, carried out in Kolkata, India and published in different international journals over the last decade and a half. Throughout the book we have used the simple 'hat calculus' developed and popularized by R.W. Jones in his two seminal articles, Jones (1965, 1971). We felt the necessity to discuss in detail on extensions of the simple two-sector general equilibrium models, inclusion of non-traded goods and factor market imperfections and the techniques of measuring social welfare in a small open economy. All these give a future economist a thorough idea how simple general equilibrium models can readily be used to analyze different complex problems pertaining to the developing world and to suggest remedial measures based on findings of the theoretical models. The contents of the book can be a part of a course on trade and development at the postgraduate level. These can as well be a small part of a course on labour economics in universities in the developing world. Although the book is primarily intended towards postgraduate students and researchers who are pursuing theoretical research on trade and development, it is also aimed at suggesting alternative policies to policymakers in the developing nations for application to development projects.

The book was written over a period of more than 3 years. It was first, Sagarika Ghosh, Senior Editor, Springer (India) who came up with a proposal of writing a book based on policy-oriented theoretical research on the developing economies like India. After satisfactory progress in the first 2 years, Chaudhuri fell seriously ill and was practically out of his academic activities for several months. At that time, it looked impossible that the book could ever be completed. After his recovery Chaudhuri could finally complete the work at least to his satisfaction. He wishes to express his heartfelt gratitude to Profs. Sarmila Banerjee, Mahalaya Chatterjee and other colleagues at the Department of Economics, Calcutta University, and, to his former student, Dr. Jayanta Kumar Dwibedi, for their kind help during the most difficult phase of his life. He would like to thank Dr. Vivek Benegal, Dr. Deepak Jayarajan and other medical practitioners for the successful treatment he received at NIMHANS, Bangalore, India, which cured him and was instrumental in his return to normal academic life.

We express our indebtedness and gratitude to the people who have helped in shaping this book in one way or the other. Chaudhuri wishes to express his intellectual indebtedness to Profs. Sajal Lahiri, Manash Ranjan Gupta, Sugata Marjit, Shigemi Yabuuchi, Krishnendu Ghosh Dastidar, Ronald W. Jones, Kaushik Basu, Partha Sen, Abhirup Sarkar, Subhayu Bandopadhyay, Hamid Beladi, Arup Mallick, Ajit Choudhury, Soumyen Sikdar and Dr. Saibal Kar. His interactions with them either face-to-face or through electronic route have helped him immensely in understanding the applications of the simple general equilibrium models to trade and development. We are also indebted to our teachers at the Department of Economics, Calcutta University, for kindling our interest in the subject matter of economics. The senior author would also wish to thank Profs. Indrajit Ray, Arijit Mukherjee, Kausik Gupta and Dr. Biswajit Mandal for their continuous academic help over the last several years. He is also deeply indebted to his former doctoral students, Jayanta Kumar Dwibedi, Dibyendu Banerjee and Titas Kumar Bandopadhyay, and, to his wife, Pampa Chaudhuri, for helping him in the correction of proofs of the book. Thanks are also due to the publishers of different journals which allowed us to reproduce modified versions of some of our published papers. We appreciate the co-operation extended to us by Sagarika Ghosh, Senior Editor, Springer (India).

Finally, Chaudhuri wishes to thank his wife, Pampa, and daughter, Salonkara, for their inspiration to persevere under difficult times. He is grateful to his parents for their spiritual support. Mukhopadhyay would like to express gratitude to her husband, Dr. Ratnakar Pani and daughter, Mayurakshi, for their continuous encouragement and support. She remembers her parents who are no more, with deep gratitude, but whose blessings and guidance have been the motivating force behind her academic activities.

Kolkata, India Sarbajit Chaudhuri
10th March, 2014 Ujjaini Mukhopadhyay

Reference

UNCTAD (2013) World investment report: global value chains: investment and trade for development. New York/Geneva

Contents

About the Authors

Sarbajit Chaudhuri is a Professor with the Department of Economics, Calcutta University, Kolkata, India. He received his Ph.D. in 1995 from the Jadavpur University, Kolkata, working under the supervision of Professor Manash Ranjan Gupta. Ranked among the top 3 % authors of India and the top 5 % authors of Asia as per RePEc/IDEAS ranking (as of April 2014), he has published more than 70 research papers in journals of international repute, such as, *Journal of Development Economics, Economica, International Review of Economics and Finance, Review of International Economics, Review of Development Economics, Economic Modelling*, *Research in Economics, Japan and the World Economy, Pacific Economic Review, The Japanese Economic Review, The Manchester School, Bulletin of Economic Research, Journal of International Trade and Economic Development*, *Review of Urban and Regional Development Studies, The Economics of Transition*, among others. He has also authored books titled *Revisiting the Informal Sector: A General Equilibrium Approach* (Springer, New York) and *Some Aspects of Agricultural Credit in a Developing Economy* (Serials Publications, New Delhi). Professor Chaudhuri has served on the editorial boards of many journals. For his work, he was made an honorary member of the Canadian Economic Association, in 2006. His areas of interest include development economics, international economics, environmental economics, health economics, labour economics, agricultural economics and micro-economics.

Ujjaini Mukhopadhyay is an Assistant Professor with the Department of Economics at Behala College, Kolkata, India. She obtained her Ph.D. from Calcutta University, India, in 2005, working under the supervision of Prof. Sarbajit Chaudhuri. Her papers have been published in reputed journals such as *Journal of International Trade and Economic Development, Energy Policy, The Environmentalist, Review of Urban and Regional Development Studies*, to name a few. She has also co-authored a book titled *Revisiting the Informal Sector: A General Equilibrium Approach* (Springer, New York). Her current research interests include development economics, labour economics, and environment management.

Chapter 1
Role of FDI in Developing Countries: Basic Concepts and Facts

1.1 Introduction

International capital flows have gained significant momentum since the sweep of globalization in the early 1990s. Achievements of some of the East Asian countries in successfully exploiting foreign investment highlighted its role in creating enormous opportunities for developing countries to achieve accelerated economic growth and subsequently sparked off competition among countries to attract foreign investors. With domestic investment in an economy being circumscribed by changes in demand and technology, high profits and low interest rates, an external stimulus to investment is often felt imperative to boost capital formation in the economy. In case of the developing economies that are typically plagued by low levels of productivity leading to low levels of wages and hence low levels of savings and investment, again perpetuating the low productivity levels, an external injection in the form of foreign investment often acts as a vehicle to break away from the 'vicious circle'. It tends to supplement national savings, facilitate access to internationally available technologies and management know-how, raise efficiency and expand output so that the inward spiral turns to a trajectory of economic growth and prosperity.

With globalization, the diversified global market has become united, the investment sector has strengthened and countries have been increasingly allowing inflows of foreign investment. The developing, emerging and transition economies have been the foremost to liberalize their foreign capital regimes and pursue various policies to attract investment. Foreign investment can be in the form of both foreign direct investment (FDI) and foreign portfolio investment (FPI). Before proceeding further we elucidate on the differences between FDI and FPI.

S. Chaudhuri and U. Mukhopadhyay, *Foreign Direct Investment in Developing Countries: A Theoretical Evaluation*, DOI 10.1007/978-81-322-1898-2_1, © Springer India 2014

1.2 Foreign Direct Investment Versus Foreign Portfolio Investment

1.2.1 Foreign Direct Investment

According to the OECD Benchmark Definition of Foreign Direct Investment (1996), FDI implies the existence of a long-term relationship between the direct investor who is a resident entity in one economy and the direct investment enterprise, an entity resident in another economy, with a significant degree of influence of the investor on the management of the enterprise. Direct investment involves both the initial transaction between the two entities and all subsequent capital transactions between them and among affiliated enterprises.

OECD (1996) recommends that a direct investment enterprise be defined as an incorporated or unincorporated enterprise in which a foreign investor owns 10 % or more of the ordinary shares or voting power of an incorporated enterprise or the equivalent of an unincorporated enterprise. However, in some cases, the ownership of 10 % of the ordinary shares or voting power may not necessarily lead to the exercise of any significant influence, while, on the other hand, a direct investor owning less than 10 % may have substantial control over the management. Some countries consider that the existence of elements of a direct investment relationship may be indicated by a combination of factors such as representation in the board of directors, participation in policy-making processes, interchange of managerial personnel, access to technical information and provision of long-term loans at lower than existing market rates.

1.2.2 Foreign Portfolio Investment

Foreign portfolio investment refers to investors or investment companies that are not located within the territory of the country in which they are investing for the purpose of realizing a financial return, and which does not result in foreign management, ownership or legal control. These investors are outsiders in the financial markets of the particular company with no direct contact with the management of the company. The money pouring in through FPI is referred to as 'hot money' since the money can be taken out from the market at any time by these investors.[1]

[1]The types of institutions that are involved in foreign portfolio investment are mutual funds, hedge funds, pension funds, insurance companies, etc.

1.2.3 *Differences Between FDI and FPI*

FDI is primarily motivated with long-term realization of returns from an enterprise in a foreign country. It involves establishment of some physical entity such as a factory or setting up of a subsidiary or affiliate by the parent firm. All capital contributions like stock acquisitions, reinvestments of business profits by a parent firm in its foreign subsidiary or direct lending by a subsidiary company are included as FDI. There is an element of direct interest in the case of FDI since the foreign investor has an influence in the management and takes part in strategic decision-making.

On the other hand, FPI is essentially aimed at realizing short-term benefits and frequently adjusts to changing short-term conditions in the host country. In situations of unfavourable business conditions, FPI can be readily withdrawn while FDI has much less flexibility.

Empirical evidences show that the volatility of FDI net inflows is, in general, much smaller than that of FPI net inflows. For instance, in East Asian countries, FDI was remarkably stable during the global financial crises of 1997–1998, while short-term flows like portfolio equity and debt flows were subject to large reversals during the period (Dadush et al. 2000; Lipsey 2001).[2] Hence, countries aspiring for foreign investment into their country usually prefer FDI to FPI due to the highly volatile and erratic nature of the latter.[3] However, FDI can also be a source of financial instability. It can respond rapidly to short-term economic changes. As noted by Khor (2000), 'retained earnings' (or profit reinvestment) is a major form of FDI, and some of these are invested in financial assets rather than physical assets; changes in the rate and volume of reinvestment can result in fluctuation and instability of FDI flows. The World Bank has also pointed out that FDI can borrow funds locally in order to export capital, hence generating rapid capital outflow. In addition, evidences from Argentina, Indonesia and Korea show that FDI had a higher coefficient of variation than portfolio capital (Claessens et al. 1995). Empirical studies suggest that the differences in volatility between FPI and FDI flows are much smaller for developed economies than for developing economies (see, e.g. Lipsey 2000).

On the other hand, before undertaking any foreign investment project, the investor has to make a strategic choice between FDI and FPI. Since FDI requires higher investment-specific costs than FPI, the former cannot be readily adjusted, while FPI can be attuned immediately to short-term changes in the environment.

[2]Also see Chuhan et al. (1996), Frankel and Rose (1996), Sarno and Taylor (1999) and Albuquerque (2003).

[3]Some economists discard the scepticism regarding portfolio investment and suggest that in the long run, the volatility of growth due to FPI gets washed out and tends to be largely irrelevant; rather it is the average growth rate of the economy that is more important. For example, of all the big emerging markets of the nineteenth century, the United States relied mostly on portfolio flows while Argentina relied the most on foreign direct investment. But despite frequent financial crises and corporate bankruptcies, the United States grew faster.

However, as a result of the investors' control position, FDI yields a higher return than FPI. Hence, there is a trade-off between flexibility and higher return for firms deciding between FDI and FPI.

The share of FDI in total foreign equity flows is larger for developing countries than for the developed ones. This is mainly owing to the high production costs related to FDI in developed countries that make the projects less profitable while high transparency in developed economies makes FPI there more efficient.[4]

1.3 Modes of FDI

There can be different modes through which an MNE or a foreign investor undertakes the production process in the host country. It can choose between the following strategies: (1) greenfield investment, i.e. setting up a new foreign affiliate or plant in the host country to produce goods locally; (2) merger and acquisition (M&A), i.e. acquisition of a local firm and its production capacity; and (3) cooperation with a local firm by setting up a joint venture.

In greenfield investment, a parent company starts a new venture in a foreign country by constructing new operational facilities and acquiring new fixed assets. Moreover, it may also include all financial transfers from a multinational's headquarters to its subsidiary that may take the form of equity or loan financing.

Although merger and acquisition are often referred to as synonymous, there exist certain differences between them. In cross-border mergers, the assets and operations of two firms from different countries are combined to establish a new legal identity. Both companies' stocks are surrendered and new company stock is issued in its place. For example, with the merger of Glaxo Wellcome and SmithKline Beecham in 1999, both firms ceased to exist, and a new company, GlaxoSmithKline was created. In case of cross-border acquisitions, the control of assets and operations is transferred from a local to a foreign company (with the former becoming an affiliate of the latter). The target company legally ceases to exist, the buyer takes over the business and the buyer's stock continues to be traded. The purchases of Pharmacia Corporation by Pfizer Inc. and Bank One Corp by JP Morgan Chase & Co. are some of the important M&A deals worldwide in the recent years. Cross-border M&As can involve private firms only or can take the specific form of privatization, with the participation of foreign buyers.

Joint venture refers to a venture by a partnership or conglomerate designed to execute a particular business undertaking and share the profits, risk or expertise. The parties create a new entity by both contributing equity and then sharing the revenues, expenses and control of the enterprise. For example, Sony Ericsson is a joint venture by the Japanese consumer electronics company Sony Corporation and the Swedish telecommunications company Ericsson to produce mobile phones.

[4] Goldstein and Razin (2006) have developed a model that describes an information-based trade-off between direct investments and portfolio investments.

The choice between the different modes of FDI requires strategic decision-making. Although several studies examine the macroeconomic determinants of the aggregate FDI, very few of them clearly focus on the determinants of FDI via M&A (Rossi and Volpin 2004; Globerman and Shapiro 2005; di Giovanni 2005) or via greenfield investments. Most of the studies suggest that the choice of a cross-border M&A as a mode of entry into a foreign market is often influenced by the following: (1) firm-level factors such as multinational experience, local experience, product diversity and international strategy, (2) industry-level factors such as technological intensity, advertising intensity and sales force intensity and (3) country-level factors such as market size and growth in the host country and cultural differences between the home and host countries.

The interdependence in preferences between M&A and greenfield investment has been explored in a number of papers (see Horn and Persson 2001; Bjorvatn 2004 and Nocke and Yeaple 2007). Raff et al. (2009) include joint venture in the decision set and show that even if greenfield investment is a viable option and the other FDI modes involve sufficiently low fixed costs, the multinational may prefer a joint venture to M&A, and the latter to greenfield investment, if the fixed cost of greenfield investment is sufficiently large.

Since the 1990s, an increasingly large share of FDI flow has been through mergers and acquisitions (Kang and Johansson 2001; Letto-Gilles et al. 2001; Chen and Findlay 2002). This may be owing to the sweep of privatization of state enterprises that has been taking place due to economic reforms in most developing countries. A pertinent question in this context is that whether this trend of M&A would continue after the privatization process halts. Calderón et al. (2004) find that an expansion of M&A is indeed followed by an increase in greenfield FDI, the latter being substantially more in developing economies. The share of cross-border M&A in FDI has strikingly increased in industrial countries as well.

1.4 Magnitude of FDI

Most of the FDI flows originate from the OECD and other developed countries. Earlier, the lion's share went to the developed countries, which accounted for about 80 % of the recipients of the inflows (OECD 2002). The United States occupied a dominant position both as a foreign investor and as a recipient of direct investment. Its outflows in 2008 were USD 311 billion and inflows were USD 316 billion. However, the share of developing countries has been increasing since 2000[5] but

[5]The declining real interest rates in developed economies and the improved investment environment in developing countries following liberalization and economic reforms, including the decision to privatize state enterprises, have been instrumental in a surge in FDI to developing countries (see, e.g. Calvo and Reinhart 1996, Fernández-Arias and Montiel 1996, Fernández-Arias 2000, and Albuquerque et al. 2003).

is spread very unevenly, with two-thirds of total FDI flows from OECD members to non-OECD countries going to Asia and Latin America. There were some strong concentrations on a few countries, such as China[6] and Singapore in the case of Asia.

According to UNCTAD (2013), the developing countries accounted for a record 52 % of global FDI inflows, exceeding flows to developed economies for the first time ever in 2012. The global rankings show that 9 of the 20 largest recipients of FDI were developing countries. Among regions, flows to developing Asia and Latin America remained at historically high levels, but their growth momentum weakened.

Interestingly, the African countries fail to attract foreign investors. Particularly, FDI inflows to sub-Saharan Africa (SSA) have remained relatively sluggish compared to inflows to other developing regions of the world. During the 1990s, for instance, SSA attracted less than 1.5 % of the global FDI, while the East Asian economies and Latin America and the Caribbean received about 3.8 % and 10 % of total global FDI inflows, respectively. Studies show that despite high gross returns on investment in Africa, the effect is more than offset by high taxes and a significant risk of capital losses mainly due to macroeconomic instability, non-enforceability of contracts and physical destruction caused by armed conflicts. Other factors proposed in recent studies are the perception about sustainability of national economic policies, poor quality of public services and closed trade regimes. Moreover due to lack of effective regional trade integration, national markets have remained small and grown at a modest pace.[7] However, countries like Mozambique, Namibia, Senegal and Mali in the late 1990s had been able to attract FDI, apparently due to favourable domestic business climates, resulting primarily from government policies towards trade liberalization, the launch of privatization programmes, modernization of investment codes, adoption of international FDI agreements and development of a few priority projects of wider economic impact.[8]

Between 2001 and 2007, the SSA share of global FDI flows increased only marginally to about 2.3 %, while the shares of East Asia and Latin America and the Caribbean stood at about 4 % and 9 %, respectively. The continent (except South Africa) received FDI inflows worth an estimated US$ 8.2 billion in 2000, representing 0.6 % of total world FDI flows but reached US$50 billion in 2012, accounting for about 5 % of the global FDI flows. This indicates that Africa has been fast picking up in terms of FDI inflows. MNEs from the South are becoming

[6] Interestingly, in case of China, ASEAN and other developing countries account for a substantial part of FDI. Hong Kong is the foremost single investor and the newly industrialized economies are the largest investors as a group. Thailand, the Philippines, Malaysia and Indonesia have substantially increased their presence in China since the early 1990s. Among the developed countries, Japan and the United States have been the most important investors in China. The other developed countries have made rather small amounts of investment in China, even though they have increased in recent years.

[7] The few studies that focus on the determinants of FDI in Africa include Chaudhuri and Srivastava (1999), Morisset (2000), Bende-Nabende (2002), Asiedu (2006) and Naudé and Krugell (2007).

[8] See OECD Report (2002).

increasingly active in Africa, building on a trend in recent years of a higher share of FDI flows to the region coming from emerging markets. In terms of FDI stock, Malaysia, South Africa, China and India are the largest developing-country investors in Africa.

1.5 Types of FDI

The theoretical foundations for understanding the behaviour of the multinational enterprises (MNEs) with respect to their forms of foreign investment were set initially by Markusen (1984) and Helpman (1984). Markusen (1984) developed a model of horizontal FDI where market-seeking MNEs set up a plant to produce and sell in a different country to avoid trade costs such as transportation and tariffs. On the other hand, in the model of vertical FDI, resource-seeking MNEs cut their production costs by taking advantage of different factor prices across countries (Helpman 1984). While vertical FDI is trade increasing, horizontal FDI tends to be trade reducing.

Vertical FDI has gained importance after the wave of globalization, particularly in the form of cross-border fragmentation where MNEs locate their affiliates in a country which has the comparative advantage in assembly process. They thus get engaged in production-process-wise vertical division of labour, with the intermediate products being exported back. The intra-firm transactions in automobile industry between the US MNEs and their assembly plants in Mexico constitute an appropriate example.

The later studies combined the two (horizontal and vertical) models into a knowledge-based model of FDI (Carr et al. 2001; Markusen 2002; Markusen and Maskus 2002). These explain FDI operations where research and development, as well as other skilled-labour-intensive or knowledge-intensive activities, are geographically separated from production, which implies that skill-based activities can be supplied at low cost to a number of production locations (Carr et al. 2001). All these general equilibrium models are set in a simple two-country framework, where the locational choices of FDI are based on home and host-country characteristics.

However, such 'traditional' theories fail to explain the cases where MNEs extend their production or distribution networks in a number of countries. In order to explain the FDI decisions by MNEs involving multi-country locations, FDI theories have been reconstructed in the three-country framework (Grossman et al. 2006; Baltagi et al. 2007; Ekholm et al. 2007). Baltagi et al. (2007) refers to two types of FDI that include third-country effects: export platform and complex vertical. MNEs are believed to follow an export platform model of FDI when foreign affiliates of MNEs export most of their output so that the local market in the host country is of no significance to their location decision. An appropriate example is a European firm producing in Mexico to serve the integrated North American market. On the other hand, the complex vertical model of FDI represents a pattern of production where an MNE sets up its vertical chain of production across multiple countries to exploit the differences in location advantages. When an MNE locates its affiliate at another country, it gets engaged in vertical division of labour between the two countries. Now if production processes in the host country can be fragmented, and a part of the process is relocated to a third country, which has comparative advantages in producing that part, then the MNE has two affiliates and gets engaged in three-country vertical division of labour. Most of the Japanese FDI in the information and communication, electronics equipment and the electronic parts and devices in East Asia is complex vertical.

1.6 Determinants of FDI

The general contention among economists and policymakers that FDI inflows are both a source and a consequence of productive efficiency has stimulated an apparent virtuous circle of competition among countries to attract FDI. On the other hand, reaching the foreign markets through direct investments has become increasingly appealing to investors. However, the fundamental determinants of FDI are highly controversial. The vast empirical literature that has developed so far does not provide conclusive evidence (Markusen 2002). The current movement of FDI flow is extremely complex, and the motivation behind relates to a wide variety of factors related to the competitive environment in which the firms operate, to their specific characteristics and to economic factors in the home and host countries.

The most fundamental question about FDI is why a firm would choose to serve a foreign market through affiliate production, rather than other options such as exporting or licensing arrangements. Secondly, what are the criteria that determine the investor firm's location decisions? In the literature, the determinants of FDI has been analysed broadly from the perspectives of partial equilibrium and general equilibrium. The partial equilibrium studies examine the internal firm-specific factors that motivate a firm to become an MNE, while studies based on general equilibrium examine the external factors that are likely to determine the location and magnitude of direct investment by MNEs.

One of the first theoretical studies of the determinants of FDI was by Ohlin (1971) who asserted that FDI is motivated mainly by the potential of high profitability in growing markets, along with the possibility of financing these investments at relatively low rates of interest in the host country. Partial equilibrium analysis suggests that FDI is better than direct exports or licensing of production to local firms since the obstacles to exports such as tariffs, transport costs and exchange rate volatility can be avoided and the presence of firm-specific assets like technologies, managerial skills and know-how can be exploited. Thus, FDI may be viewed as a vent to internalize trade costs and externalities from firm-specific assets.[9]

[9]See Blonigen (2005) and Artige and Nicolini (2006) for a detailed exposition on the studies of determinants of FDI based on partial equilibrium framework.

Hymer (1976) showed that firms would prefer to supply the foreign market by way of direct investments when they can compete with the local firms having better knowledge of the local market, due to their compensatory advantage on being multinationals. This can happen when there exist imperfect competition in commodity market (e.g. product differentiation) and factor markets (e.g. access to patented or proprietary knowledge), internal or external economies of scale and governmental intervention (e.g. restriction on imports). Kindleberger (1969) added that the monopolistic competitive market structure also determines the behaviour of multinationals; on the other hand, Caves (1971) claimed that FDIs are made basically in sectors that are dominated by oligopolies. In the presence of product differentiation, (horizontal) investments will occur in the same sector, while with no product differentiation, (vertical) investments will be made in sectors within the productive chain of firms. Thus, the hypothesis of direct investment being determined by specific assets that compensate the initial disadvantage faced by foreign firms in relation to local firms went on to become the HKC tradition, named after Hymer, Kindleberger and Caves.

Buckley and Casson (1976, 1981) developed the hypothesis of transaction cost internalization, where imperfect intermediate product markets have high transaction costs when managed by different firms, while these costs would be minimized if markets were integrated by multinationals.

As already mentioned in the previous section, the general equilibrium models typically identify two main motivations why a firm would like to make direct investments in foreign countries. The first one is the market-seeking FDI, which is motivated to avoid trade frictions like tariffs and transport costs.[10] The second is the production cost-minimizing FDI that seeks to have access to lower-cost inputs. Dunning (1993) added two more motivations, natural resource-seeking FDI and strategic asset-seeking FDI looking for technology, skills or brand names.

Dunning (2001) developed a paradigm known as OLI (Ownership, Location, Internalization). It claims that for FDI to take place, three conditions must be fulfilled simultaneously. The multinationals must have (1) an ownership advantage, i.e. they need to have some firm-specific asset (e.g. tangible assets like products and technology and intangible assets like patents that differentiate them from domestic firms to compensate for the extra costs in terms of local knowledge that a foreign firm must incur to operate in foreign markets); (2) locational advantage in both home and host countries like low production costs so that a multinational invests in one country but not in another; and (3) internalization advantage arising due to internalizing business contacts and not to outsource.

[10]Earlier when local industries were heavily protected, FDI used to be an effective means to circumvent import barriers. But with liberalization of import regime of large number of developing countries, MNCs can choose between exporting and undertaking FDI. As a consequence, purely market-seeking FDI may decline (UNCTAD 1996). However, there is no conclusive evidence in support of this. It can be argued that the decline in market-seeking FDI may be limited to only manufacturing, which again may be counteracted by regional integration that increases market size and enhances economic growth (UNCTAD 2000).

On the other hand, three broad factors determine the production location choice of multinationals: the trade restrictions and other policies of host countries, the proactive measures that countries adopt to promote and facilitate investment and the characteristics of their economies (for more details, see UNCTAD 1998). In this respect, the decision of firms to invest abroad is a counterpart to the international trade and investment policies of the countries involved. Also, institutional variables are major determinant of inward FDI. These include low level of economic, social and political risks, government stability, democratic accountability, functioning of bureaucracy, stable and reliable, transparent legal and regulatory framework, easiness to create a company, lack of corruption, transparency, enforcement of contract law, security of property rights, efficiency of justice and prudential standards (See Dumludag et al. 2007 and Quéré et al. 2007).

While overall stability and liberalization of national FDI regulations are necessary, these may not be sufficient to induce FDI. Multinationals tend to take more liberal FDI regimes for granted and consider the convergence of FDI regimes to be the natural consequence of globalization. As a result, openness to FDI may be characterized by diminishing returns. It is observed that privatization of state-owned enterprises that couples with economic reforms have been successful in inducing FDI in many developing countries, including Latin American countries and transition economies in Central and Eastern Europe. Privatization has led to the rising share of FDI in services and the growing importance of M&As, as opposed to greenfield investment. Reinvestment of earnings of firms acquired by foreign investors through privatization may produce significant additional investment in the rationalization and modernization of privatized firms. Privatization also sends an optimistic signal regarding the government's commitment to economic reform.

The locational choice also depends on the type of FDI. The resource-seeking MNCs are more selective on the grounds of accessibility of raw materials; complementary factors of production, mainly labour; and nature and quality of physical infrastructure. The most important factor to attract market-seeking FDI is the size and growth of the host country, while the efficiency-seeking FDI mainly looks for cost competitiveness. Countries with larger market size, faster economic growth and higher degree of economic development have the potential to provide more and better opportunities for marketing. They can also provide larger economies of scale and spillover effects. For the efficiency-seeking MNCs, productivity-adjusted labour costs, availability of sufficiently skilled labour, business-related services and trade policy reflecting the degree of openness and the exchange rates are vital. The degree of development of host countries is also important since it is positively related to domestic entrepreneurship, education level and local infrastructure.

1.7 Outward Flow of FDI from Developing Countries

The neoclassical school of thought considers that international capital flows are instrumental in closing the savings gap in developing countries (e.g. Chenery and Bruno 1962). According to the Heckscher–Ohlin approach to trade by

Mundell (1957), capital is expected to flow from capital-abundant developed countries to capital-scarce developing countries, due to the opportunities to obtain higher returns on investment.

But, in recent years there has been substantial outflow of FDI from developing and emerging countries. According to UNCTAD (2007), the rise in FDI outflows from developing economies has been from US$ 35.6 billion in 2003 to US$ 174 billion in 2006. The share of developing economies in global FDI outflows has also risen from 6.3 % in 2003 to 35 % in 2012 (UNCTAD 2013). Investors from South, East and Southeast Asia and Latin America are the major drivers for the strong growth in FDI outflows. Brazil, Russian Federation, China[11] and India[12] remain the leading sources of FDI among emerging investor countries, accounting for 10 % of the world total. Asian countries remained the largest source of FDI, accounting for three quarters of the developing-country total (UNCTAD 2013).

While earlier episodes of outward flow of capital from developing countries involved mainly the newly industrializing economies (NIEs) of Asia, and some Latin American and West Asian economies, subsequently, a wide range of developing countries, such as Argentina, Chile, India, Malaysia, Nigeria, South Africa, Thailand, Turkey and Venezuela, the Russian Federation as well as several lower-income economies also have been venturing for direct investments abroad. FDI inflows to least developed countries (LDCs) also hit a record high, an increase led by developing-country MNEs, especially from India (UNCTAD 2013).

While outward direct investment can play an important role in enhancing the global competitiveness of firms from developing economies by providing access to strategic assets, technology, skills and natural resources and markets, investment flows between developing economies serve to enhance South–South cooperation. FDI from developing countries to other developing countries seems to be growing faster than that from developing countries to developed countries.

There is an emerging literature on FDI flows from developing economies, which suggests that these flows may differ from those of developed economies (Filatotchev et al. 2007). There has been increased discussion and analyses of the motivation and implications of the presence of developing countries MNC. Lecraw (1977) was possibly the first to study the characteristics of developing countries' overseas firms and found that they tend to use labour-intensive technology and produce for both domestic and international markets. On the basis of Dunning's (1977) paradigm of OLI advantages, other studies sought to identify the advantages derived by developing countries' multinational firms. According to Wells (1983) although the multinational firms from developing counties enjoy the same basic

[11]Some of the important acquisitions by Chinese firms are that of IBM PC by Lenovo, France's Thomson Electronics by TCL and United Kingdom's MG Rover Group by Nanjing Automobile.

[12]Some of the major acquisitions of overseas firms by Indian firms are of the Brazilian firm Petrobas by ONGC in 2006, Stokes Group of the United Kingdom by Mahindra and Mahindra in 2006, US firm Infocrossing by Wipro Ltd in 2007, Corus Steel of the United Kingdom by Tata Steel in 2007 and South African firm MTN by Bharti Airtel in 2009, to name only a few.

advantages as those from developed countries, they are derived from different sources. For example, the ownership advantage for FDI from developing countries originates from technology and management expertise that are suitable or adaptable to local conditions in other developing countries, in contrary to the advantages due to sophisticated technology in case of FDI from developed countries. Such adapted advantages may facilitate multinational firms from developing countries in overcoming the disadvantages in host countries so that they are likely to initially choose countries with economic and cultural similarities and geographic proximity (Lall 1983; Tolentino 1993). They can invest on a relatively large scale in more developed and geographically distant countries only after having gaining adequate international experience through overseas operations (Riemens 1989; Dunning and Narula 1996). However, these studies have been criticized on the ground that since they are based on the OLI approach erected on the observations of American and British experiences, they are likely to be unable to capture the unique characteristics of multinational firms from developing countries (Yeung 1998).

An alternative approach to that of OLI framework have been adopted in a number of studies that examine outward FDI from developing countries in light of its relation to both economic development and knowledge and innovation transfer or spillover. Dunning (1981, 1986) in his investment development path (IDP) theory argued that a country's outward and inward FDI position is related to its level of economic development. A country will initially experience increasing FDI inflows and then generate enlarged outward FDI as its economy grows and its income increases (Dunning and Narula 1996). In many cases outward FDI from developing countries has been undertaken as an effective means to access localized innovative assets and capabilities (Cantwell 1989; Wesson 1993; Dunning 1998; Porter 1998). Such asset-seeking FDI tries to enhance its dynamic competitive advantage by strategically locating itself around geographically dispersed local innovation centres. The FDI surge has also partly been fuelled in some countries by soaring export revenues from manufactured products and natural resources, which have contributed to building up the financial strength needed to engage in overseas investment.

The push factors behind the rise in South–South flows are growing wealth in emerging markets, rising cost of labour and non-tradables, breaking up of domestic monopolies, new technology and communications leading to improved information sharing and reduced transaction costs, strategic desire to procure inputs such as oil, capital account liberalization regarding outward FDI, changes in trade barriers, regional trade agreements and government policies encouraging outward FDI. The pull factors include large and growing markets, geographical proximity, ethnic and cultural ties, supply of cheap labour, abundance in raw materials, incentives in host countries, the ability to use domestic skilled labour to design and operate projects abroad at low cost and to lower the costs of technical personnel and management preferential treatment of foreign companies and export markets through preferential treatment (Aykut and Ratha 2003; Athukorala 2009).

The FDI outflow to developed host countries may be explained in terms of their relatively higher growth rates and larger markets. Tariff-jumping[13] is also projected as a significant motive behind FDI, in cases of, for example, Brazil to Europe, from Asia to Europe (see Kumar 1995; Page 1998).

However, it would be an oversimplification to assert that the internationalization of developing-country firms is underpinned by a common set of competitive advantages. The determinants are often country specific and firm specific. For example, Chinese FDI[14] is attracted to countries with bad institutions (Buckley et al. 2007), natural resources (Cheung and Qian 2008), high GDP and cultural proximity to and a common border with China (Cheng and Ma 2008). On the other hand, the availability of a pool of managers and technicians was found to be by far the main source of their competitive edge for the Indian firms. On the other hand, the relative importance of developed and developing economy in Indian FDI destination depends on the product categories. Indian multinationals that are motivated to exploit their local technological advantages operate predominantly in developing economies, like in case of standard manufacturing products (such as automobiles, textiles and chemicals). In contrast, firms with domestic labour cost advantage and managerial talents target developed economies, for example, in information technology (IT) support and related activities (Ramamurti and Singh 2008).

1.8 Economic Recession and FDI

The recent global financial crisis, initiated in 2008, has made quite a colossal impact on the international investment scenario. The capacity of companies to invest has been weakened by reduced access to financial resources, both internally and externally, and their propensity to invest has been severely affected by shrunken growth prospects and burgeoning risks. The recession began in the developed world and spread rapidly to developing and transition economies. There has been wide variation in its economic impact, depending on region and country. UNCTAD estimates show that FDI inflows suffered a one-third contraction in many developed countries in 2008, mainly as a result of the protracted and deepening problems affecting financial institutions and liquidity crisis in financial markets. The decline in inflows has been particularly significant in countries such as Finland, Germany, Hungary, Italy and the United Kingdom. However, there is still certain optimism since the financial crisis and the impending difficult economic period may create good opportunities for companies to buy bargain assets, which can help promote cross-border M&As.

---

[13]Tariff-jumping implies that countries with higher tariff tend to have higher return on capital, so that it becomes profitable for a foreign investor to invest in that country. In other words, there is a positive correlation between the tariff rate imposed in a country and the amount of FDI it attracts.

[14]There is considerable literature on Chinese outward FDI. One can look at Cai (1999), Hong and Sun (2004), Child and Rodrigues (2005), etc.

In developing and transition economies, preliminary estimates suggest that FDI inflows have been more resilient, though the worst impact of the global economic crisis had been transmitted to these countries. According to the OECD investment news (2009), in 2008, international investment in many emerging economies continued to grow. For example, cross-border mergers and acquisitions into the largest emerging economies (Brazil, Russia, India, Indonesia, China and South Africa) increased by 5 %, while they declined by 26 % in the OECD countries.

The further deterioration of the global economic situation in 2012, in particular the deepening of the crisis in the Eurozone and the slowing of growth in the emerging economies depressed the investors' cross-border investment initiatives. The primary sector was the most heavily hit in relative terms, in both greenfield projects and cross-border M&As, the contraction being particularly striking in developing countries. The manufacturing sector suffered the largest decline in FDI, particularly in the form of greenfield projects across developed, developing and transition economies. However, services turned out to be the sector least affected, whereby business services, transport, storage and communication sectors managed to preserve their volume of FDI projects. In fact, for the first time since the onset of the crisis in 2008, the construction industry registered an increase in both the value and the number of FDI projects. This shows that international companies are still actively seeking opportunities, though with less aggression, to expand their service activities especially into developing countries, offering reassurance about the fundamental resilience of highly strategic services industries (UNCTAD 2013).

References

Albuquerque R (2003) The composition of international capital flows: risk sharing through foreign direct investment. J Int Econ 61:353–383

Albuquerque R, Loayza N, Servén L (2003) World market integration through the lens of foreign direct investment. Mimeo/World Bank, Washington, DC

Artige L, Nicolini R (2006) Evidence on the determinants of foreign direct investment: the case of three European regions, Working paper 2006/07, centre for research in economics and population economics. University of Liege, Bellaterra

Asiedu E (2006) Foreign direct investment in Africa: the role of natural resources, market size, government policy, institutions and political instability. World Econ 19(1):63–77

Athukorala P (2009) Outward foreign direct investment from India. Asian Dev Rev 26(2):125–153

Aykut D, Ratha D (2003) South-South FDI flows: how big are they? Transl Corp 13:149–176

Baltagi B, Egger P, Pfaffermayr M (2007) Estimating models of complex FDI: are there third-country effects? J Econ 140(1):260–281

Bende-Nabende A (2002) Foreign direct investment determinants in Sub-Saharan Africa: a cointegration analysis. Econ Bull 6(4):1–19

Bjorvatn K (2004) Economic integration and the profitability of crossborder mergers and acquisitions. Eur Econ Rev 48:1211–1226

Blonigen BA (2005) A review of the empirical literature on FDI determinants. Atl Econ J 33(4):383–403

Buckley PJ, Casson MC (1976) The future of the multinational enterprise. Homes/Meier, London

Buckley PJ, Casson MC (1981) The optimal timing of a foreign direct investment. Econ J 91:75–87

Buckley PJ, Clegg LJ, Cross AR, Liu X, Voss H, Zheng P (2007) The determinants of Chinese outward foreign direct investment. J Int Bus Stud 38:499–518

Cai KG (1999) Outward foreign direct investment: a novel dimension of China's integration into the regional and global economy. China Q 160:856–880

Calderón C, Loayza N, Servén L (2004) Greenfield foreign direct investment and mergers and acquisitions: feedback and macroeconomic effects. World Bank policy research working paper 3192. Washington, DC

Calvo S, Reinhart C (1996) Capital flows to Latin America: is there evidence of contagion effects? In: Calvo G, Goldstein M, Hochreiter E (eds) Private capital flows markets after the Mexican crisis. Institute for International Economics/Austrian National Bank, Washington, DC/Vienna

Cantwell J (1989) Technological innovation and multinational corporations. Basil Blackwell, Oxford

Carr DL, Markusen JR, Maskus KE (2001) Estimating the knowledge-capital model of the multinational enterprise. Am Econ Rev 91:69–708

Caves RE (1971) International corporations: the industrial economics of foreign investment. Economica 38:1–27

Chaudhuri K, Srivastava DK (1999) Dearth of private capital flows in Sub-Saharan Africa. Appl Econ Lett 6(6):365–368

Chen C, Findlay C (2002) A review of cross-border mergers & acquisitions in APEC. The Australian National University/Mimeo, Canberra

Chenery HB, Bruno M (1962) Development alternatives in an open economy: the case of Israel. Econ J 72(285):79–103

Cheng LK, Ma Z (2008) China's outward foreign direct investment. Paper presented at the Indian Statistical Institute, 12 December 2008. http://www.isid.ac.in/~pu/seminar/12_12_2008_Paper.doc

Cheung YW, Qian XW (2008) The empirics of China's outward direct investment. CESifo GmbH, Munich

Child J, Rodrigues SB (2005) The internationalization of Chinese firms: a case for theoretical extension? Manag Organ Rev 1(3):381–410

Chuhan P, Perez-Quiros G, Popper H (1996) Do short-term investment and direct investment differ? World Bank policy research working paper 1669. Washington, DC

Claessens S, Dooley MP, Warner A (1995) Portfolio capital flows: hot or cold? World Bank Econ Rev 9(1):153–174

Dadush U, Dasgupta D, Ratha D (2000) The role of short-term debt in recent crises. Financ Dev 37:54–57

di Giovanni J (2005) What drives capital flows? The case of cross-border M&A activity and financial deepening. J Int Econ 65:127–149

Dumludag D, Saridogan E, Kurt S (2007) Determinants of foreign direct investment: an institutionalist approach. Working paper. http://www.ekh.lu.se/ehes/paper/devrim_dumludag_EHES2007_paper.pdf

Dunning JH (1977) Trade, location of economic activities and the MNE: a search for an eclectic approach. In: Ohlin B, Hesselborn PO, Wijkman PM (eds) Proceedings of a nobel symposium held at Stockholm. Macmillan, London, pp 395–431

Dunning JH (1981) Explaining the international direct investment position of countries: toward a dynamic or developmental approach. Weltwirtschaftliches Arch 117(1):30–64

Dunning JH (1986) The investment development cycle revisited. Weltwirtschaftliches Arch 122:667–677

Dunning JH (1993) Multinational enterprises and the global economy. Addison-Wesley Publishing Company, Reading

Dunning JH (1998) Location and the multinational enterprises: a neglected factor? J Int Bus Stud 29:45–67

Dunning JH (2001) The eclectic (OLI) paradigm of international production: past, present and future. Int J Econ Bus 8(2):173–190

Dunning JH, Narula R (1996) The investment development path revisited: some emerging issues. In: Dunning JH, Narula R (eds) Foreign direct investment and governments: catalysts for economic restructuring. Routledge, London, pp 1–41

Ekholm K, Forslid R, Markusen J (2007) Export-platform foreign direct investment. J Eur Econ Assoc 5(4):776–795

Fernández-Arias E (2000) The new wave of capital inflows: sea change or tide? Working paper no. 415. Inter-American Development Bank, Washington, DC

Fernández-Arias E, Montiel PJ (1996) The surge in capital inflows to developing countries: an analytical overview. World Bank Econ Rev. Reprinted in Milner C (ed) (1997) The globalization of the world economy: developing and newly industrializing countries. Edward Elgar, London

Filatotchev I, Strange R, Piesse J, Lien YC (2007) FDI by firms from newly industrialised economies in emerging markets: corporate governance, entry mode and location. J Int Bus Stud 38:556–572

Frankel JA, Rose AK (1996) Currency crashes in emerging markets: an empirical treatment. J Int Econ 41:351–366

Globerman S, Shapiro D (2005) Assessing international mergers and acquisitions as a mode of foreign direct investment. In: Eden L, Dobson W (eds) Governance, multinationals and growth, New horizons in international business. Edward Elgar, Cheltenham/Northampton, pp 68–99

Goldstein I, Razin A (2006) An information-based trade off between foreign direct investment and foreign portfolio investment. J Int Econ 70:271–295

Grossman G, Helpman E, Szeidl A (2006) Optimal integration strategies for the multinational firm. J Int Econ 70:216–238

Helpman E (1984) A simple theory of international trade with multinational corporations. J Polit Econ 92:451–472

Hong E, Sun L (2004) Go overseas via direct investment: internationalization strategy of Chinese corporations in a comparative prism. Centre for Financial and Management Studies/SOAS/University of London, London

Horn H, Persson L (2001) The equilibrium ownership of an international oligopoly. J Int Econ 53:307–333

Hymer SH (1976) The international operations of national firms: a study of foreign direct investment. The MIT Press, Cambridge

Kang NH, Johansson S (2001) Cross-border mergers and acquisitions: their role in industrial globalization, STI working paper 2000/1. OECD/Mimeo, Paris

Khor M (2000) Globalisation and the South: some critical issues. UNCTAD discussion paper no. 147. Geneva

Kindleberger CP (1969) American business abroad: six lectures on direct investment. Yale University Press, New Haven

Kumar N (1995) Changing character of foreign direct investment from developing countries: case studies from Asia, Intech discussion paper 9516. UN Intech, Maastricht

Lall S (ed) (1983) The new multinationals: the spread of third world enterprises. Wiley, New York

Lecraw D (1977) Direct investment by firms from less developed countries. Oxf Econ Pap 29(3):442–457

Letto-Gilles G, Meschi M, Simonetti R (2001) Cross-border mergers and acquisitions: patterns in the EU and effects. South Bank University/Mimeo, London

Lipsey RE (2000) Inward FDI and economic growth in developing countries. Transl Corp 9(1): 67–95

Lipsey RE (2001) Foreign direct investors in three financial crises, NBER working paper 8084. National Bureau of Economic Research, Cambridge, MA

Markusen JR (1984) Multinationals, multi-plant economies, and the gains from trade. J Int Econ 16:205–226

Markusen JR (2002) Multinational firms and the theory of international trade. MIT Press, Cambridge

Markusen JR, Maskus KE (2002) Discriminating among alternative theories of the multinational enterprise. Rev Int Econ 10(4):694–707

Morisset P (2000) Foreign direct investment to Africa: policies also matter. Transnatl Corp 9(2):107–125

Mundell RA (1957) International trade and factor mobility. Am Econ Rev 47:321–335

Naudé WA, Krugell WF (2007) Investigating geography and institutions as determinants of foreign direct investment in Africa. Appl Econ 39(10):1223–1233

Nocke V, Yeaple S (2007) Cross-border mergers and acquisitions vs. greenfield foreign direct investment: the role of firm heterogeneity. J Int Econ 72:336–365

OECD (1996) Benchmark definition of foreign direct investment (3rd Edition). Paris, France

OECD (2009) Investment policy perspectives. Organisation for Economic Co-operation and Development, Paris

OECD Report (2002) Foreign direct investment for development: maximising benefits, minimising costs. Organisation for Economic Co-operation and Development, Paris

Ohlin B (1971) Comercio Interregional e Internacional. Oikos, Barcelona (orig. 1933)

Page S (1998) South-north investment by developing countries in the EC: a sign of the emergence of new investors. In: Hickman BG, Klein L (eds) Link 1991–1992 proceedings. World Scientific, Singapore

Porter M (1998) On competition. Harvard Business School Press, Cambridge, MA

Quéré A, Coupet M, Mayer T (2007) Institutional determinants of foreign direct investment. World Econ 30:764–782

Raff H, Ryan M, Stähler F (2009) The choice of market entry mode: greenfield investment, M&A and joint venture. Int Rev Econ Financ 18(1):3–10

Ramamurti R, Singh JV (2008) Indian multinational: generic internationalization strategies. In: Ramamurti R, Singh JV (eds) Emerging multinational from emerging markets. Cambridge University Press, Cambridge

Riemens P (1989) On the foreign operations of third world firms. Koninklijk Nederlands Aardrijkskundig Genootschap, Insituut voor Sociale Geografie, Faculteit Ruimtelijke Wetenschappen, Universiteit van Amsterdam, Amsterdam

Rossi S, Volpin P (2004) Cross-country determinants of mergers and acquisitions. J Financ Econ 74:277–304

Sarno L, Taylor MP (1999) Hot money, accounting labels and the permanence of capital flows to developing countries: an empirical investigation. J Dev Econ 59:337–364

Tolentino PE (1993) Technological innovation and third world multinationals. Routledge, London

UNCTAD (1996) World investment report. United Nations, New York

UNCTAD (1998) World investment report: trends and determinants. United Nations, New York

UNCTAD (2000) FDI determinants and TNC strategies: the case of Brazil. United Nations, New York

UNCTAD (2007) World investment report: transnational corporations, extractive industries and development. United Nations, New York/Geneva

UNCTAD (2013) The world investment report: global value chains: investment and trade for development. United Nations, New York

Wells LT (1983) Third world multinationals: the rise of foreign direct investment from developing countries. MIT Press, Cambridge, MA

Wesson TJ (1993) An alternative motivation for foreign direct investment. Unpublished doctoral dissertation, Harvard University

Yeung H (1998) Transnational corporations and business networks: Hong Kong firms in the ASEAN region. Routledge, London

Chapter 2
General Equilibrium Models: Usefulness and Techniques of Application

2.1 Introduction

The general equilibrium theory is a branch of theoretical economics that seeks to explain the behaviour of supply, demand and prices in an economy with many interacting markets. It intends to prove that there exist a set of prices that result in an overall (hence general) equilibrium, in contrast to partial equilibrium, which only analyses single markets. As is the case with all models, this is an abstraction from the real economy; nevertheless, it is depicted as a useful model that considers equilibrium prices as long-term prices and actual prices as deviations from equilibrium prices.

The effects of an FDI (perhaps of other parametric variations as well) in the developing economies are better studied in a general equilibrium framework rather than in a partial equilibrium framework. An FDI drives other resources towards the capital-receiving sector(s) from the other sectors including non-traded sectors of the economy, thereby affecting the prices of the non-tradables. The inherent interrelationships between different sectors determine which sectors would expand and which ones would contract. The sector that has a complementary relationship with the capital-receiving sector is likely to expand, while the sector that acts as a substitute should contract. An FDI is expected to affect all the key variables of the economy including social welfare, unemployment of labour, poverty and income inequalities, degrees of factor market distortions and human capital formation. It is not possible to study all these effects together by using a partial equilibrium framework, since it concentrates only on one market at a time.

Hence, for a comprehensive discussion in the subsequent chapters of the book, we follow the simple general equilibrium techniques as developed and popularized by R. W. Jones in his two highly influential articles, Jones (1965, 1971). While Jones (1965) deals with the 2×2 Heckscher–Ohlin–Samuelson (HOS) model, Jones (1971) is based on the 2×3 specific-factor, full-employment model. In this chapter, we present the essence of these two papers in the simplest possible manner. Later, we

S. Chaudhuri and U. Mukhopadhyay, *Foreign Direct Investment in Developing Countries: A Theoretical Evaluation*, DOI 10.1007/978-81-322-1898-2_2, © Springer India 2014

shall discuss on extensions of the simple two-sector general equilibrium models, inclusion of non-traded goods, the techniques of measuring social welfare in a small open economy and its changes resulting from changes in policy parameters.

2.2 The 2×2 Heckscher–Ohlin–Samuelson Model

The basic assumptions of the 2×2 Heckscher–Ohlin–Samuelson (H–O–S) model of production are the following:

1. Two commodities, X_1 and X_2, are produced using two primary factors of production, labour (L) and capital (K).
2. The production functions exhibit constant returns to scale (CRS) with positive but diminishing marginal returns to each factor.
3. The factors are fully employed and are perfectly mobile between the two sectors. The latter implies that factor prices are the same in both sectors.
4. Commodities can be classified in terms of relative factor intensities, which are irreversible, i.e. a commodity is intensive in the use of the same factor of production at all factor price-ratios. In other words, isoquants of the two commodities cut only once.
5. Perfect competition prevails in product as well as factor markets so that commodity prices, P_1 and P_2, reflect unit costs of production in the two sectors.
6. Commodity prices and factor endowments are given exogenously.

The production functions are given by the following two equations:

$$X_i = F_i\,(L_i, K_i) \quad \text{for } i = 1, 2 \tag{2.1 \& 2.2}$$

where L_i and K_i denote employment of labour and use of capital in the ith sector.

Since the production functions exhibit CRS, the equations of unit isoquants are obtained as follows:

$$1 = f_i\,(a_{L_i}, a_{K_i}) \tag{2.3}$$

where a_{L_i} and a_{K_i} denote, respectively, the labour and capital requirement per unit of X_i.

Now given the output level, profit maximization implies minimization of costs. In other words, the producers minimize cost along the unit isoquant. At the point of cost minimization, the iso-cost line, with slope ($-W/r$), is tangent to the unit isoquant with slope (da_{K_i}/da_{L_i}). Thus, cost minimization with respect to both the commodities implies

$$W da_{L1} + r da_{K1} = 0 \tag{2.4}$$

$$W da_{L2} + r da_{K2} = 0 \tag{2.5}$$

The above two equations are called the ‘envelope conditions’.

The input–output coefficients, $a_{ji}s$, are functions of the (W/r) ratio and the state of production technology, where W and r are the wage rate and return to capital, respectively.

The competitive profit conditions (equality between price and unit cost) in the two sectors are represented as follows

$$a_{L1}W + a_{K1}r = P_1 \tag{2.6}$$

$$a_{L2}W + a_{K2}r = P_2 \tag{2.7}$$

Now, the full-employment conditions of labour and capital are given by

$$a_{L1}X_1 + a_{L2}X_2 = L \tag{2.8}$$

$$a_{K1}X_1 + a_{K2}X_2 = K \tag{2.9}$$

The two zero-profit conditions, Eqs. (2.6) and (2.7), together are called the price system, while the two full-employment conditions, namely, Eqs. (2.8) and (2.9), comprise the output system of the model. So the model consists of four independent equations, Eqs. (2.6), (2.7), (2.8) and (2.9); four endogenous variables, W, r, X_1, X_2; and four parameters P_1, P_2, L and K.[1] For uniquely determining the factor prices and output levels, the factor intensities of production of the two commodities must differ. We assume that sector 1 (sector 2) is more labour-intensive (capital-intensive) than sector 2 (sector 1), i.e. $a_{L1}/a_{K1} > a_{L2}/a_{K2}$.

Now, sector 1 is more labour-intensive relative to sector 2 in physical sense if $\lambda_{L1}/\lambda_{K1} > \lambda_{L2}/\lambda_{K2}$,

where $\lambda_{ji} = (a_{ji}X_i/E_j)$ is the allocative share of the jth factor in the ith sector for $j = L, K$, $i = 1, 2$ and E_j is the endowment of factor j.

On the other hand, sector 1 is more labour-intensive relative to sector 2 in value sense if $\theta_{L1}/\theta_{K1} > \theta_{L2}/\theta_{K2}$ where $\theta_{ji} = \left(W_j a_{L_i}/P_i\right)$ is the distributive share of the jth factor in the total value of production of the ith commodity for $j = L, K$ and $i = 1, 2$. Besides, P_i denotes market price of the ith commodity, while W_j stands for price of the jth factor of production.

In the absence of any distortions in the factor markets, if sector 1 is more labour-intensive relative to sector 2 in physical sense, it is also labour-intensive in value sense.

Hence, when the factor intensities of the two sectors differ, the system is determinate and each variable can be uniquely determined. Given the commodity

[1] There are, of course, two other parameters denoting the states of production technologies in the two sectors.

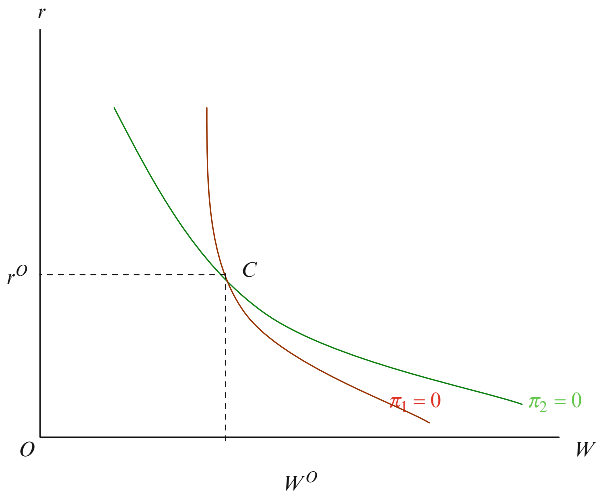

Fig. 2.1 Determination of equilibrium factor prices in the H–O–S model

prices, factor prices can be determined from the price system alone. Thus, any changes in factor endowments cannot affect factor prices. A production system like this where factor prices are independent of factor endowments is called a decomposable system.

The determination of factor prices can be shown in terms of Fig. 2.1. The two zero-profit curves, $\pi_1 = 0$ and $\pi_2 = 0$ in the (W, r) space, represent Eqs. (2.6) and (2.7), respectively. The slopes of the two curves are $-(a_{L1}/a_{K1})$ and $-(a_{L2}/a_{K2})$. The $\pi_1 = 0$ curve is steeper than the $\pi_2 = 0$ curve implying that sector 1 (sector 2) is labour-intensive (capital-intensive) with respect to the other input. The equilibrium W and r are obtained from the point of intersection (C in Fig. 2.1) of the two zero-profit curves.

Once the factor prices are obtained, the factor coefficients, $a_{ji}s$, are also determined since these are functions of (W/r) ratio and technological parameters. Then, X_1 and X_2 are solved from Eqs. (2.8) and (2.9). The lines, L_1L_2 and K_1K_2, in Fig. 2.2 represent the two full-employment conditions given by Eqs. (2.8) and (2.9). These are drawn as straight lines[2] given the two commodity prices, P_1 and P_2. The slopes of the two curves are $-(a_{L1}/a_{L2})$ and $-(a_{K1}/a_{K2})$, respectively. As sector 1 (sector 2) is labour-intensive (capital-intensive) compared to the other sector, the L_1L_2 curve is steeper than the K_1K_2 curve. The equilibrium values of X_1 and X_2 are obtained from the point of intersection (D in Fig. 2.2) of the two curves.

[2]The $a_{ji}s$ depend only on the factor price ratio, (W/r), which in turn depend on the commodity prices only. Therefore, so long as the commodity prices do not change, $a_{ji}s$ also do not change and the slopes of the L_1L_2 and K_1K_2 curves remain constant.

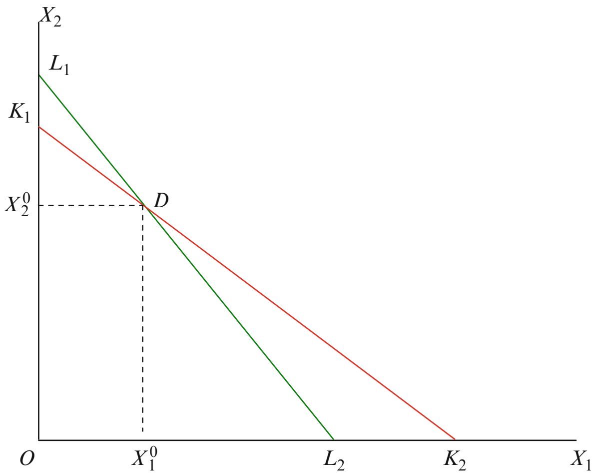

Fig. 2.2 Determination of equilibrium output composition in the H–O–S model

If P_1 rises (falls), ceteris paribus, the $\pi_1 = 0$ curve shifts upwards (downwards) thereby causing the wage rate to rise (fall) while the return to capital to fall (rise). Any change in P_2 leads to similar shifts of the $\pi_2 = 0$ curve. If the two prices change in the same proportion and in the same direction, the two curves shift equi-proportionately in the same direction. The two factor prices change in the same proportion and in the same direction producing no change in the wage–rental ratio and hence in $a_{ji}s$.

2.3 Comparative Statics

The stage is now ready for deriving comparative static results in the H–O–S model. The parameters of the system are P_1, P_2, L and K.[3] We examine the consequences of changes in any of the parameter(s) on the four endogenous variables W, r, X_1 and X_2.

2.3.1 Effects of Changes in Commodity Prices on Factor Prices

Totally differentiating Eqs. (2.6) and (2.7) in the price system, using the envelope conditions and the '$\widehat{\ }$' notation, we obtain

$$\theta_{L1}\widehat{W} + \theta_{K1}\widehat{r} = \widehat{P}_1 \tag{2.10}$$

[3]The state of technology is also a parameter. But here we assume that it does not change.

$$\theta_{L2}\widehat{W} + \theta_{K2}\widehat{r} = \widehat{P}_2 \tag{2.11}$$

Here, '$\widehat{\ }$' means proportional change, e.g. $\widehat{x} = dx/x$.

The changes in factor prices can be determined uniquely by solving Eqs. (2.10) and (2.11). Thus, we find

$$\widehat{W} = \left(\frac{1}{|\theta|}\right)\left[\theta_{K2}\widehat{P}_1 - \theta_{K1}\widehat{P}_2\right] \tag{2.12}$$

and

$$\widehat{r} = \left(\frac{1}{|\theta|}\right)\left[\theta_{L1}\widehat{P}_2 - \theta_{L2}\widehat{P}_1\right] \tag{2.13}$$

where $|\theta|$ is given by

$$|\theta| = (\theta_{L1}\theta_{K2} - \theta_{K1}\theta_{L2}) \tag{2.14}$$

Now, subtraction of Eq. (2.13) from Eq. (2.12) yields

$$\left(\widehat{W} - \widehat{r}\right) = \left(\frac{1}{|\theta|}\right)\left(\widehat{P}_1 - \widehat{P}_2\right) \tag{2.15}$$

It is evident that $\widehat{W}$ and $\widehat{r}$ can be determined if both the commodities are produced and $|\theta| \neq 0$ which in turn implies that for uniquely determining the factor prices, the factor intensities for production of the commodities must differ. Since we have assumed that sector 1 (sector 2) is labour-intensive (capital-intensive), we have

$$|\theta| = (\theta_{L1}\theta_{K2} - \theta_{K1}\theta_{L2}) > 0$$

From (2.15) it follows that an increase in the price of labour-intensive good, X_1, raises the wage–rental ratio in a magnified amount. If $\widehat{P}_1 > \widehat{P}_2$ and X_1 is labour-intensive, then from Eqs. (2.12), (2.13), (2.14) and (2.15), it is easy to show[4] that

$$\widehat{W} > \widehat{P}_1 > \widehat{P}_2 > \widehat{r} \tag{2.16.1}$$

This is the essence of the Stolper–Samuelson theorem which states that a rise in the price of a commodity raises the real reward of its intensive factor and a decline in the real reward of its un-intensive factor.

Analogously, if X_1 is capital-intensive, we have $|\theta| < 0$. In this case, an increase in P_1 reduces the real wage and raises the real return to its intensive factor, capital.

[4] See Chaudhuri and Mukhopadhyay (2009), chapter 2 for the proof.

So in this case, we must have the following relationship:

$$\widehat{W} < \widehat{P}_2 < \widehat{P}_1 < \widehat{r} \tag{2.16.2}$$

2.3.2 Responses of Outputs to Changes in Commodity Prices and Factor Endowments

Any changes in factor endowments cannot affect factor prices since the latter depend only on commodity prices. However, output levels of the two sectors depend on both factor endowments and commodity prices.[5]

Totally differentiating Eqs. (2.8) and (2.9) we obtain

$$\lambda_{L1}\widehat{X}_1 + \lambda_{L2}\widehat{X}_2 = \widehat{L} - (\lambda_{L1}\widehat{a}_{L1} + \lambda_{L2}\widehat{a}_{L2}) \tag{2.8.1}$$

$$\lambda_{K1}\widehat{X}_1 + \lambda_{K2}\widehat{X}_2 = \widehat{K} - (\lambda_{K1}\widehat{a}_{K1} + \lambda_{K2}\widehat{a}_{K2}) \tag{2.9.1}$$

By definition, the elasticity of factor substitution in sector i is given by

$$\sigma_i = \frac{\widehat{a}_{Ki} - \widehat{a}_{Li}}{\widehat{W} - \widehat{r}} \quad \text{for } i = 1, 2 \tag{2.17.1 \& 2.17.2}$$

Solving the two envelope conditions[6] and Eqs. (2.17.1) and (2.17.2), one finds

$$\widehat{a}_{Ki} = \sigma_i \theta_{Li} \left(\widehat{W} - \widehat{r}\right) \quad \text{for } i = 1, 2 \tag{2.18.1 \& 2.18.2}$$

$$\widehat{a}_{Li} = -\sigma_i \theta_{Ki} \left(\widehat{W} - \widehat{r}\right) \quad \text{for } i = 1, 2 \tag{2.19.1 \& 2.19.2}$$

Using (2.18.1), (2.18.2), (2.19.1) and (2.19.2), Eqs. (2.8.1) and (2.9.1) can be rewritten as

$$\lambda_{L1}\widehat{X}_1 + \lambda_{L2}\widehat{X}_2 = \widehat{L} + \delta_L \left(\widehat{W} - \widehat{r}\right) \tag{2.8.2}$$

$$\lambda_{K1}\widehat{X}_1 + \lambda_{K2}\widehat{X}_2 = \widehat{K} - \delta_K \left(\widehat{W} - \widehat{r}\right) \tag{2.9.2}$$

[5] Outputs depend on commodity prices provided technologies of production are of variable-coefficient type, i.e. $a_{ji}s$ are not fixed. This point has been explained in more details in a subsequent paragraph.

[6] $\theta_{L1}\widehat{a}_{L1} + \theta_{K1}\widehat{a}_{K1} = 0$ and $\theta_{L2}\widehat{a}_{L2} + \theta_{K2}\widehat{a}_{K2} = 0$ are the two alternative expressions of the two envelope conditions, given by Eqs. (2.4) and (2.5).

where

$$\left.\begin{aligned}\delta_L &= \lambda_{L1}\theta_{K1}\sigma_1 + \lambda_{L2}\theta_{K2}\sigma_2 \\ \delta_K &= \lambda_{K1}\theta_{L1}\sigma_1 + \lambda_{K2}\theta_{L2}\sigma_2\end{aligned}\right\} \tag{2.20}$$

The changes in output levels can be determined by solving Eqs. (2.8.2) and (2.9.2) as follows:

$$\widehat{X}_1 = \left(\frac{1}{|\lambda|}\right)\left[\lambda_{K2}\widehat{L} - \lambda_{L2}\widehat{K} + \{\lambda_{K2}\delta_L + \lambda_{L2}\delta_K\}\left(\widehat{W} - \widehat{r}\right)\right] \tag{2.21}$$

$$\widehat{X}_2 = \left(\frac{1}{|\lambda|}\right)\left[\lambda_{L1}\widehat{K} - \lambda_{K1}\widehat{L} - \{\lambda_{L1}\delta_K + \lambda_{K1}\delta_L\}\left(\widehat{W} - \widehat{r}\right)\right] \tag{2.22}$$

where

$$|\lambda| = (\lambda_{L1}\lambda_{K2} - \lambda_{L2}\lambda_{K1}) \tag{2.23}$$

With the help of Eq. (2.15), Eqs. (2.21) and (2.22) can be rewritten as follows:

$$\widehat{X}_1 = \left(\frac{1}{|\lambda|}\right)\left[\lambda_{K2}\widehat{L} - \lambda_{L2}\widehat{K} + \left\{(\lambda_{K2}\delta_L + \lambda_{L2}\delta_K)\left(\widehat{P}_1 - \widehat{P}_2\right)\left(\frac{1}{|\theta|}\right)\right\}\right] \tag{2.21.1}$$

$$\widehat{X}_2 = \left(\frac{1}{|\lambda|}\right)\left[\lambda_{L1}\widehat{K} - \lambda_{K1}\widehat{L} - \left\{(\lambda_{L1}\delta_K + \lambda_{K1}\delta_L)\left(\widehat{P}_1 - \widehat{P}_2\right)\left(\frac{1}{|\theta|}\right)\right\}\right] \tag{2.22.1}$$

Subtraction of Eq. (2.22.1) from Eq. (2.21.1) yields

$$\left(\widehat{X}_1 - \widehat{X}_2\right) = \frac{\left(\widehat{L} - \widehat{K}\right)}{|\lambda|} + \frac{(\delta_L + \delta_K)}{|\lambda|\,|\theta|}\left(\widehat{P}_1 - \widehat{P}_2\right) \tag{2.24}$$

Owing to our assumption that sector 1 (sector 2) is labour-intensive (capital-intensive), we have $|\lambda| > 0$.

It has already been explained that in the absence of any factor market distortions if any sector is labour-intensive (capital-intensive) relative to the other in physical sense, it is also labour-intensive (capital-intensive) in value sense.

If X_1 is labour-intensive, both $|\lambda|$ and $|\theta|$ are positive, whereas if X_1 is assumed to be capital-intensive, both $|\lambda|$ and $|\theta|$ are negative, so that the product $|\lambda||\theta|$ is always positive.

Equation (2.24) shows the relationship between changes in outputs to changes in factor endowments and factor prices. The output response to changes in factor endowments is captured by the Rybczynski theorem which states that a rise in the endowment of a factor at constant commodity prices leads to the expansion of the commodity that uses the factor intensively and contraction of the other commodity.

Substituting $\widehat{P}_1 = \widehat{P}_2 = 0$ in Eq. (2.24), it follows that if X_1 is labour-intensive, an increase in the labour endowment raises X_1 by a magnified amount and lowers X_2. If $\widehat{L}$ exceeds $\widehat{K}$, then

$$\widehat{X}_1 > \widehat{L} > \widehat{K} > \widehat{X}_2 \tag{2.25}$$

But if X_1 is capital-intensive, $|\lambda| < 0$. In this case, an increase in L leads to higher production of X_2 and a decline in X_1.

Now for finding out the effects of changes in commodity prices on outputs, we keep the factor endowments unchanged so that $\widehat{L}, \widehat{K} = 0$. Thus, if $\widehat{P}_1 > \widehat{P}_2$, then $\widehat{X}_1 > \widehat{X}_2$. In particular, from (2.21.1) and (2.22.1) it follows that $\widehat{X}_1 > 0$ and $\widehat{X}_2 < 0$. If $\widehat{P}_1 = \widehat{P}_2 > 0$, then $\widehat{W} = \widehat{P}_1 = \widehat{P}_2 = \widehat{r} > 0$ so that $\left(\widehat{W} - \widehat{r}\right) = 0$ and $\widehat{X}_1 = \widehat{X}_2 = 0$.

Therefore, an increase in the price of a commodity leads to a rise in production of that commodity and a fall in that of the other commodity. If both the commodity prices change at the same rate, the production of both commodities remains unchanged.

If $\widehat{P}_1 > \widehat{P}_2 > 0$, the relative price of commodity 1 (commodity 2) rises (falls). This leads to an increase in the wage rate, W, and a fall in the return to capital, r, via the Stolper–Samuelson effect. As the (W/r) ratio increases, producers in both the sectors would substitute labour by cheaper capital. Consequently, in both the sectors, the producers adopt more capital-intensive techniques of production than before. Both a_{K1} and a_{K2} increase while a_{L1} and a_{L2} decrease. At given levels of output, there arises a shortage of capital and a surplus of labour. This leads to a Rybczynski-type effect thereby causing the labour-intensive sector (sector 1) to expand and the capital-intensive sector (sector 2) to contract.

So a change in the relative prices of the two commodities alters the product mix through changes in the input coefficients, $a_{ji}s$. If technologies of production are of the fixed-coefficient type, i.e. if $\sigma_1 = \sigma_2 = 0$, then δ_L and δ_K are also equal to zero. Then, from (2.21.1) and (2.22.1) it follows that $\widehat{X}_1 = \widehat{X}_2 = 0$. So changes in commodity prices have no effect on the composition of outputs. In this case, there is no Rybczynski-type effect that follows a Stolper–Samuelson effect. Therefore, any change in the price system is not transmitted into the output system.

2.4 The 2 × 3 Specific-Factor, Full-Employment Model

We now consider a two-sector, specific-factor model of production. Two commodities, X_1 and X_2, are produced with three inputs, two sector-specific factors and one intersectorally mobile factor. Labour and capital of type 1 (say K_1) are used to produce X_1, while labour and capital of type 2 (say K_2) are combined to produce X_2. Each type of capital is used specifically in one sector while labour is mobile between both the sectors. The three inputs are fully employed. The wage rate is denoted by W, while the returns to capital of type 1 and type 2 are represented by r_1 and r_2, respectively. All the other assumptions of the H–O–S model are retained. It is to be noted that the two industries cannot be classified in terms of factor intensities because they use two different types of capital. However, according to Jones and Neary (1984), the two industries can still be classified in terms of the distributive shares of the intersectorally mobile factor, i.e. labour. If $\theta_{L1} > \theta_{L2}$, we can say that sector 1 is more labour-intensive than sector 2 and vice versa.

Under competitive conditions, the zero-profit conditions in the two sectors are given by

$$a_{L1}W + a_{K1}r_1 = P_1 \tag{2.26}$$

$$a_{L2}W + a_{K2}r_2 = P_2 \tag{2.27}$$

The full-employment conditions of labour and two types of capital are given by

$$a_{L1}X_1 + a_{L2}X_2 = L \tag{2.8}$$

$$a_{K1}X_1 = K_1 \tag{2.28}$$

$$a_{K2}X_2 = K_2 \tag{2.29}$$

Use of Eqs. (2.28) and (2.29) and substitution in (2.8) yield

$$\left(\frac{a_{L1}}{a_{K1}}\right)K_1 + \left(\frac{a_{L2}}{a_{K2}}\right)K_2 = L \tag{2.30}$$

This model consists of five independent equations, Eqs. (2.26), (2.27), (2.28), (2.29) and (2.30), and five endogenous variables, W, r_1, r_2, X_1 and X_2. The parameters of the system are P_1, P_2, L, K_1 and K_2. However, this model is indecomposable. The three unknown factor prices cannot be solved from the price system consisting of two equations. One has to derive an additional equation from the output system which is free of X_is but contains terms, $a_{ji}s$, which are functions of factor prices. Equation (2.30) is such an equation. The values of W, r_1 and r_2 are obtained by solving Eqs. (2.26), (2.27) and (2.30). Therefore, in this 2×3 specific-factor, full-employment model, factor prices depend not only on commodity prices but also on factor endowments. Any changes in the factor endowments affect factor prices, which in turn affect the per unit input requirements, $a_{ji}s$, in each sector.[7] The determination of factor prices can be shown in terms of Fig. 2.3.

[7]It is to be noted that the model loses its consistency if production technologies are of the fixed-coefficient type because Eq. (2.30) then does not implicitly contain factor prices.

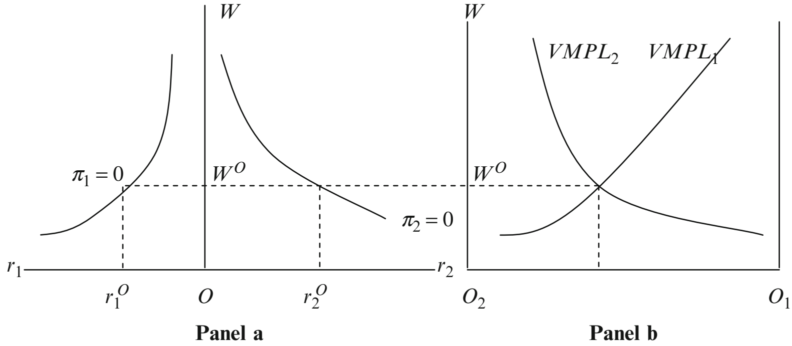

Fig. 2.3 Determination of factor prices in the 2 × 3 specific-factor, full-employment model

In Panel (b) of Fig. 2.3, the distance O_1O_2 measures the labour endowment of the economy. VMPL$_1$ and VMPL$_2$ are the labour demand curves of sector 1 and sector 2, respectively. The equilibrium wage rate is W^O. Panel (a) shows the two zero-profit curves representing Eqs. (2.26) and (2.27). The equilibrium returns to capital of type 1 and capital of type 2 are r_1^O and r_2^O, respectively. If the price of commodity 1, P_1, rises, ceteris paribus, the zero-profit curve of sector 1 in the second quadrant of Panel (a) shifts upwards. Besides, the labour demand curve of sector 1 shown in Panel (b) in Fig. 2.3 shifts in the leftward direction. Consequently, the wage rate and the return to capital of type 1 increase while the return to capital of type 2 falls.[8]

2.4.1 Comparative Statics

Let us now study the consequences of any changes in the parameters of the system, namely, P_1, P_2, L, K_1 and K_2, on the five endogenous variables, W, r_1, r_2, X_1 and X_2.

Given that $a_{L1} = a_{L1}(W, r_1)$ and $a_{K1} = a_{K1}(W, r_1)$, total differentiation yields, respectively,

$$\left.\begin{aligned} \widehat{a}_{L1} &= S^1_{LL}\widehat{W} + S^1_{LK}\widehat{r}_1 \\ \widehat{a}_{K1} &= S^1_{KL}\widehat{W} + S^1_{KK}\widehat{r}_1 \end{aligned}\right\} \tag{2.18.3}$$

Similarly, from $a_{L2} = a_{L2}(W, r_2)$ and $a_{K2} = a_{K2}(W, r_2)$, we get

$$\left.\begin{aligned} \widehat{a}_{L2} &= S^2_{LL}\widehat{W} + S^2_{LK}\widehat{r}_2 \\ \widehat{a}_{K2} &= S^2_{KL}\widehat{W} + S^2_{KK}\widehat{r}_2 \end{aligned}\right\} \tag{2.19.3}$$

[8]The increase in r_1 may not be clear from Panel (a), Fig. 2.3. However, it can be proved mathematically. See the results presented in (2.37).

Here, S^i_{jk} is the degree of substitution between factors in the ith sector, $i = 1, 2$, for example, in sector 1, $S^1_{LL} = (\partial a_{L1}/\partial W)(W/a_{L1})$, $S^1_{LK} = (\partial a_{L1}/\partial r)(r/a_{L1})$. $S^i_{jk} > 0$ for $j \neq k$ and $S^i_{jj} < 0$. It should be noted that as the production functions are homogeneous of degree one, the factor coefficients, $a_{ji}s$, are homogeneous of degree zero in the factor prices. Hence, the sum of elasticities of any factor coefficient (a_{ji}) in any sector with respect to factor prices must be equal to zero. For example, in sector 1, for the labour coefficient, we have $(S^1_{LL} + S^1_{LK}) = 0$, while for the capital coefficient, $(S^1_{KL} + S^1_{KK}) = 0$. Similarly, in sector 2, $(S^2_{LL} + S^2_{LK}) = 0$ and $(S^2_{KL} + S^2_{KK}) = 0$.

Now, total differentiation of Eqs. (2.26) and (2.27) and use of 'envelope conditions' in sector 1 and sector 2 entail

$$\theta_{L1}\widehat{W} + \theta_{K1}\widehat{r}_1 = \widehat{P}_1 \tag{2.31}$$

$$\theta_{L2}\widehat{W} + \theta_{K2}\widehat{r}_2 = \widehat{P}_2 \tag{2.32}$$

Totally differentiating Eq. (2.30) gives

$$\lambda_{L1}\left(\widehat{a}_{L1} - \widehat{a}_{K1}\right) + \lambda_{L1}\widehat{K}_1 + \lambda_{L2}\left(\widehat{a}_{L2} - \widehat{a}_{K2}\right) + \lambda_{L2}\widehat{K}_2 = \widehat{L} \tag{2.30.1}$$

Using (2.18.3) and (2.19.3) and simplifying from Eq. (2.30.1), we can derive

$$A\widehat{W} + B\widehat{r}_1 + C\widehat{r}_2 = -\lambda_{L1}\widehat{K}_1 - \lambda_{L2}\widehat{K}_2 + \widehat{L} \tag{2.30.2}$$

Where

$$\begin{aligned} A &= \left[\lambda_{L1}\left(S^1_{LL} - S^1_{KL}\right) + \lambda_{L2}\left(S^2_{LL} - S^2_{KL}\right)\right] < 0 \\ B &= \lambda_{L1}\left(S^1_{LK} - S^1_{KK}\right) > 0 \\ C &= \lambda_{L2}\left(S^2_{LK} - S^2_{KK}\right) > 0 \end{aligned}$$

Solving (2.31), (2.32) and (2.30.2), one finds

$$\widehat{W} = \underset{(-)}{\left(\tfrac{1}{\Delta}\right)}\left[-\underset{(+)}{B}\theta_{K2}\widehat{P}_1 - \underset{(+)}{C}\theta_{K1}\widehat{P}_2 + \theta_{K1}\theta_{K2}\left(\widehat{L} - \lambda_{L1}\widehat{K}_1 - \lambda_{L2}\widehat{K}_2\right)\right] \tag{2.33}$$

$$\widehat{r}_1 = \underset{(-)}{\left(\tfrac{1}{\Delta}\right)}\left[\underset{(+)}{C}\theta_{L1}\widehat{P}_2 - \theta_{L1}\theta_{K2}\left(\widehat{L} - \lambda_{L1}\widehat{K}_1 - \lambda_{L2}\widehat{K}_2\right) - (\underset{(+)}{C}\theta_{L2} - \underset{(-)}{A}\theta_{K2})\,\widehat{P}_1\right] \tag{2.34}$$

$$\widehat{r}_2 = \underset{(-)}{\left(\tfrac{1}{\Delta}\right)}\left[(\underset{(-)}{A}\theta_{K1} - \underset{(+)}{B}\theta_{L1})\,\widehat{P}_2 + \underset{(+)}{B}\theta_{L2}\widehat{P}_1 + \theta_{K1}\theta_{L2}\left(\widehat{L} - \lambda_{L1}\widehat{K}_1 - \lambda_{L2}\widehat{K}_2\right)\right] \tag{2.35}$$

where

$$\underset{}{\Delta} = -\theta_{L1}\theta_{K2}\underset{(+)}{B} - \theta_{K1}(\theta_{L2}\underset{(+)}{C} - \theta_{K2}\underset{(-)}{A}) < 0 \tag{2.36}$$

From (2.33), (2.34) and (2.35), the following results readily follow:

$$\left.\begin{array}{l}
\text{(i) When } \widehat{P}_1 > 0, \text{then } \widehat{W} > 0;\ \widehat{r}_1 > 0 \text{ and } \widehat{r}_2 < 0.\\
\text{(ii) When } \widehat{P}_2 > 0, \text{then } \widehat{W} > 0;\ \widehat{r}_1 < 0 \text{ and } \widehat{r}_2 > 0.\\
\text{(iii) When } \widehat{L} > 0, \text{then } \widehat{W} < 0;\ \widehat{r}_1 > 0 \text{ and } \widehat{r}_2 > 0.\\
\text{(iv) When } \widehat{K}_1 > 0, \text{then } \widehat{W} > 0;\ \widehat{r}_1 < 0 \text{ and } \widehat{r}_2 < 0.\\
\text{(v) When } \widehat{K}_2 > 0, \text{then } \widehat{W} > 0;\ \widehat{r}_1 < 0 \text{ and } \widehat{r}_2 < 0.
\end{array}\right\} \tag{2.37}$$

At constant overall factor endowments, the relation between the changes in commodity prices and factor prices can be established by subtracting (2.32) from (2.31). Noting that $(\theta_{L1} + \theta_{K1}) = 1 = (\theta_{L2} + \theta_{K2})$, we get

$$\theta_{K2}\left(\widehat{W} - \widehat{r}_2\right) - \theta_{K1}\left(\widehat{W} - \widehat{r}_1\right) = \left(\widehat{P}_1 - \widehat{P}_2\right)$$

The above expression entails that if $\widehat{P}_1 > \widehat{P}_2$, then $\widehat{r}_1 > \widehat{P}_1 > \widehat{W} > \widehat{P}_2 > \widehat{r}_2$. So, any changes in commodity prices drastically affect the returns to specific factors. The return to the mobile factor (labour) rises in terms of one sector and falls in terms of the other. From the relationships depicted in (2.37 – (iii), (iv) and (v)), it is evident that a rise in the endowment of the mobile factor brings about a fall in its return and augments the returns to both the specific factors, while an increase in the stock in one of the two specific factors lowers the returns to both the specific factors and raises the return to the mobile factor.

Total differentiation of (2.28) and (2.29), use of (2.33), (2.34) and (2.35) and simplification yield, respectively,

$$\begin{aligned}
\widehat{X}_1 = {} & \underset{(-)}{\left(\frac{\widehat{P}_1}{\Delta}\right)}\Big[\underset{(+)}{S^1_{KL}}\{\lambda_{L2}(\underset{(-)}{S^2_{LL}} - \underset{(+)}{S^2_{KL}}) - \underset{(+)}{C}\theta_{L2}\Big] - \underset{(-)}{\left(\frac{\widehat{P}_2}{\Delta}\right)}\underset{(+)}{C}\underset{(-)}{S^1_{KK}} - \underset{(-)}{\left(\frac{\widehat{L}}{\Delta}\right)}\underset{(+)}{S^1_{KL}}\theta_{K2}\\
& + \underset{(-)}{\left(\frac{\widehat{K}_1}{\Delta}\right)}\Big[-\lambda_{L1}\underset{(+)}{S^1_{LK}}\theta_{L1}\theta_{K2} - \underset{(+)}{C}\theta_{K1}\theta_{L2} + \{\lambda_{L1}\underset{(-)}{S^1_{LL}} + \lambda_{L2}(\underset{(-)}{S^2_{LL}} - \underset{(+)}{S^2_{KL}})\theta_{K1}\theta_{K2}\Big]\\
& - \underset{(-)}{\left(\frac{\widehat{K}_2}{\Delta}\right)}\underset{(-)}{S^1_{KK}}\lambda_{L2}\theta_{K2}
\end{aligned} \tag{2.38}$$

and

$$\begin{aligned}\widehat{X}_2 = &-\underset{(-)}{\left(\frac{\widehat{P}_1}{\Delta}\right)} \underset{(+)}{B} \underset{(-)}{S^2_{KK}} - \underset{(-)}{\left(\frac{\widehat{P}_2}{\Delta}\right)} \left[\underset{(-)}{S^2_{KK}} \left\{\theta_{K1}\lambda_{L1}\left(\underset{(-)}{S^1_{LL}} - \underset{(+)}{S^1_{KL}}\right) - \underset{(+)}{B}\theta_{L1}\right\}\right] - \underset{(-)}{\left(\frac{\widehat{L}}{\Delta}\right)} \underset{(+)}{S^2_{KL}}\theta_{K1} \\ &- \underset{(-)}{\left(\frac{\widehat{K}_1}{\Delta}\right)} \underset{(-)}{S^2_{KK}}\theta_{K1}\lambda_{L1} + \underset{(-)}{\left(\frac{\widehat{K}_2}{\Delta}\right)} \left[-\underset{(+)}{B}\theta_{L1}\theta_{K2} - \theta_{K1}\lambda_{L2}\underset{(+)}{S^2_{LK}} + \underset{(-)}{A}\theta_{K1}\theta_{K2}\right]\end{aligned} \tag{2.39}$$

From (2.38) and (2.39) the following results readily follow:

$$\left.\begin{array}{ll}\text{(i)} & \text{When } \widehat{P}_1 > 0, \text{then } \widehat{X}_1 > 0 \text{ and } \widehat{X}_2 < 0. \\ \text{(ii)} & \text{When } \widehat{P}_2 > 0, \text{then } \widehat{X}_1 < 0 \text{ and } \widehat{X}_2 > 0. \\ \text{(iii)} & \text{When } \widehat{L} > 0, \text{then } \widehat{X}_1 > 0 \text{ and } \widehat{X}_2 > 0. \\ \text{(iv)} & \text{When } \widehat{K}_1 > 0, \text{then } \widehat{X}_1 > 0 \text{ and } \widehat{X}_2 < 0. \\ \text{(v)} & \text{When } \widehat{K}_2 > 0, \text{then } \widehat{X}_1 < 0 \text{ and } \widehat{X}_2 > 0.\end{array}\right\} \tag{2.40}$$

Thus, an increase in the price of a commodity expands the production of that commodity and reduces that of the other. If the endowment of the mobile factor increases, the levels of production of both the commodities rise. An expansion in the stock of the specific factor raises the production of the commodity that uses the factor and reduces production of the other.

All the comparative static results obtained in the 2×3 specific-factor, full-employment model can be intuitively explained in the following fashion.

If P_1 rises (say, by 10 %), ceteris paribus, initially both W and r_1 in sector 1 increase by 10 %. As labour is the intersectorally mobile factor, labour moves out of sector 2 to sector 1 thereby partially offsetting the increase in W. Finally, W increases by less than 10 %. From the zero-profit condition in sector 1 (Eq. 2.26), it is evident that r_1 must rise by more than 10 %. The wage–rental ratio, W/r_1, falls. Producers in sector 1 substitute capital of type 1 by labour as the latter has become relatively cheaper. The production technique in sector 1 becomes less capital (of type 1)-intensive. At given X_1, there would be adequacy of capital of type 1. Besides, the supply of labour to this sector has already increased. As sector 1 gets higher supply of both resources, it expands. Sector 2 must contract as it now gets less labour than before. The demand for capital of type 2 decreases which in turn lowers the return to capital of type 2, i.e. r_2. This is also clear from the zero-profit condition of sector 2 given by Eq. (2.27). The effects of an increase/decrease in P_2 on the factor prices and quantities of production can be explained in the similar line.

An increase in the endowment of capital of type 1 (K_1) lowers its return, r_1. Sector 1 expands as K_1 is specific to this sector. It demands more labour for its expansion that raises the wage rate, W. Sector 1 draws the additional labour from sector 2 causing the latter to contract. So sector 2 contracts and the demand for capital of type 2 falls that lowers the return to capital of this type, r_2, since its supply is exogenously given. In Panel (b) of Fig. 2.3, the labour demand curve for sector 1, VMPL_1, shifts in the upward direction. Consequently, W rises and both r_1 and r_2 fall. The outcomes of an accumulation of capital of type 2 can also be explained in the similar fashion.

Finally, if the labour endowment grows (say, following an immigration of labour from neighbouring countries), the wage rate plummets. As labour is the intersectorally mobile factor, both the sectors expand. The demand for each type of capital (sector-specific input) goes up leading to increases in both r_1 and r_2. In terms of Panel (b) of Fig. 2.3, the length of O_1O_2 in the horizontal axis, which measures the labour endowment, increases. The two labour demand curves, VMPL_1 and VMPL_2, must intersect each other at a lower wage rate. From Panel (a) of Fig. 2.3, one finds that both r_1 and r_2 increase.

2.5 Extensions of 2-Sector, Full-Employment General Equilibrium Model

Production Structure 1

Consider the following production structure for a small open economy which is a price-taker in the international market. Three commodities are produced and three inputs are used in production. Sector 1 is the agricultural sector that uses labour and land in the production process. Sectors 2 and 3 are the two manufacturing sectors which produce their outputs by means of labour and capital. All the commodities are internationally traded and their prices are given internationally. Commodity 1 is taken to be the numeraire. Other standard assumptions of the 2-sector, full-employment model hold.

Under competitive conditions, the three zero-profit conditions are

$$Wa_{L1} + Ra_{N1} = 1 \tag{2.41}$$

$$Wa_{L2} + ra_{K2} = P_2 \tag{2.42}$$

$$Wa_{L3} + ra_{K3} = P_3 \tag{2.43}$$

Here, R and r are the returns to land (N) and capital (K), respectively, and W is the wage rate.

The full-employment conditions of the three factors of production, namely, labour, land and capital, are as follows:

$$a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 = L \tag{2.44}$$

$$a_{N1}X_1 = N \tag{2.45}$$

$$a_{K2}X_2 + a_{K3}X_3 = K \tag{2.46}$$

where L, N and K are the labour, land and capital endowments of the economy, respectively.

This is a decomposable production structure because there are three unknown factor prices, W, r and R, in the price system and the same number of independent equations, i.e. (2.41), (2.42) and (2.43). Equations (2.42) and (2.43) together look like the price system of the H–O–S model and display H–O properties. Thus, Eqs. (2.42) and (2.43) together form a Heckscher–Ohlin subsystem or HOSS. For uniquely determining the factor prices, relative factor intensities of the two sectors in the HOSS must differ. We assume that sector 2 is more labour-intensive than sector 3, i.e. $(a_{L2}/a_{K2}) > (a_{L3}/a_{K3})$. The two factor prices, W and r, are solved from Eqs. (2.42) and (2.43). R is obtained by plugging the value of W in Eq. (2.41). Once factor prices are known, the factor coefficients, $a_{ji}s$, are also known. Then, from Eq. (2.45) one gets X_1. Finally, solving Eqs. (2.44) and (2.46) simultaneously, we find out X_2 and X_3. Owing to the decomposition property, we find that the factor prices do not depend on factor endowments. However, the production levels of the two commodities depend on both commodity prices and factor endowments.

Production Structure 2

It considers a three-sector economy with four factors of production: unskilled labour, skilled labour, capital of type N and capital of type K.[9] The unskilled wage is fixed economy-wide at $\overline{W}$ due to the minimum wage legislation of the government. In all the three sectors, both types of labour are used. Capital of type N is used in sector 1 which is the agricultural sector, while the other two sectors use capital of type K. Sectors 1 and 2 are the two export sectors, while sector 3 is the import-competing sector.

The usual zero-profit conditions for the three sectors are as follows:

$$\overline{W}a_{L1} + W_S a_{S1} + Ra_{N1} = 1 \tag{2.47}$$

$$\overline{W}a_{L2} + W_S a_{S2} + ra_{K2} = P_2 \tag{2.48}$$

$$\overline{W}a_{L3} + W_S a_{S3} + ra_{K3} = P_3 \tag{2.49}$$

W_S is the skilled wage. As the unskilled wage is exogenously given, sectors 2 and 3 together form a HOSS. We assume that sector 3 is more capital-intensive relative to sector 2 with respect to skilled labour. This implies that $(a_{K3}/a_{S3}) > (a_{K2}/a_{S2})$.

[9]This production structure has been used in Beladi and Marjit (1992b).

Skilled labour and the two types of capital are fully utilized. The full-employment conditions for these resources are given as follows:

$$a_{S1}X_1 + a_{S2}X_2 + a_{S3}X_3 = S \tag{2.50}$$

$$a_{N1}X_1 = N \tag{2.51}$$

$$a_{K2}X_2 + a_{K3}X_3 = K \tag{2.52}$$

Since the unskilled wage is exogenously given at $\overline{W}$, there arises a possibility of unskilled unemployment. We assume that the supply of unskilled labour is greater than its aggregate demand in the three sectors at $\overline{W}$ so that there is unemployment of unskilled labour in the economy. The aggregate employment of unskilled labour in the economy (L) is given by

$$L = a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 \tag{2.53}$$

This production structure is also decomposable. W_S and r are determined from Eqs. (2.48) and (2.49). Plugging the value of W_S in (2.47), one can obtain R. So, here also factor prices do not depend on factor endowments. The three output levels are obtained from Eqs. (2.50), (2.51) and (2.52). The aggregate employment of unskilled labour is obtained from Eq. (2.53).

Production Structure 3

We consider another production structure with three sectors. Sector 2 produces a final manufacturing commodity, X_2, with the help of labour and capital of type 1. Sector 1 is the agricultural sector that produces its output by using labour and fertilizer. Fertilizer is produced in sector 3 by means of labour and capital of type 2. Sector 3 is the import-competing sector of the economy. The domestic production of fertilizer falls short of its demand in sector 1. So, the remaining part is imported at the internationally given price, P_3. All the three commodities are internationally traded, and hence, their prices are exogenously given. The equational structure of the model is as follows:

The usual three zero-profit conditions are given by

$$Wa_{L1} + P_3a_{31} = P_1 \tag{2.54}$$

$$Wa_{L2} + r_1a_{K2} = P_2 \tag{2.55}$$

$$Wa_{L3} + r_2a_{K3} = P_3 \tag{2.56}$$

The full-employment conditions are given by the following three equations:

$$a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 = L \tag{2.57}$$

$$a_{K2}X_2 = K_1 \tag{2.58}$$

$$a_{K3}X_3 = K_2 \tag{2.59}$$

The volume of import of fertilizer (commodity 3) is

$$M = a_{31}X_1 - X_3 \tag{2.60}$$

It is to be noted that it is also a decomposable production structure but does not contain any HOSS. W is found from (2.54). Plugging the value of W in Eqs. (2.55) and (2.56), we respectively obtain r_1 and r_2. Then, the output levels are obtained from Eqs. (2.57), (2.58) and (2.59).

Production Structure 4

Consider a small open economy with three sectors; two types of labour, skilled and unskilled; and two types of capital. Sector 1 is agriculture that uses unskilled labour and capital of type 1. Sector 2 is a low-skill manufacturing sector that produces its output by means of unskilled labour and capital of type 2. Finally, sector 3 produces a high-skill commodity like computer software by using skilled labour and capital of type 2. The three zero-profit conditions are given by the following equations:

$$Wa_{L1} + r_1a_{K1} = P_1 \tag{2.61}$$

$$Wa_{L2} + r_2a_{K2} = P_2 \tag{2.62}$$

$$W_Sa_{S3} + r_2a_{K3} = P_3 \tag{2.63}$$

All the inputs are fully employed and the full-employment conditions are given by the following four equations:

$$a_{L1}X_1 + a_{L2}X_2 = L \tag{2.64}$$

$$a_{K1}X_1 = K_1 \tag{2.65}$$

$$a_{K2}X_2 + a_{K3}X_3 = K_2 \tag{2.66}$$

$$a_{S3}X_3 = S \tag{2.67}$$

In the price system there are three equations, namely, Eqs. (2.61), (2.62) and (2.63), with four unknown factor prices, W, r_1, r_2 and W_S. This system does not satisfy the decomposition property. Factor prices cannot be determined from the price system alone. We shall have to derive an additional equation from the output system which is free of X_is that can be used together with the three zero-profit conditions to solve for the four unknown factor prices. From (2.64) using (2.65), we get

$$\left(\frac{a_{L1}K_1}{a_{K1}}\right) + a_{L2}X_2 = L$$

or

$$X_2 = \left[L - \left(\frac{a_{L1}K_1}{a_{K1}}\right)\right]\left(\frac{1}{a_{L2}}\right) \tag{2.64.1}$$

Similarly, from (2.66) and (2.67)

$$a_{K2}X_2 + \left(\frac{a_{K3}S}{a_{S3}}\right) = K_2$$

or

$$X_2 = \left[K_2 - \left(\frac{a_{K3}S}{a_{S3}}\right)\right]\left(\frac{1}{a_{K2}}\right) \tag{2.66.1}$$

From Eqs. (2.64.1) and (2.66.1), one gets

$$\left[K_2 - \left(\frac{a_{K3}S}{a_{S3}}\right)\right]\left(\frac{1}{a_{K2}}\right) = \left[L - \left(\frac{a_{L1}K_1}{a_{K1}}\right)\right]\left(\frac{1}{a_{L2}}\right) \tag{2.68}$$

The four unknown factor prices are obtained by solving Eqs. (2.61), (2.62), (2.63) and (2.68) simultaneously. Equation (2.68) contains all endowment parameters, namely, L, S, K_1 and K_2. So the equilibrium factor prices depend on P_1, P_2, P_3, L, S, K_1 and K_2. X_1 and X_3 are obtained from Eqs. (2.65) and (2.67), respectively. Finally, X_2 is determined from either Eqs. (2.64.1) or (2.66.1).

2.5.1 Production Structures with Non-traded Goods

The commodities which are produced and consumed/used up within an economy and are not traded internationally are called non-traded goods or local goods. These goods cannot be traded internationally due to factors like the nature of the goods, political barriers and artificial trade barriers. However, these goods are traded domestically and their prices are determined by demand–supply forces. Non-traded goods may either be intermediate inputs or final commodities.

Production Structure 5

If we introduce a third sector, in the 2×2 full-employment model, that produces a non-traded intermediate good for another sector, the production structure would look like the following:

$$Wa_{L1} + ra_{K1} = P_1 \tag{2.69}$$

$$Wa_{L2} + ra_{K2} = P_2 \tag{2.70}$$

$$Wa_{L3} + ra_{K3} + P_2 a_{23} = P_3 \tag{2.71}$$

In all the three sectors of the economy, labour and capital are used as inputs. Sector 1 produces the export commodity, while sector 3 is the import-competing sector. Both the traded sectors produce final commodities. Apart from labour and capital, sector 3 uses a non-traded input which is produced in sector 2. Equations (2.69), (2.70) and (2.71) are the three competitive equilibrium conditions. a_{23} is the amount of the non-traded good required to produce one unit of good, X_3. P_1 and P_3 are given by the small open economy assumption, while P_2 being the price of the non-traded good is determined endogenously.

The other equations of the model are as follows:

$$a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 = L \tag{2.72}$$

$$a_{K1}X_1 + a_{K2}X_2 + a_{K3}X_3 = K \tag{2.73}$$

$$a_{23}X_3 = X_2 \tag{2.74}$$

Equations (2.72) and (2.73) are the full-employment conditions for labour and capital, respectively. Finally, Eq. (2.74) states that in equilibrium the demand for the non-traded input in sector 3 is exactly equal to its production in sector 2.

There are six endogenous variables, W, r, P_2, X_1, X_2 and X_3, and the same number of independent equations, namely, Eqs. (2.69), (2.70), (2.71), (2.72), (2.73) and (2.74). In the price system there are three variables and the same number of equations. So this is a decomposable system and factor prices depend on commodity prices only. From Eqs. (2.69) and (2.70), W and r are obtained as functions of P_2. Plugging the values of W and r in Eq. (2.71), we can solve for P_2. Once the factor prices are known, the factor coefficients, a_{ji}s, are also known. Then, by solving Eqs. (2.72), (2.73) and (2.74), the output levels are obtained. Sector 1 and sector 2 together form a HOSS.

Production Structure 6

We consider a small open economy with a 3×3 full-employment production structure. Sectors 1 and 3 are the two traded sectors which use two different types of capital apart from labour for production. Sector 2 produces a non-traded final commodity using labour and capital of N type. Capital of N type is completely mobile between sectors 1 and 2, while capital of K type is specific to sector 3. The three competitive zero-profit conditions are as follows:

$$Wa_{L1} + Ra_{N1} = P_1 \tag{2.75}$$

$$Wa_{L2} + Ra_{N2} = P_2 \tag{2.76}$$

$$Wa_{L3} + ra_{K3} = P_3 \tag{2.77}$$

Here also sectors 1 and 2 form a HOSS. Labour, capital of type N and capital of type K are fully utilized in production. The full-employment conditions for these three inputs are respectively given by the following equations:

$$a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 = L \tag{2.78}$$

$$a_{N1}X_1 + a_{N2}X_2 = N \tag{2.79}$$

$$a_{K3}X_3 = K \tag{2.80}$$

There are six equations to solve for seven unknowns, W, R, r, P_2, X_1, X_2 and X_3, which means that there is indeterminacy problem. In order to make the system consistent, we shall have to include the demand–supply equality condition for the non-traded final commodity.

The demand function for the non-traded final commodity (good 2) depends on the relative prices of the commodities, P_2/P_1 and P_3/P_1, and the national income, Y, and is given by the following:

$$X_2^D = D\left(\underset{(-)}{\frac{P_2}{P_1}}, \underset{(+)}{\frac{P_3}{P_1}}, \underset{(+)}{Y}\right) \tag{2.81}$$

Commodity 2 is assumed to be a normal good with negative and positive own price and income elasticities of demand, respectively. The cross-price elasticity is positive.

Now, the national income, which is equal to the aggregate factor income in the present context, is expressed as

$$Y = WL + RN + rK \tag{2.82}$$

Finally, the demand–supply equality condition for good 2 is given by

$$D\underset{(-)\ (+)\ (+)}{\left(\frac{P_2}{P_1}, \frac{P_3}{P_1}, Y\right)} = X_2 \tag{2.83}$$

From Eqs. (2.75), (2.76) and (2.77), the three unknown factor prices, W, R and r, are determined as functions of P_2. Then, X_1, X_2 and X_3 are solved from (2.78), (2.79) and (2.80) as functions of P_2. Y is found from Eq. (2.82). Finally, the equilibrium price of the non-traded good, P_2, is solved from Eq. (2.83). Once P_2 is determined, all other endogenous variables are automatically determined.

2.6 Measurement of Social Welfare

The optimum social welfare depends on the commodity prices faced by the consumers and national income. When the commodity prices change, there are two effects on welfare – price effect and income effect. In such cases, national welfare should ideally be measured in terms of a strictly quasi-concave social welfare function since both the price and income effects can be captured by this function. However, in a small open economy which is a price-taker at the international market and where there is no non-traded final commodity, national income at domestic or world prices can be used as a good proxy for social welfare as it can capture the income effect. So, national income at world prices or domestic prices may be used for measuring social welfare only when the commodity prices do not change.[10]

2.6.1 National Income at World Prices as Measurement of Social Welfare

We consider a production structure where two goods, X_1 and X_2, are produced with the help of labour (L) and capital (K). There is international trade, and X_1 is the export good, while X_2 is the importable good. Commodity 1 is chosen as the numeraire. The world price of good 2, P_2, is determined in the international market. There is a tariff at the ad valorem rate, t, on the import-competing sector so that the domestic price of commodity 2 is $P_2(1 + t)$. Both the factors are fully employed and

[10] If there is a tariff on the import-competing sector, the domestic price of the commodity that the consumers face is different for its international price. Now, if the tariff rate changes, the domestic price of the commodity also changes which would alter the consumption levels of the final commodities due to price effect. Consequently, there would be a corresponding change in social welfare which remains unaccounted for if one attempts to analyse the welfare consequence of a change in the tariff through a change in national income.

are mobile between the sectors producing the two goods. The total capital stock in the economy consists of domestic capital (K_D) and foreign capital (K_F) and these are perfect substitutes.[11] Foreign capital income, rK_F, is completely repatriated where r is the return to capital. It is assumed that X_1 is more labour-intensive than X_2 so that $(a_{L1}/a_{K1}) > (a_{L2}/a_{K2})$.

The competitive profit conditions imply

$$a_{L1}W + a_{K1}r = 1 \tag{2.84.1}$$

$$a_{L2}W + a_{K2}r = P_2(1 + t) \tag{2.84.2}$$

The full-employment conditions of labour and capital are depicted by

$$a_{L1}X_1 + a_{L2}X_2 = L \tag{2.85.1}$$

$$a_{K1}X_1 + a_{K2}X_2 = K = K_D + K_F \tag{2.85.2}$$

The expression for national income at international prices, I, is given by

$$I = X_1 + P_2X_2 - rK_F \tag{2.86}$$

Differentiating Eq. (2.86) and assuming the initial stock of foreign capital to be equal to zero, the change in national income at world prices is given by

$$dI = [dX_1 + P_2dX_2 - rdK_F] = \left[dX_1 + P_2^*dX_2 - tP_2dX_2 - rdK_F\right]$$

or

$$dI = \left[F_L{}^1dL_1 + F_K{}^1dK_1 + P_2{}^*F_L{}^2dL_2 + P_2{}^*F_K{}^2dK_2 - tP_2dX_2 - rdK_F\right] \tag{2.86.1}$$

[Here, note that $X_1 = F^1(L_1, K_1)$ and $X_2 = F^2(L_2, K_2)$ are the two production functions.]

$$\begin{aligned} dI &= [WdL_1 + rdK_1 + WdL_2 + rdK_2 - rdK_F - tP_2dX_2] \\ &= [W(dL_1 + dL_2) + r(dK_1 + dK_2) - rdK_F - tP_2dX_2] \end{aligned} \tag{2.86.2}$$

[11] This simplified assumption has been made in Brecher and Alejandro (1977), Khan (1982), Grinols (1991), Chandra and Khan (1993), Gupta (1997), etc. However, in the papers of Beladi and Marjit (1992a, b) and Marjit and Beladi (1996), foreign capital has been treated differently from domestic capital, and these two types of capital are not engaged in the same sector of the economy.

In Eq. (2.86.2), tP_2dX_2 measures the change in the distortionary cost of tariff protection of the supply side.

Also note that the full-employment conditions for the two inputs, labour and capital, are $L_1 + L_2 = L$ and $K_1 + K_2 = K_D + K_F = K$.

When there occurs an inflow of foreign capital, given the labour endowment, we have $[(dL_1 + dL_2 = dL = 0$ and, $dK_1 + dK_2 = dK = dK_F)]$. Then, from (2.86.2) we find that

$$dI = -tP_2dX_2 \tag{2.86.3}$$

2.6.2 National Income at Domestic Prices

The expression for national income at domestic prices, Y, is given by

$$Y = X_1 + {P_2}^* X_2 + tP_2M - rK_F \tag{2.87}$$

where M denotes the volume of import of commodity 2 and is given by

$$M = D_2\left({P_2}^*, Y\right) - X_2 \tag{2.88}$$

So, tP_2M is the tariff revenue collected by the government which is transferred to the consumers in a lump-sum manner.

Differentiating Eq. (2.87) and keeping t and P_is unchanged, one gets

$$dY = \left[dX_1 + {P_2}^* dX_2 + tP_2dM - rdK_F\right] \tag{2.87.1}$$

Differentiating (2.88) (holding t and P_2 constant) and using (2.87.1), we find

$$dM = \left(\frac{\partial D_2}{\partial Y}\right)\left[dX_1 + {P_2}^* dX_2 + tP_2dM - rdK_F\right] - dX_2 \tag{2.88.1}$$

Differentiating the production functions and the full-employment conditions, Eq. (2.87.1) may be expressed as follows:

$$\begin{aligned}
dY &= \left[{F_L}^1 dL_1 + {F_K}^1 dK_1 + {P_2}^* {F_L}^2 dL_2 + {P_2}^* {F_K}^2 dK_2 + tP_2dM - rdK_F\right] \\
&= [WdL_1 + rdK_1 + WdL_2 + rdK_2 - rdK_F + tP_2dM] \\
&= [W(dL_1 + dL_2) + r(dK_1 + dK_2) - rdK_F + tP_2dM]
\end{aligned}$$

or

$$dY = tP_2dM \tag{2.87.2}$$

Using (2.87.2), Eq. (2.88.1) may be expressed as

$$dM = tP_2\,(\partial D_2/\partial Y)\,dM - dX_2$$

or $dM[1 - tP_2(\partial D_2/\partial Y)] = -dX_2$
or

$$dM = -VdX_2 \tag{2.88.2}$$

where $m = P_2{}^*(\partial D_2/\partial Y)$ is the marginal propensity to consume commodity 2 with $1 > m > 0$ and $V = [(1+t)/\{1+t(1-m)\}] > 1$.

Using (2.88.2) from Eq. (2.87.2), one can easily derive the following expression for change in national income at domestic prices:

$$dY = -tP_2VdX_2 \tag{2.87.3}$$

2.6.3 Social Welfare Function

Each individual in the society derives positive utility from consumption of the two goods produced in the economy. It is assumed that the individuals are homogeneous in their preferences, so that the strictly quasi-concave social welfare function is given by

$$U = U\,(D_1, D_2) \tag{2.89}$$

where D_i denotes the demand for the ith commodity for $i = 1, 2$.

Given that international trade occurs, trade balance requires

$$D_1 + P_2^* D_2 = X_1 + P_2^* X_2 + tP_2\,(D_2 - X_2) - rK_{\mathrm{F}} \tag{2.90}$$

where $(X_1 - D_1)$ is the amount of export of X_1 and $(D_2 - X_2)$ denotes the amount of X_2 that is imported.

Differentiating Eqs. (2.89) and (2.90), the production functions and the import demand function, it can be shown that[12]

$$\left(\frac{dU}{U_1}\right) = tP_2V\,[HP_2dt - dX_2] \tag{2.91}$$

where $H = [(\partial D_2/\partial P_2^*) + D_2(\partial D_2/\partial Y)] < 0$ is the Slutsky's pure substitution term. m and V have already been defined in Sect. 2.6.2.

[12]This has been done in details in Chapter 2 of Chaudhuri and Mukhopadhyay (2009).

From (2.91) we find that

$$\left(\frac{1}{U_1}\right)\left(\frac{dU}{dK_\mathrm{F}}\right) = -tP_2V\left(\frac{dX_2}{dK_\mathrm{F}}\right) \tag{2.91.1}$$

2.6.4 Labour Market Imperfection and Welfare

Now, let us assume imperfection in the labour market. Let sector 2 producing X_2 be the formal sector with unionized wage, while sector 1 that produces X_1 be the informal sector offering the competitive wage.

Let the unionized wage function in the formal sector be as follows:

$W* = W*(W, Z)$ with $W* > W$, $(\partial W*/\partial W) > 0$ and $(\partial W*/\partial Z) > 0$.

Here, Z denotes the bargaining power of the trade unions in sector 2.

Equation (2.84.2) has to be replaced by the following:

$$a_{L2}W^* + a_{K2}r = P_2(1+t) \tag{2.84.3}$$

In this case $P_2{*}F_L{}^2 = W*$, and the expressions (2.86.2), (2.87.3) and (2.91) would respectively become

$$dI = \left(W^* - W\right)dL_2 - tP_2dX_2 = \left[\left(W^* - W\right)a_{L2} - tP_2\right]dX_2 \tag{2.86.4}$$

$$dY = V\left[\left(W^* - W\right)a_{L2} - tP_2\right]dX_2 \tag{2.87.4}$$

and,

$$\left(\frac{dU}{U_1}\right) = V\left[tH(P_2)^2dt + \left\{\left(W^* - W\right)a_{L2} - tP_2\right\}dX_2\right] \tag{2.91.2}$$

In the presence of labour market distortions, the expressions for changes in national income at world prices, national income at domestic prices and in social welfare, with respect to a change in foreign capital stock, are given as follows:

$$\left(\frac{dI}{dK_\mathrm{F}}\right) = \left[\left(W^* - W\right)a_{L2} - tP_2\right](dX_2/dK_\mathrm{F}) \tag{2.86.5}$$

$$\left(\frac{dY}{dK_\mathrm{F}}\right) = V\left[\left(W^* - W\right)a_{L2} - tP_2\right]\left(\frac{dX_2}{dK_\mathrm{F}}\right) \tag{2.87.5}$$

and

$$\left(\frac{1}{U_1}\right)\left(\frac{dU}{dK_\mathrm{F}}\right) = V\left[\left(W^* - W\right)a_{L2} - tP_2\right]\left(\frac{dX_2}{dK_\mathrm{F}}\right) \tag{2.91.3}$$

References

Beladi H, Marjit S (1992a) Foreign capital and protectionism. Can J Econ 25:233–238
Beladi H, Marjit S (1992b) Foreign capital, unemployment and national welfare. Jpn World Econ 4:311–317
Brecher RA, Diaz Alejandro CF (1977) Tariffs, foreign capital and immiserizing growth. J Int Econ 7:317–322
Chandra V, Khan MA (1993) Foreign investment in the presence of an informal sector. Economica 60:79–103
Chaudhuri S, Mukhopadhyay U (2009) Revisiting the informal sector: a general equilibrium approach. Springer, New York
Grinols EL (1991) Unemployment and foreign capital: the relative opportunity cost of domestic labour and welfare. Economica 57:107–121
Gupta MR (1997) Foreign capital and informal sector: comments on Chandra and Khan. Economica 64:353–363
Jones RW (1965) The structure of simple general equilibrium models. J Polit Econ 73:551–572
Jones RW (1971) A three-factor model in theory, trade and history. In: Bhagwati J et al (eds) Trade, balance of payments and growth. North-Holland, Amsterdam
Jones RW, Neary P (1984) Positive theory of international trade. In: Jones RW, Kenen PB (eds) Handbook of development economics, vol 1. North-Holland, Amsterdam
Khan MA (1982) Tariffs, foreign capital and immiserizing growth with urban unemployment and specific factors of production. J Dev Econ 10:245–256
Marjit S, Beladi H (1996) Protection and gainful effects of foreign capital. Econ Lett 53:311–326

Chapter 3
FDI, Welfare and Developing Countries

3.1 Introduction

In the first 30 years after the World War II, the fundamental approach in development strategies throughout the world was guided by the development consensus that emphasized on more stringent trade policies and inward-oriented strategies, making use of discriminating policies like tariffs and quotas and restricting inflow of foreign capital and imports. But the 'success story' of the East Asian Tigers revolutionized the views about the appropriate road to development. A new approach known as the Washington Consensus started to be accepted widely as an alternative development strategy and it gained further momentum after the conclusion of the multilateral agreement and the formation of the World Trade Organization (WTO) in the Uruguay round of discussions. The perceptions about development have drastically changed from the development consensus and the Washington Consensus has culminated into a paradigm shift in shaping the character of the world economy. The new prescription is for more openness and less intervention that is likely to entail efficiency and dynamism to the growth process. The bottom line is to head towards liberalized economies involving freer inflow of foreign capital, curbing down on the much conspicuous protectionist policies, embarking on structural reforms and integrating the domestic market with the world market.

The importance and desirability of inflow of foreign capital in the context of a developing economy has triggered much debate among trade and development economists.[1] The optimism regarding foreign capital inflow tends to vary among different authors. Until the early 1980s, entry of foreign capital was highly

[1]The empirical literature that deals with the linkage between FDI and welfare of the developing host country presents contradictory results. Whether FDI fosters economic growth in host countries depends largely on the country being studied, the methodology employed and government policies. In fact, FDI can have dramatically different impacts, both positive and negative. See Hein (1992), Singh (1998), Borensztein et al. (1998), UNCTAD (1999), Edison et al. (2002), Martinez and Allard (2009) and Soumare (2013) among others.

S. Chaudhuri and U. Mukhopadhyay, *Foreign Direct Investment in Developing Countries: A Theoretical Evaluation*, DOI 10.1007/978-81-322-1898-2_3,

discouraged in the developing countries since foreign capital was thought to be welfare deteriorating. The much-needed theoretical foundation was provided by the well-known 'Brecher–Alejandro (1977) proposition'. However, the cynical view has undergone a diametrical change during the liberalized economic regime, and many economists have successfully shown that foreign capital might be welfare improving in several cases. In this chapter, we initially discuss the pessimistic view regarding the role of foreign capital in influencing social welfare of a developing economy using the general equilibrium framework and then put forward a host of circumstances where foreign capital may be welfare improving.

3.2 Pessimistic View

Let us begin our discussion on the welfare consequence of foreign capital with the pessimistic view suggesting that growth with foreign capital in a small open economy is immiserizing, that is, welfare worsening. In this section, we first elucidate the 'Brecher–Alejandro (1977) proposition' and then discuss a few extensions made by other economists where this result holds.

3.2.1 Immiserizing Growth: Brecher and Alejandro (1977) Proposition

Brecher and Alejandro (1977) have considered the 2×2 Heckscher–Ohlin (H–O) framework to analyse the welfare consequence of an inflow of foreign capital in a small open economy. Two commodities, 1 and 2, are produced in the economy using two factors of production – labour and capital. Factors are fully employed and sector 1 is assumed to be more labour-intensive than sector 2. There is perfect competition in both product and factor markets, and the production functions exhibit constant returns to scale with positive but diminishing marginal productivity to each factor. The economy exports good 1 and imports good 2 and the import-competing sector is protected by a tariff. The aggregate capital stock of the economy consists of both domestic capital and foreign capital and these are assumed to be perfect substitutes. All foreign capital income is fully repatriated.

The competitive zero-profit conditions are given as

$$Wa_{L1} + ra_{K1} = P_1 \tag{3.1}$$

$$Wa_{L2} + ra_{K2} = P_2^* \tag{3.2}$$

where P_1 and P_2 are the world prices of commodities 1 and 2; $P_2^* = (1 + t)P_2$; t is the ad valorem rate of tariff so that P_2^* represents the domestic or tariff-inclusive price of commodity 2; wage rate and interest rate on capital are denoted by W and

r, respectively; a_{L_i} is the labour–output ratio and a_{K_i} is the capital–output ratio in the ith sector, $i = 1, 2$.

The full-employment conditions of labour and capital are given respectively by

$$a_{L1}X_1 + a_{L2}X_2 = L \tag{3.3}$$

$$a_{K1}X_1 + a_{K2}X_2 = K_D + K_F = K \tag{3.4}$$

where L is the total labour endowment in the economy and K_D and K_F denote domestic capital and foreign capital endowments, respectively.

In this system, there are four endogenous variables, W, r, X_1 and X_2, that can be solved from Eqs. (3.1), (3.2), (3.3) and (3.4). This is a decomposable system where factor prices do not depend on factor endowments. The factor prices W and r can be solved from the price Eqs. (3.1) and (3.2), that is, the domestic commodity prices P_1 and P_2^* determine the factor prices. Once factor prices are known, factor coefficients, i.e. a_{ji}s, are also known. The levels of production of X_1 and X_2 are then solved from the output Eqs. (3.3) and (3.4), so that the output levels depend on both commodity prices and factor endowments.

Here, welfare is defined as a positive function of national income. The expression for national income at world prices is given by

$$I = WL + rK_D - tP_2X_2 \tag{3.5}$$

WL is the aggregate wage income while rK_D is the income on domestic capital. Foreign capital income rK_F is completely repatriated. Finally, tP_2X_2 measures the distortionary cost of tariff on the production side.[2]

Now, we consider an increase in the capital stock in the economy due to foreign capital inflow, with the endowment of labour remaining unchanged.

Total differentiation of (3.3) yields,[3]

$$a_{L1}dX_1 + a_{L2}dX_2 = dL$$

Dividing through by L gives

$$\left(\frac{a_{L1}X_1}{L}\right)\left(\frac{dX_1}{X_1}\right) + \left(\frac{a_{L2}X_2}{L}\right)\left(\frac{dX_2}{X_2}\right) = (dL/L)$$

---

[2]The presence of tariff artificially raises the domestic price of commodity X_2, which leads to a misallocation of economic resources, since the producers will now be producing more of X_2 and less of X_1 than their free trade levels. Social welfare decreases owing to this commodity market distortion. Both producers' surplus and consumers' surplus will be lower than their optimum (free trade) levels.

[3]In the decomposable system, an increase in factor endowment has no effect on factor prices, so that (W/r) also remains constant. Hence, $a_{L_i} = a_{L_i}(W/r)$ and $a_{K_i} = a_{K_i}(W/r)$ remain constant as well. Therefore, $da_{L_i} = da_{K_i} = 0$.

The above expression can be written as

$$\lambda_{l1}\widehat{X}_1 + \lambda_{L2}\widehat{X}_2 = \widehat{L} \tag{3.3.1}$$

Similarly, by differentiating (3.4) and dividing by K gives

$$\lambda_{K1}\widehat{X}_1 + \lambda_{K2}\widehat{X}_2 = \widehat{K} \tag{3.4.1}$$

where λ_{ji} is the proportion of factor j employed in the ith sector, $j = L, K$ and $i = 1, 2$ and '$\widehat{\ }$' denotes proportional change.

Solving (3.3.1) and (3.4.1) by Cramer's rule gives

$$\left.\begin{aligned} \widehat{X}_1 &= -(\lambda_{L2}/\Delta)\,\widehat{K}; \text{and} \\ \widehat{X}_2 &= (\lambda_{L1}/\Delta)\,\widehat{K} \end{aligned}\right\} \tag{3.6}$$

where $\Delta = (\lambda_{L1}\lambda_{K2} - \lambda_{L2}\lambda_{K1}) > 0$ since it is assumed that sector 2 is more capital-intensive than sector 1. Hence, $\widehat{X}_1 < 0$ and $\widehat{X}_2 > 0$, when $\widehat{K} > 0$ following a Rybczynski effect.

Therefore, in accordance with the Rybczynski theorem, with increased capital endowment, the production of the capital-intensive, import-competing sector (sector 2) increases. The output of sector 1 falls so that the extra labour for production of X_2 is released from sector 1 in a full-employment situation.

Differentiating (3.5) with respect to K gives[4]

$$\left(\frac{dI}{dK}\right) = -tP_2\left(\frac{dX_2}{dK}\right) \tag{3.7}$$

Now $(dX_2/dK) = (\lambda_{L1}/\Delta)(X_2/K) > 0$, which implies that

$$(dI/dK) < 0. \tag{3.8}$$

The important result that follows is that an inflow of foreign capital with full repatriation of its earnings is necessarily immiserizing if the import-competing sector is capital-intensive and is protected by a tariff. This is because it leads to an expansion of the tariff-protected, capital-intensive import-competing sector thereby cutting back the volumes of trade further for a small open economy and moves it further away from the free trade situation, which is the optimal policy. This result is called the Brecher–Alejandro proposition, which is also known as the immiserizing effect of foreign capital. It is also evident from Eqs. (3.7) and (3.8) that in the absence of any tariff, foreign capital does not affect national income.

[4]Since this is a decomposable system as already mentioned, $\widehat{W} = \widehat{r} = 0$ as $\widehat{K} > 0$, so that $L(dW/dK) = 0$ and $K_D(dr/dK) = 0$. Same results are obtained if one differentiates Eq. (3.5) with respect to K_F. This is because from Eq. (3.4) it follows that $dK = dK_F$.

3.2.2 Re-examination of the Brecher–Alejandro Proposition (1977)

In the literature, the Brecher–Alejandro proposition has also been re-examined in terms of three-sector models. The third sector may either be a duty-free zone (DFZ) (sometimes called foreign enclave) as in the works of Beladi and Marjit (1992a, b) or it may be an urban informal sector as in the works of Grinols (1991), Chandra and Khan (1993) and Gupta (1997). The works of Beladi and Marjit (1992a, b) are simple three-sector extensions of the Heckscher–Ohlin–Samuelson framework where the third sector, the DFZ, uses sector-specific capital that is foreign owned. They have shown that with full repatriation of foreign capital income, an inflow of foreign capital may lead to immiserizing growth in the presence of tariff distortion even if the foreign capital is employed in the export sector. This generalizes the main result in the existing literature, which primarily focuses on foreign capital inflow in the protected sector of the economy.

We now present the essence of the Beladi and Marjit (1992a) model. A three-sector full-employment general equilibrium model in the context of a small open economy is considered. Sector 1 is the duty-free zone (DFZ) that uses labour and capital of type N. The other two sectors use capital of type K.

Under competitive conditions, the three zero-profit conditions are

$$Wa_{L1} + Ra_{N1} = 1 \tag{3.9}$$

$$Wa_{L2} + ra_{K2} = P_2 \tag{3.10}$$

$$Wa_{L3} + ra_{K3} = P_3\,(1 + t) \tag{3.11}$$

R and r are the returns to capital of type N and type K, respectively.

The full-employment conditions of the three factors of production are as follows:

$$a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 = L \tag{3.12}$$

$$a_{N1}X_1 = N_{\mathrm{D}} + N_{\mathrm{F}} = N \tag{3.13}$$

$$a_{K2}X_2 + a_{K3}X_3 = K_{\mathrm{D}} + K_{\mathrm{F}} = K \tag{3.14}$$

where N_{D}, N_{F}, K_{D} and K_{F} are the domestic and foreign capital stocks of type N and type K in the economy, respectively.

The expression for national income at world prices is given by

$$I = WL + RN_{\mathrm{D}} + rK_{\mathrm{D}} - tP_3X_3 \tag{3.15}$$

Here, WL is the aggregate wage income, while RN_{D} and rK_{D} are rental incomes from domestic capital stocks of type N and type K, respectively. Finally, tP_3X_3 measures the supply side distortionary cost of tariff protection of the import-competing sector.[5] Incomes earned on foreign capital are completely repatriated.

One can note from the price system that this production structure possesses the decomposition property and that sectors 2 and 3 together form a Heckscher–Ohlin subsystem (HOSS). We assume that sector 3 is more capital-intensive vis-à-vis sector 2 in physical sense. This means that $(a_{K3}/a_{L3}) > (a_{K2}/a_{L2})$.

Since the model satisfies the decomposition property, factor prices W, R and r are determined from the price system alone independent of the output system. So if foreign capital of type N flows in, factor prices will not undergo any changes. Sector 1 expands as capital of type N is specific to this sector. For an expansion of sector 1, more labour is required which must come from the HOSS. A Rybczynski-type effect takes place since the availability of labour in the HOSS decreases. Sector 2 contracts while sector 3 expands as the former sector is more labour-intensive than the latter. As the tariff-protected import-competing sector expands, the distortionary cost of protection of the supply side rises, which works negatively on welfare.

This can be easily seen by differentiating (3.15) with respect to N_{F}. We obtain

$$\left(\frac{dI}{dN_{\mathrm{F}}}\right) = -tP_3\left(\frac{dX_3}{dN_{\mathrm{F}}}\right) < 0 \quad \left(\text{since}\left(\frac{dX_3}{dN_{\mathrm{F}}}\right) > 0\right). \tag{3.16}$$

Therefore, the immiserizing result holds.

Is the presence of a tariff necessary for deriving the immiserizing result? We have so far seen that it is. But there can be cases where this result may be obtained even without the tariff distortion in the presence of any other type of distortion in the economy (e.g. unskilled labour market imperfection leading to the possibility of unskilled unemployment). The model presented in Beladi and Marjit (1992b) depicts such a case. It considers a three-sector economy with four factors of production: unskilled labour, skilled labour, capital of type N and capital of type K. The unskilled wage is fixed economy-wide at $\overline{W}$ due to minimum wage legislation of the government which gives rise to the possibility of unskilled unemployment in the economy. In all the three sectors, both types of labour are used. Capital of type N is used in sector 1 which is a DFZ while the other two sectors use capital of type K. Sectors 1 and 2 are the two export sectors, while sector 3 is the import-competing sector that is protected by an import tariff.

The usual zero-profit conditions for the three sectors are as follows:

$$\overline{W}a_{L1} + W_{\mathrm{S}}a_{S1} + Ra_{N1} = 1 \tag{3.17}$$

$$\overline{W}a_{L2} + W_{\mathrm{S}}a_{S2} + ra_{K2} = P_2 \tag{3.18}$$

[5]In the original Beladi and Marjit (1992a) paper, social welfare is measured in terms of a strictly quasi-concave social utility function. It, however, does not make any difference because relative commodity prices are given to the economy by virtue of the small open economy assumption.

$$\overline{W}a_{L3} + W_{S}a_{S3} + ra_{K3} = P_3\,(1 + t) \tag{3.19}$$

Here, W_S is the skilled wage. Since the unskilled wage $\overline{W}$ is given, sectors 2 and 3 together form a HOSS. It is reasonable to assume that the protected sector (sector 3) is more capital-intensive relative to sector 2 with respect to skilled labour. This implies that $(a_{K3}/a_{S3}) > (a_{K2}/a_{S2})$.

Skilled labour and the two types of capital are completely utilized. The full-employment conditions for these resources are given as follows:

$$a_{S1}X_1 + a_{S2}X_2 + a_{S3}X_3 = S \tag{3.20}$$

$$a_{N1}X_1 = N_{D} + N_{F} = N \tag{3.21}$$

$$a_{K2}X_2 + a_{K3}X_3 = K_{D} + K_{F} = K \tag{3.22}$$

Since the unskilled wage is exogenously given at $\overline{W}$, there arises a possibility of unskilled unemployment. We assume that the supply of unskilled labour is greater than its aggregate demand in the three sectors at $\overline{W}$ so that there is unemployment of unskilled labour in the economy. The aggregate employment of unskilled labour in the economy (L) is given by

$$L = a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 \tag{3.23}$$

Finally, we measure social welfare by national income at international prices, which is given by

$$I = \overline{W}L + W_{S}S + RN_{D} + rK_{D} - tP_3X_3 \tag{3.24}$$

Note that $\overline{W}L$ is the aggregate wage income of unskilled labour, which may change if the aggregate unskilled employment (L) changes due to any policy changes.

This production structure is also decomposable like the Beladi and Marjit (1992a) model. W_S and r are determined from Eqs. (3.18) and (3.19). Plugging the value of W_S in (3.17), one can obtain R. So factor prices do not depend on factor endowments.

Now suppose that foreign capital of type N flows in, resulting in an expansion of sector 1. The expansion requires more skilled labour that must come from the HOSS. As the supply of skilled labour to the HOSS decreases, this paves the way for a Rybczynski-type effect. Sector 3 expands while sector 2 contracts given our factor intensity rankings of these two sectors. Since the protected sector expands, the distortionary cost of tariff of the supply side rises, which works negatively on welfare. What happens to the aggregate unskilled employment becomes important. The use of unskilled labour rises in both sectors 1 and 3, while it falls in sector 2. So the net effect on aggregate unskilled employment (L) is ambiguous. It depends on the relative intensities with which different factors are used in the three sectors. To find out the consequence on national welfare, we differentiate Eq. (3.24) with respect to N_F and find that

$$\left(\frac{dI}{dN_F}\right) = \overline{W}\left(\frac{dL}{dN_F}\right) - tP_3\left(\frac{dX_3}{dN_F}\right) \tag{3.25}$$

In (3.25), while $(dX_3/dN_F) > 0$, the sign of (dL/dN_F) is ambiguous. If $(dL/dN_F) < 0$, welfare certainly worsens. Since in the absence of any tariff, $t = 0$, from (3.25), it then follows that welfare deteriorates iff $(dL/dN_F) < 0$. Hence, welfare deteriorates even in the absence of any tariff if the aggregate unskilled employment in the economy falls.

3.2.3 Introduction of Rural–Urban Migration

As the developing countries are plagued by labour market distortion, several attempts have been made to analyse the welfare impact of foreign capital inflow using a Harris–Todaro (hereafter, HT) type (1970) framework. For example, Khan (1982) has considered a mobile capital generalized HT model with urban unemployment.

Khan (1982) has shown that the 'Brecher–Alejandro proposition' is valid even in a two-sector mobile capital HT model.[6] The two-sector Heckscher–Ohlin model considered in the previous section is modified to capture the impact of rural–urban migration in the presence of urban unemployment. Total labour endowment L is used to produce X_1 and X_2, and a part remains unemployed so that we have $L = L_1 + L_2 + L_U$. Here, L_1 and L_2 denote total employment levels in rural and urban sectors, respectively while L_U is urban unemployment. The model considers intersectoral wage differential. The rural wage W is perfectly flexible, while there exists distortion in the urban labour market where the wage is institutionally fixed at $\overline{W}$, with $W < \overline{W}$. It is assumed that the urban sector is more capital-intensive vis-à-vis the rural sector in value terms.[7]

The price system depicted in the Brecher–Alejandro (1977) model is slightly modified to include the institutionalized wage in the urban sector (sector 2). The zero-profit condition for sector 2 is modified as follows:

$$\overline{W}a_{L2} + ra_{K2} = P_2^* \tag{3.26}$$

[6]The two-sector mobile capital version of the HT model is known as the Corden and Findlay (1975) framework.

[7]This implies that $(\theta_{K2}/\theta_{L2}) > (\theta_{K1}/\theta_{L1})$, i.e. $\left(a_{K2}/\overline{W}a_{L2}\right) > (a_{K1}/Wa_{L1})$, where θ_{ji} is the distributive share of the jth factor in the ith sector. It should be mentioned that if sector 2 is capital-intensive in value sense, it automatically implies that it is more capital-intensive vis-a-vis sector 1 in physical sense as well.

The labour endowment equation now includes urban unemployment and is given by

$$a_{L1}X_1 + a_{L2}X_2 + L_{\mathrm{U}} = L \tag{3.27}$$

The rural-urban wage differential induces rural workers to migrate to urban areas. The HT migration equilibrium condition states that the expected urban wage must equal the actual rural wage. Therefore, in migration equilibrium, we have

$$\overline{W}\frac{L_2}{L_2 + L_{\mathrm{U}}} = W$$

Using (3.27), the above expression can be rewritten as follows:

$$a_{L1}X_1 + \left(\frac{\overline{W}}{W}\right)a_{L2}X_2 = L \tag{3.28}$$

The expression for the national income at world prices remains the same despite the introduction of labour market distortion and rural–urban migration. This is because of the 'envelope property' implied by the HT structure that states that the average wage of all workers in an HT economy is equal to the rural sector wage, W.

Now, the price system consists of Eqs. (3.1) and (3.26), while Eqs. (3.4), (3.27) and (3.28) constitute the output system. This is again a decomposable system with an additional variable L_{U} and an additional Eq. (3.28). Differentiating (3.4) and (3.28) and considering $dL = 0$, one gets

$$\left.\begin{aligned} \lambda_{K1}\widehat{X}_1 + \lambda_{K2}\widehat{X}_2 &= \widehat{K} \\ \lambda_{L1}\widehat{X}_1 + \left(\overline{W}/W\right)\lambda_{L2}\widehat{X}_2 &= 0 \end{aligned}\right\} \tag{3.29}$$

Solving (3.29) by Cramer's rule, the following expressions are obtained:

$$\left.\begin{aligned} \widehat{X}_1 &= \widehat{K}\left[\left\{\left(\overline{W}/W\right)\lambda_{L2}\right\}/\Delta\right] \\ \widehat{X}_2 &= -\widehat{K}\left[\lambda_{L1}/\Delta\right] \end{aligned}\right\} \tag{3.30}$$

where $\Delta = \lambda_{K1}\lambda_{L2}\overline{W} - W\lambda_{K2}\lambda_{L1} < 0$ since the urban sector is more capital-intensive than the rural sector in value sense.

Therefore, $\widehat{X}_1 < 0$ and $\widehat{X}_2 > 0$, when $\widehat{K} > 0$. As in the previous case, Rybczynski effect leads to expansion of sector 2 and contraction of sector 1.

As the expression for national income at world prices remains unchanged, we have

$$\left(\frac{dI}{dK}\right) = -tP_2\left(\frac{dX_2}{dK}\right) \tag{3.31}$$

Since $(dX_2/dK) > 0$, Eq. (3.31) implies that $(dI/dK) < 0$.

Therefore, the immiserizing effect of foreign capital continues to be valid even after the introduction of labour market imperfection, rural–urban migration and urban unemployment. The presence of labour market imperfection cannot affect the welfare consequence as factor prices including the rural wage remain unaffected despite inflows of foreign capital.

3.2.4 Introduction of the Informal Sector: Chandra and Khan (1993) Model

Chandra and Khan (1993) have shown the validity of the immiserizing effect of foreign capital even in the presence of an urban informal sector. They have used different concepts of the informal sector so that their actual work consists of several models dealing with different conceptualizations of the informal sector. However, we here present only the model that considers informal sector as producing an internationally traded final commodity and assume that there is intersectoral capital mobility so that the return to capital is the same for all the three sectors. Chandra and Khan (1993) consider a dual economy with two broad sectors: urban and rural. The urban sector is further subdivided into informal and formal sectors so that in all we have three sectors. Let sectors 1, 2 and 3 denote the rural, urban informal and urban formal sectors, respectively. All the three sectors produce internationally traded commodities and their prices are given internationally due to the small open economy assumption. Sector 3 is the import-competing sector and is protected by an import tariff.

Given the perfectly competitive markets, the usual zero-profit conditions are given by

$$W_1 a_{L1} + r a_{K1} = P_1 \tag{3.32}$$

$$W_2 a_{L2} + r a_{K2} = P_2 \tag{3.33}$$

$$\overline{W}_3 a_{L3} + r a_{K3} = P_3 (1 + t) \tag{3.34}$$

where W_1, W_2 and $\overline{W}_3$ denote the rural sector, urban informal sector and formal sector wage rates, respectively.

Full employment of labour[8] is depicted by

$$a_{L1} X_1 + a_{L2} X_2 + a_{L3} X_3 = L \tag{3.35}$$

[8]Here, the informal sector is the residual sector in the sense that those who do not get employment in the urban formal sector are automatically absorbed in the urban informal sector.

Complete utilization of capital implies that

$$a_{K1}X_1 + a_{K2}X_2 + a_{K3}X_3 = K_{\mathrm{D}} + K_{\mathrm{F}} = K \tag{3.36}$$

In migration equilibrium, the expected urban wage for a prospective rural migrant is equal to the rural wage. Hence, the migration equilibrium condition is given by

$$\left(\frac{\overline{W}_3 a_{L3}X_3 + W_2 a_{L2}X_2}{a_{L3}X_3 + a_{L2}X_2}\right) = W_1$$

Using (3.35) and simplifying, the above condition can be rewritten as follows:

$$a_{L1}X_1 + \left(\frac{W_2}{W_1}\right) a_{L2}X_2 + \left(\frac{\overline{W}_3}{W_1}\right) a_{L3}X_3 = L \tag{3.37}$$

The national income at world prices is now given by

$$I = W_1 L + rK_{\mathrm{D}} - tP_3X_3 \tag{3.38}$$

This is also a decomposable system where input prices are determined from the price system alone (Eqs. (3.32), (3.33) and (3.34)) without any help of the output system.

Subtraction of (3.35) from (3.37) and simplification yield[9]

$$(W_1 - W_2)\,\lambda_{L2} + \left(W_1 - \overline{W}_3\right)\lambda_{L3} = 0 \tag{3.39}$$

Now, the effect of an increase in the inflow of foreign capital on welfare is considered. In the decomposable system, an increase in capital endowment has no effect on factor prices, so that (W_i/r) also remains unchanged. Hence, $a_{L_i} = a_{L_i}(W_i/r)$ and $a_{K_i} = a_{K_i}(W_i/r)$ remain unchanged as well. Therefore, differentiating (3.39), one obtains

$$\widehat{X}_2 = \widehat{X}_3 \tag{3.40}$$

Differentiating (3.35) and (3.36), using (3.39) and (3.40) and considering $dL = 0$, we get the following two expressions, respectively:

$$\lambda_{L1}\widehat{X}_1 + (\lambda_{L2} + \lambda_{L3})\,\widehat{X}_3 = 0 \text{ and} \tag{3.41}$$

$$\lambda_{K1}\widehat{X}_1 + (\lambda_{K2} + \lambda_{K3})\,\widehat{X}_3 = \widehat{K} \tag{3.42}$$

[9]Here, $\overline{W}_3 > W_1 > W_2$.

Solving (3.41) and (3.42) by Cramer's rule, one finds

$$\left.\begin{aligned} \widehat{X}_1 &= (\lambda_{L2} + \lambda_{L3})\left(\widehat{K}/\Delta\right) \text{ and} \\ \widehat{X}_3 &= -\left(\lambda_{L1}\widehat{K}/\Delta\right) \end{aligned}\right\} \tag{3.43}$$

where

$$\Delta = [\lambda_{K1}(\lambda_{L2} + \lambda_{L3}) - \lambda_{L1}(\lambda_{K2} + \lambda_{K3})] \tag{3.44}$$

Now, according to the Chandra–Khan capital intensity condition (hereafter, CKCIC), the urban sector as a whole (consisting of both formal sector and informal sector) is capital-intensive relative to the rural sector iff

$$\left[\frac{(\lambda_{K2} + \lambda_{K3})}{(\lambda_{L2} + \lambda_{L3})}\right] > \left(\frac{\lambda_{K1}}{\lambda_{L1}}\right) \tag{3.45}$$

Now from (3.44), it follows that $\Delta < 0$. This suggests that $\widehat{X}_1 < 0$ and $\widehat{X}_3 > 0$, when $\widehat{K} > 0$.[10]

It is evident that with an increase in capital endowment, the overall urban sector expands and the rural sector contracts owing to Rybczynski effect iff the CKCIC holds. The result holds even if the rural and/or informal sector does not use capital, that is, λ_{K1} and/or $\lambda_{K2} = 0$.

Now differentiating (3.38) with respect to K, we obtain

$$\left(\frac{dI}{dK}\right) = -tP_3\left(\frac{dX_3}{dK}\right) < 0 \text{ since } \left(\frac{dX_3}{dK}\right) > 0 \tag{3.46}$$

Hence, an inflow of foreign capital is again immiserizing if the CKCIC holds.

3.2.5 2 × 3 Specific-Factor Model and Immiserizing Growth

In the 2×3 specific-factor, full-employment model, the decomposition property does not hold. Factor prices depend not only on commodity prices but also on factor endowments. Therefore, any changes in factor endowments affect all the variables including factor prices. In such a structure, an inflow of foreign capital in the export sector of the economy can never be immiserizing. This is an interesting result obtained in Jones and Marjit (1992). Let us first prove this result and then

[10] From (3.40) and (3.43), it follows that $\widehat{X}_2 = -\left(\lambda_{L1}\widehat{K}/\Delta\right) > 0$.

examine whether by slightly altering the assumptions of the model we can obtain the standard immiserizing result even in this framework.

The structure of the model is given as follows:

$$W a_{L1} + r_1 a_{K1} = P_1 \tag{3.47}$$

$$W a_{L2} + r_2 a_{K2} = P_2 (1 + t) = P_2^* \tag{3.48}$$

$$a_{L1} X_1 + a_{L2} X_2 = L \tag{3.49}$$

$$a_{K1} X_1 = K_1 \tag{3.50}$$

$$a_{K2} X_2 = K_2 \tag{3.51}$$

The national income at world prices is given by

$$I = WL + r_2 K_2 - t P_2 X_2 \tag{3.52}$$

Equations (3.47) and (3.48) are the two zero-profit conditions relating to the two sectors of the economy. Sector 1 uses capital of type 1, while sector 2 uses capital of type 2. These are the two sector-specific inputs. Full-employment conditions for the two types of capital are given by (3.50) and (3.51). Full utilization of labour leads to Eq. (3.49).

We make the simplifying assumption that the entire stock of capital of type 1 is owned by foreign capitalists. Therefore, the entire income earned on capital of type 1 is repatriated and hence it is not included in the country's expression for national income (Eq. 3.52). On the contrary, capital of type 2 is owned by domestic capitalists and the return to this type of capital is included in the national income. If these assumptions are relaxed such that the total capital stock of either type consists of both domestic capital and foreign capital, which are perfect substitutes, the qualitative results remain unaltered, but the algebra becomes clumsier. Sector 1 is the export sector while sector 2 is the tariff-protected import-competing sector. So, foreign capital is employed in the export sector of the economy.

Using (3.50) and (3.51), Eq. (3.49) can be rewritten as follows:

$$\left(\frac{a_{L1}}{a_{K1}} K_1\right) + \left(\frac{a_{L2}}{a_{K2}} K_2\right) = L \tag{3.53}$$

The three input prices W, r_1 and r_2 are solved from Eqs. (3.47), (3.48) and (3.53) as functions of commodity prices and factor endowments.

Totally differentiating Eqs. (3.47), (3.48) and (3.53), simplifying and considering $dP_1, dP_2, dK_2, dL = 0$ and $dK_1 > 0$, we obtain

$$\left.\begin{aligned} &\theta_{L1}\widehat{W} + \theta_{K1}\widehat{r}_1 = 0 \\ &\theta_{L2}\widehat{W} + \theta_{K2}\widehat{r}_2 = 0 \\ &-A\widehat{W} + B\widehat{r}_1 + C\widehat{r}_2 = -\lambda_{L1}\widehat{K}_1 \end{aligned}\right\} \tag{3.54}$$

where $\sigma_i = (\widehat{a}_{K_i} - \widehat{a}_{L_i})/(\widehat{W} - \widehat{r})$ is the elasticity of substitution between two factors in the ith sector, $i = 1, 2$ and $A = (\lambda_{L1}\sigma_1 + \lambda_{L2}\sigma_2) > 0; B = \lambda_{L1}\sigma_1 > 0;$ $C = \lambda_{L2}\sigma_2 > 0$.

Solving (3.54) by Cramer's rule, one gets the following:

$$\left.\begin{aligned} \widehat{W} &= -\left(\frac{\theta_{K1}\theta_{K2}\lambda_{L1}}{\Delta}\right)\widehat{K}_1; \\ \widehat{r}_1 &= \left(\frac{\theta_{L1}\theta_{K2}\lambda_{L1}}{\Delta}\right)\widehat{K}_1 \text{ and} \\ \widehat{r}_2 &= \left(\frac{\theta_{K1}\theta_{L2}\lambda_{L1}}{\Delta}\right)\widehat{K}_1 \end{aligned}\right\} \tag{3.55}$$

where

$$\Delta = -\left[\theta_{L1}\theta_{K2}B + \theta_{K1}\left(\theta_{L2}C + \theta_{K2}A\right)\right] < 0 \tag{3.56}$$

Differentiating (3.51), we have

$$\widehat{X}_2 = -\sigma_2\theta_{L2}\left(\widehat{W} - \widehat{r}_2\right) = \left(\frac{\sigma_2\theta_{L2}\theta_{K1}\lambda_{L1}}{\Delta}\right)\widehat{K}_1 \tag{3.57}$$

(obtained after using (3.55))

Totally differentiating (3.52), we get

$$\widehat{I} = \left(\frac{WL}{I}\right)\widehat{W} + \left(\frac{r_2K_2}{I}\right)\widehat{r}_2 - tP_2X_2\widehat{X}_2 \tag{3.58}$$

Substituting the expressions for $\widehat{W}$, $\widehat{r}_2$ and $\widehat{X}_2$ from (3.55) and (3.57) in (3.58), we find

$$\begin{aligned} \left(\frac{\widehat{I}}{\widehat{K}_1}\right) = &-\left(\frac{WL}{I}\right)\left(\frac{\theta_{K1}\theta_{K2}\lambda_{L1}}{\Delta}\right) + \left(\frac{r_2K_2}{I}\right)\left(\frac{\theta_{K1}\theta_{L2}\lambda_{L1}}{\Delta}\right) \\ &-\left(\frac{tP_2X_2}{I}\right)\left(\frac{\sigma_2\theta_{L2}\theta_{K1}\lambda_{L1}}{\Delta}\right) \end{aligned}$$

After simplification, this reduces to

$$\left(\frac{\widehat{I}}{\widehat{K}_1}\right) = -\underset{(-)}{\left(\frac{\theta_{K1}\theta_{K2}\lambda_{L1}W}{I\Delta}\right)} a_{L1}X_1 - \left(\frac{tP_2X_2}{I}\right)\underset{(-)}{\left(\frac{\sigma_2\theta_{L2}\theta_{K1}\lambda_{L1}}{\Delta}\right)} > 0 \quad (3.59)$$

This result can be stated in terms of the following proposition.

Proposition 3.1 *In the 2 × 3 specific-factor, full-employment model, an inflow of foreign capital in the export sector unambiguously improves welfare of the economy.*

So in a 2 × 3 full-employment model, an inflow of foreign capital employed in the export sector of the economy cannot be immiserizing.[11] This is the Jones and Marjit (1992) result. The intuition behind this result is as follows. If foreign capital enters the export sector, it would expand and require more labour (intersectorally mobile factor) for its expansion. As labour moves from sectors 2 to 1, the former sector has to contract. In other words, the import-competing sector has to contract because of the scarcity of the mobile factor. This produces a positive effect on national income through a decrease in the supply side distortionary cost of tariff protection and an increase in the aggregate factor income.

3.2.6 2 × 3 Specific-Factor Model, Technology Transfer and Immiserizing Growth

Chaudhuri (2001a) has demonstrated that even in a 2 × 3 full-employment structure, the immiserizing result may be obtained if the inflow of foreign capital in the export sector is accompanied by a technology transfer, which leads to a fall in the labour–output ratio in this sector. In this situation, one may be able to derive a necessary and sufficient condition under which the immiserizing result is obtained.

A general equilibrium of the system is represented by Eqs. (3.47), (3.48), (3.49), (3.50) and (3.51) of the previous section and an additional equation as given by the following:

$$a_{L1} = a_{L1}\left(\underset{(-)}{\frac{W}{r_1}}, \underset{(-)}{A}\,(\underset{(+)}{K_1})\right) \quad (3.60)$$

Equations (3.47), (3.48), (3.49), (3.50) and (3.51) have already been explained in Sect. 3.2.5. Equation (3.60) states that the labour–output ratio in sector 1, a_{L1}, is a decreasing function of both the wage–rental ratio in sector 1 and the state of

[11] One requires at least a three-sector model to show that an inflow of foreign capital in the export sector is immiserizing.

technology, A. This means that the better the technology is, the lower the value of a_{L1}would be. The state of technology is again a positive function of the amount of foreign capital in the economy. As K_1 increases due to an inflow of foreign capital, it ushers in a more labour-saving technology transfer, which lowers the labour–output ratio, a_{L1}, in that sector.[12]

The general equilibrium properties of the model and the expression for the national income remain the same. Equation (3.53) also remains unchanged. Here, also the three unknown factor prices, W, r_1 and r_2, are determined from Eqs. (3.47), (3.48) and (3.53). Differentiating Eqs. (3.47), (3.48), (3.50), (3.51), (3.52) and (3.53) and (3.60), one can find out a necessary and sufficient condition under which national income declines as K_1 rises.[13]

The intuition behind this result is fairly straightforward. The key issue is whether the output of the tariff-protected import-competing sector rises or not. Since the import-competing sector is not directly affected due to an inflow of capital in the export sector, everything hinges on the direction of movement in the export sector's labour demand. On one hand, foreign capital inflows tend to increase labour demand by the export sector, and on the other, the accompanying labour-saving technology transfer tends to reduce it. When the necessary and sufficient condition is satisfied, the latter effect dominates over the former and labour is released by sector 1. Consequently, W falls and r_2 rises. Producers in sector 2 adopt more labour-intensive technique of production. Hence, the capital–output ratio of sector 2, a_{K2}, falls. Full utilization of domestic capital (capital of type 2) leads to an expansion of the tariff-protected import-competing sector of the economy. The economy's welfare, measured by national income at world prices, declines if the increase in the distortionary cost of tariff of the supply side outweighs the increase in aggregate domestic factor income. This happens if the necessary and sufficient condition is satisfied. This leads to the following proposition.

Proposition 3.2 *The 'immiserizing' result relating to FDI flow in the export sector in a 2×3 full-employment model may hold if the FDI is accompanied by a technology transfer that lowers the labour–output ratio in that sector.*

However, in the 2×3 case, if foreign capital flows to the import-competing sector, social welfare may improve. The analysis so far has provided the much-needed theoretical support behind the negative attitude of the developing countries towards foreign capital up to the early 1980s.

---

[12]This is only a simplifying assumption. The qualitative results of the model remain unaffected even if one considers a case where both a_{L1} and a_{K1} are decreasing functions of A. The assumption then required is that the proportionate fall in a_{L1} is greater than that in a_{K1} due to an increase in A.

[13]See Chaudhuri (2001a) for detailed derivations.

3.3 Towards Tracing the Optimism Behind FDI

A typical developing country is characterized by capital scarcity and therefore adopts measures to allow inflow of foreign capital in abundance in order to facilitate economic growth. It is important to mention that the developing countries have been able to attract a substantial amount of foreign capital during the last three decades by adopting liberalized investment and trade policies. As per the UNCTAD (2008), the average yearly foreign direct investment (FDI) inflow to developing countries increased from nearly \$20.6 billion during the 1980s to \$118 billion during the 1990s and then 292 billion dollars per year, on an average, during the first 8 years of the new millennium. Though some developing countries have witnessed capital outflows, net FDI inflow to the developing world has increased steadily during the last three decades or so. Average yearly net FDI flows to developing countries increased from nearly \$14.7 billion during the 1980s to 165 billion dollars per year, on an average, during 2000–2008 (calculation based on UNCTAD (2008)). The rate of growth of FDI flows has been exceptionally fast during 2010–2012. As per the World Investment Report, UNCTAD (2013), FDI flows to developing countries increased from 637 billions of dollars in 2010 to \$703 billion in 2012. In percentage terms, the share of the developing countries in world FDI flows increased from 45.2 % in 2010 to 52 % in 2012.

A pertinent question is why developing countries are yearning for foreign capital given the standard welfare deteriorating effect of foreign capital. A few possible explanations may be as follows. First, the immiserizing result of Brecher–Alejandro (1977) has been derived in the context of the standard H–O–S framework, where the decomposition property holds. So factor prices remain unchanged despite an inflow of foreign capital and welfare deteriorates as the tariff-protected import-competing sector expands. However, as found in Grinols (1991), in an indecomposable production structure, the result may be different. Secondly, foreign capital is immiserizing if it is allowed to enter the import-competing sector.[14] On the contrary, if foreign capital is allowed to enter an intermediate good (internationally traded or non-traded) producing sector, it may be welfare improving, as shown by Marjit and Beladi (1996) and Chaudhuri (2001b). Third, in Khan (1982) and Chandra and Khan (1993), the immiserizing result has been obtained by using the HT framework where the presence of labour market distortion cannot influence the welfare consequence of an inflow of foreign capital due to the 'envelope property' implied by the HT structure. But, if a full-employment structure is followed, foreign capital inflows might be welfare improving in a 2×2 production structure in the presence of tariff and labour market distortions (Chaudhuri 2005). Finally, standard trade models do not adequately capture some of the essentials characteristics of a typical developing economy. Even in an HT structure, with agricultural dualism and

[14]Chaudhuri (2007) is a notable exception.

non-traded commodities, it is possible to show that an inflow of foreign capital may well be welfare improving (Chaudhuri 2007).

3.3.1 Welfare Consequence of FDI in a Model with Specific-Capital, Informal Sector

In Sect. 3.2.4, while presenting the Chandra and Khan model, we have considered a three-sector HT-type general equilibrium model with an urban informal sector where there is perfect capital mobility among all the three sectors of the economy. However, if we allow the informal sector (sector 2) to use a specific type of capital (say, capital of type N), an inflow of foreign capital in a tariff-protected urban formal sector (sector 3) may be welfare improving. Let us analyse this in detail in terms of the following three-sector HT-type general equilibrium model:

$$W_1 a_{L1} + r a_{K1} = P_1 \tag{3.61}$$

$$W_2 a_{L2} + R a_{N2} = P_2 \tag{3.62}$$

$$W_3^* a_{L3} + r a_{K3} = P_3 (1 + t) \tag{3.63}$$

$$a_{K1} X_1 + a_{K3} X_3 = K_{\mathrm{D}} + K_{\mathrm{F}} = K \tag{3.64}$$

$$a_{N2} X_2 = N \tag{3.65}$$

$$a_{L1} X_1 + a_{L2} X_2 + a_{L3} X_3 = L \tag{3.66}$$

$$\left(\frac{W_2 a_{L2} X_2 + W_3^* a_{L3} X_3}{a_{L2} X_2 + a_{L3} X_3} \right) = W_1 \tag{3.67}$$

$$I = W_1 L + RN + r K_{\mathrm{D}} - t P_3 X_3 \tag{3.68}$$

Equations (3.61), (3.62) and (3.63) are the three price–unit cost equality conditions for the rural sector (sector 1), the urban informal sector (sector 2) and the urban formal sector (sector 3), respectively. The wage rates in the three sectors are W_1, W_2 and W_3^*, respectively. W_3^* is exogenously given due to institutional reasons. Capital of type K (rate of return, r) is perfectly mobile between sectors 1 and sector 3, while capital of type N (rate of return, R) is specific to sector 2. Equations (3.64), (3.65) and (3.66) are the full-employment conditions for the two types of capital and labour, respectively. Finally, the HT migration equilibrium condition is given by (3.67). All the commodities are internationally traded, and their prices are given by the small open economy assumption. National income at world prices is given by Eq. (3.68), where RN is the return to capital of type N.

This is an indecomposable system. However, sectors 1 and 3 together form a HOSS since they use the same two inputs – labour and capital of type K. It is reasonable to assume that the tariff-protected import-competing sector (sector 3) is more capital-intensive than sector 1 in value sense, i.e. $(a_{K3}/W_3^* a_{L3}) > (a_{K1}/W_1 a_{L1})$. Given W_3^*, r is obtained from (3.63). Then, W_1 is found from (3.61). So, r and W_1 do not depend on factor endowments. But R and W_2 depend on factor endowments as these two and the output levels are solved from the remaining five equations.

An inflow of foreign capital (of type K) leads to an expansion of sector 3 following a Rybczynski effect since it has been assumed to be more capital-intensive vis-à-vis sector 1 in value sense. This raises the expected urban wage for a prospective rural migrant and leads to fresh migration from the rural sector to the urban sector. As the number of new migrants in the urban sector exceeds the number of new jobs created in the urban formal sector (sector 3), the supply of labour to the urban informal sector rises, which depresses the informal sector wage W_2 and raises R (Eq. 3.62). Producers in sector 2 substitute capital by labour leading to a fall in the capital–output ratio, a_{N2}. Sector 2 expands as it uses capital of type N, which is sector-specific (see Eq. 3.65). The aggregate wage income does not change as the rural sector wage, W_1, remains unaltered.[15] But the aggregate factor income unambiguously rises since R increases. This works positively on welfare. On the other hand, as the protected sector expands, the deadweight loss due to tariff rises and affects welfare adversely. However, if the return to the specific factor used by the informal sector rises sufficiently, national income at world prices may increase. This establishes the following proposition.

Proposition 3.3 *In a three-sector HT economy with an urban informal sector that uses a specific input, an inflow of foreign capital may be welfare improving.*

3.3.2 *Foreign Capital Inflow and Welfare with Intermediate Goods*

In this section, we examine the welfare consequences of foreign capital inflow in the intermediate good-producing sector. An intermediate good is not meant for final consumption; rather it is used to produce final commodity(ies). On the other hand, intermediate goods can be of two types: (internationally) traded and non-traded. The price of a traded intermediate good is internationally determined, while that of a non-traded (or local) intermediate product is domestically determined by demand–supply forces. Let us consider the case of a traded intermediate good.[16]

---

[15] W_1 is the average wage of all workers in an HT economy. This is due to the 'envelope property' implied by the HT structure.

[16] The following model is based on Marjit and Beladi (1996).

We consider a small open economy with three sectors producing two final commodities and a traded intermediate input. Sector 1 produces a final commodity by means of labour and capital of type N. Sector 2 is the other final good-producing sector that uses labour, capital of type N and the traded intermediate good. Finally, sector 3 produces the traded intermediate good with labour and capital of type K. Capital of type N is domestic capital, while capital of type K is fully owned by foreign capitalists. So sector 3 can be called a 'foreign enclave'. Sectors 1 and 2 are the two export sectors, while sector 3 is the import-competing sector, which is protected by an import tariff. Domestic production of the intermediate input falls short of its aggregate demand in sector 2. Therefore, the remaining amount has to be imported. The equational structure of this general equilibrium set-up is given by the following set of equations:

$$Wa_{L1} + Ra_{N1} = P_1 \tag{3.69}$$

$$Wa_{L2} + Ra_{N2} + P_3(1+t)a_{32} = P_2 \tag{3.70}$$

$$Wa_{L3} + ra_{K3} = P_3(1+t) \tag{3.71}$$

$$a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 = L \tag{3.72}$$

$$a_{N1}X_1 + a_{N2}X_2 = N \tag{3.73}$$

$$a_{K3}X_3 = K_{\mathrm{F}} \tag{3.74}$$

Equations (3.69), (3.70) and (3.71) are the three zero-profit conditions, while Eqs. (3.72), (3.73) and (3.74) are the full-employment conditions for the different inputs. The volume of import of good 3, denoted M, is given by

$$M = a_{32}X_2 - X_3 \tag{3.75}$$

Finally, national income at world prices[17] is expressed as follows:

$$I = WL + RN + tP_3M = WL + RN + tP_3(a_{32}X_2 - X_3) \tag{3.76}$$

Here, $(WL + RN)$ is the aggregate factor income, while the remaining term denotes the tariff revenue of the government, which the consumers receive as transfer payments.

[17] This expression has been derived in Appendix 3.1.

It is easy to check that this is a decomposable production structure with three zero-profit conditions and three unknown factor prices: W, R and r. Sectors 1 and 2 contain a HOSS. It is reasonable to assume that sector 1 is more labour-intensive vis-à-vis sector 2 with respect to capital of type N, i.e. $(a_{L1}/a_{N1}) > (a_{L2}/a_{N2})$.

Now, if foreign capital enters sector 3, it expands and absorbs more labour than before. This additional labour must come from the HOSS. The availability of labour in the HOSS declines, which in turn produces a Rybczynski-type effect. Consequently, sector 1 contracts and sector 2 expands since sector 1 is more labour-intensive than sector 2. As the aggregate factor income does not change due to the decomposition property of the production structure, the welfare consequence of foreign capital inflows must solely depend on the change in tariff revenue. Differentiating (3.76) with respect to K_F, we get

$$\left(\frac{dI}{dK_F}\right) = tP_3\left[a_{32}\left(\frac{dX_2}{dK_F}\right) - \left(\frac{dX_3}{dK_F}\right)\right] \tag{3.77}$$

We find that both sectors 2 and 3 expand due to an inflow of foreign capital in sector 3. This means that both the demand for the traded intermediate good (in sector 2) and its domestic production in sector 3 increase. The volume of import of that commodity increases and welfare of the economy improves iff $a_{32}\left(\frac{dX_2}{dK_F}\right) > \left(\frac{dX_3}{dK_F}\right)$. This establishes the following proposition.

Proposition 3.4 *An inflow of foreign capital in the traded intermediate input-producing sector may be welfare improving.*[18]

3.3.3 FDI in a 2 × 2 Full-Employment Model with Labour Market Imperfection

It has been shown in Sect. 3.2 that in any decomposable two-sector or three-sector HT model (e.g. Khan (1982), Chandra and Khan (1993)), an inflow of foreign capital in a tariff-protected import-competing sector is immiserizing despite the presence of labour market distortion. This is because the aggregate wage income of all workers employed in different sectors of the economy does not change due to the 'envelope property' implied by the HT structure. Labour reallocation occurs but the aggregate wage income does not change. But, in a full-employment model, the result might be different due to the existence of a positive labour reallocation effect. We now show

[18]This result holds even if the intermediate good is non-traded. Chaudhuri (2001b) has shown in terms of a three-sector HT model that an FDI in the sector that produces a non-traded intermediate good, like infrastructure, improves national welfare if the vertically integrated export sector is more capital-intensive relative to the vertically integrated import-competing sector.

that in a 2×2 H–O–S model with tariff and labour market distortion, an inflow of foreign capital might be welfare improving.

We consider a small open economy, with two sectors: informal and formal. Sector 1 is the informal sector that produces a primary export commodity while the formal sector (sector 2) produces a manufacturing commodity. It is assumed that workers in sector 2 are unionized and earn a contractual wage, W^*, while the wage rate in sector 1, W, is market determined. All other assumptions of the H–O–S model are retained. Sector 2 is more capital-intensive vis-à-vis sector 1 in value terms, and the former is the tariff-protected import-competing sector of the economy. Product prices are given by the small open economy assumption.

The general equilibrium is represented by the set of following equations:

$$Wa_{L1} + ra_{K1} = P_1 \tag{3.78}$$

$$W^*(W, U)\, a_{L2} + ra_{K2} = P_2(1 + t) \tag{3.79}$$

where W^* is the unionized wage function[19] that satisfies the following properties: $W^* = W$ for $U = 0$ and $W^* > W$ for $U > 0$; $(\partial W^*/\partial W), (\partial W^*/\partial U) > 0$ where U is the bargaining strength of the labour unions:

$$a_{L1}X_1 + a_{L2}X_2 = L \tag{3.80}$$

$$a_{K1}X_1 + a_{K2}X_2 = K_D + K_F = K \tag{3.81}$$

Equations (3.78) and (3.79) are the two price–unit cost equality conditions in the two sectors, while (3.80) and (3.81) are the two full-employment conditions for labour and capital, respectively. The capital stock of the economy consists of both domestic capital (K_D) and foreign capital (K_F), and these are perfect substitutes.

There are four endogenous variables in the system: W, r, X_1 and X_2. Solving Eqs. (3.78) and (3.79) yields W and r. Then $a_{ji}s$ are determined as functions of input price ratios. Finally, X_1 and X_2 are obtained from (3.80) and (3.81).

The national income at world prices of the economy is given by

$$I = Wa_{L1}X_1 + W^*a_{L2}X_2 + rK_D - tP_2X_2 \tag{3.82}$$

The foreign capital income, rK_F, is fully repatriated. In Eq. (3.82), $Wa_{L1}X_1$ and $W^*a_{L2}X_2$ give the total wage income of the workers employed in sectors 1 and 2,

[19] Assuming that each firm in sector 2 has a separate trade union, the unionized wage function may be derived as a solution to the Nash bargaining game between the representative firm and the representative union in the industry. This function has been derived in details in Chaudhuri and Mukhopadhyay (2009).

respectively. rK_{D} is the rental income from domestic capital. Finally, tP_2X_2 measures the cost of tariff protection of the import-competing sector.

Differentiating Eqs. (3.80) and (3.81) and solving, the following expressions can be derived:

$$\widehat{X}_1 = -\left(\frac{1}{|\lambda|}\right)\lambda_{L2}\widehat{K} \tag{3.83}$$

$$\widehat{X}_2 = \left(\frac{1}{|\lambda|}\right)\lambda_{L1}\widehat{K} \tag{3.84}$$

where $|\lambda| = (\lambda_{L1}\lambda_{K2} - \lambda_{L2}\lambda_{K1}) > 0$ as sector 2 is more capital-intensive relative to sector 1 in both physical and value terms.

Differentiating Eq. (3.82) with respect to K and using Eqs. (3.83) and (3.84), the following expression can be easily derived:

$$\left(\frac{dI}{dK}\right) = \left(\frac{\lambda_{L1}a_{L2}X_2}{|\lambda|\,K}\right)(W^* - W) - \left(\frac{tP_2X_2\lambda_{L1}}{|\lambda|\,K}\right) \tag{3.85}$$

Now, since $W^* > W$ and $|\lambda| > 0$, from (3.85), it follows that $(dI/dK) > 0$ iff $(a_{L2}(W^* - W)) > tP_2$. However, in the absence of any tariff, $(dI/dK) > 0$, irrespective of any condition. This establishes the following proposition.

Proposition 3.5 *Welfare of the economy improves owing to an inflow of foreign capital in the presence of a tariff iff* $(a_{L2}(W^* - W)) > tP_2$. *In the absence of any tariff, foreign capital is unequivocally welfare improving.*[20]

We intuitively explain Proposition 3.5 as follows. An inflow of foreign capital produces a Rybczynski effect and leads to an expansion of the capital-intensive import-competing sector (sector 2) and a contraction of sector 1. The expansion of sector 2 reduces welfare by increasing the cost of tariff protection of the supply side. This we call the *output effect (of sector 2)*. On the other hand, as the higher wage-paying sector 2 expands at the cost of lower wage-paying sector 1, the aggregate wage income rises. This may be termed as the *labour reallocation effect*, which produces a positive effect on welfare. So, two opposite forces on welfare are generated. If the latter effect, measured by $((\lambda_{L1}a_{L2}X_2/|\lambda|K)(W^* - W))$, dominates over the former, denoted by $(tP_2X_2\lambda_{L1}/|\lambda|K))$ in (3.85), welfare of the economy improves.

[20] In the standard 2×2 Heckscher–Ohlin framework, welfare remains unaffected despite foreign capital inflows if there is no tariff protection. But in the present set-up, one gets a different result because of the presence of labour market distortion. This result, however, cannot be obtained in an HT framework despite labour market distortion due to the envelope property implied by this structure.

In the absence of any bargaining power of the trade unions, we have $W^* = W$. Then from (3.85), it follows that

$$\left(\frac{dI}{dK}\right) = -\left(\frac{tP_2X_2\lambda_{L1}}{|\lambda|\,K}\right) < 0 \tag{3.85.1}$$

It should be noted that in the presence of multiple distortions, welfare results relating to a single distortion could easily change.[21] However, in the absence of any labour market distortion, it boils down to the standard Brecher–Alejandro (1977) case, and foreign capital inflow is immiserizing.

3.3.4 Foreign Capital and Welfare in the Presence of Agricultural Dualism[22]

In the traditional literature on development economics, a developing country is typically described as a dual economy. A dual economy is broadly classified into two sectors: an industrialized (urban) sector and an agricultural (rural) sector. The labour market in a dual economy is stratified into two parts, with the workers in the industrial sector earning higher wages than their counterparts in the rural sector. Owing to the existence of wage differential, rural workers migrate to the urban sector at the risk of unemployment, although they can be fully employed in the rural sector at the current competitive wage rate. Harris and Todaro (1970) formulated this labour allocation mechanism, which is commonly observed between rural and urban areas in a developing economy. However, a simple two-sector mobile capital HT model, such as Corden and Findlay (1975), may not appropriately describe the complex nature of a dual economy. The existence of agricultural dualism and the presence of non-traded commodities are two of the salient features of such an economy.

Agricultural dualism is a common symptom of the developing countries. The distinction between advanced and backward agriculture can be made on the basis of inputs used, economies of scale, efficiency and elasticity of substitution. Many of the farmers in the agricultural sector of a developing economy stick to old and unscientific methods of cultivation although in other parts of the economy the introduction of the so-called Green Revolution technology has brought about revolutionary changes with respect to production technologies and modern inputs use and the increase in factor productivity. However, the improved technology is designed for the best areas (irrigation, high soil fertility) with chemical intensive technology. Although Green Revolution has modernized agricultural technology, it is limited only to a few pockets of a developing economy and only rich (large) farmers have been its beneficiaries. The small and marginal farmers continue to

[21] See Batra (1973) in this context.

[22] This section is based on excerpts of the Chaudhuri (2007) paper.

depend on rain-fed backward agricultural techniques. Therefore, the adoption of the Green Revolution technology has led to an increase in the extent of agricultural dualism in developing economies.

The existence of non-traded goods, the prices of which are domestically determined by demand–supply forces, is another essential feature of a developing economy. As discussed earlier, non-traded goods may either be intermediate inputs or final commodities. There are many final agricultural commodities, which are consumed domestically and are produced mainly by small and marginal farmers using traditional techniques of production. On the other hand, most of the commercial crops and some of the food grains are produced by large cultivators using advanced techniques of production. A lion's share of these commodities is exported to foreign countries and their prices are determined internationally.

In this section, we examine the welfare consequence of an inflow of foreign capital in the backdrop of a three-sector HT model with agricultural dualism and a non-traded final commodity. The analysis indicates favourable effects of foreign capital inflow on national welfare and justifies the desirability of FDI in a developing economy from the view point of achieving a decent economic growth. This theoretical exercise may also be useful in explaining as to why many developing countries including India have come across 'jobless growth' during the liberalized regime.[23]

We consider a small open dual economy, which is broadly divided into an urban sector and a rural sector. The rural sector is further subdivided into two subsectors so that in all there are three sectors in the economy. Of the two rural sectors, there is an advanced agricultural sector (sector 1), which produces its output (X_1) by means of labour (L) and land-capital (N) as inputs. This is the export sector of the economy. The other rural subsector (sector 2), which is the backward agricultural sector, produces a non-traded final commodity (X_2) using the same two inputs. The input 'land-capital' is broadly conceived to include durable capital equipments of all kinds.[24] It is sensible to assume that sector 2 is more labour-intensive than sector 1. On the other hand, the urban sector (sector 3) produces a manufacturing commodity (X_3) with the help of labour and capital (K). This is the import-competing sector of the economy and is protected by an import tariff. Capital is specific to sector 3 while the input, land-capital, is completely mobile between the two rural sectors. Labour is perfectly mobile between the urban sector and the rural sectors. The urban sector faces an imperfect labour market in the form of a unionized labour market where workers receive a contractual wage, W^*, while the wage rate in the two rural sectors, W, is market determined. The two wage rates are related by the HT condition of migration equilibrium where the expected urban wage equals the rural wage rate and $W^* > W$. The aggregate capital stock of the economy consists of both domestic capital (K_D) and foreign capital (K_F), and these are perfect substitutes. Income from foreign capital is completely repatriated. Production functions exhibit

[23]The role of FDI on unemployment will be taken up separately in Chap. 7.

[24]See Bardhan (1973) in this context.

constant returns to scale with positive but diminishing marginal productivity to each factor. Commodity 1 is chosen as the numeraire.

Given the assumption of perfectly competitive markets, the usual price–unit cost equality conditions relating to the three sectors of the economy are given by the following three equations, respectively:

$$Wa_{L1} + Ra_{N1} = 1 \tag{3.86}$$

$$Wa_{L2} + Ra_{N2} = P_2 \tag{3.87}$$

$$W^* a_{L3} + ra_{K3} = (1 + t)\, P_3 = P_3^* \tag{3.88}$$

Here, R and r are the returns to land-capital and capital, respectively.

Full utilization of land-capital and capital imply the following two equations, respectively.

$$a_{N1} X_1 + a_{N2} X_2 = N \tag{3.89}$$

$$a_{K3} X_3 = K_{\mathrm{D}} + K_{\mathrm{F}} = K \tag{3.90}$$

There is unemployment of labour in the urban sector. The labour endowment equation of the economy is given by the following:

$$a_{L1} X_1 + a_{L2} X_2 + a_{L3} X_3 + L_{\mathrm{U}} = L \tag{3.91}$$

In an HT framework the labour allocation mechanism is such that in the labour market equilibrium, the rural wage rate, W, equals the expected wage income in the urban sector. Since the probability of finding a job in the urban manufacturing sector is $(a_{L3}X_3/(a_{L3}X_3 + L_{\mathrm{U}}))$ in the present case, the expected wage in the manufacturing sector is $(W^* a_{L3}X_3/(a_{L3}X_3 + L_{\mathrm{U}}))$. Therefore, the rural-urban migration equilibrium condition is expressed as

$$\left(\frac{W^* a_{L3} X_3}{(a_{L3} X_3 + L_{\mathrm{U}})} \right) = W$$

or, equivalently,

$$\left(\frac{W^*}{W} \right) a_{L3} X_3 + a_{L2} X_2 + a_{L1} X_1 = L \tag{3.92}$$

The demand for the non-traded final commodity, denoted D_2, is given by

$$D_2 = D_2 \underset{(-)\,(+)\,(+)}{\left(P_2, P_3^*, Y \right)} \tag{3.93}$$

We assume that commodity 2 is a normal good with negative and positive own price elasticity and income elasticity of demand, respectively. The cross-price elasticity is positive. So, we have $E^2_{P2} = ((\partial D_2/\partial P_2)(P_2/D_2)) < 0$; $E^2_Y = ((\partial D_2/\partial Y)(Y/D_2)) > 0$; and, $E^2_{P_3^*} = ((\partial D_2/\partial P_3^*)(P_3^*/D_2)) > 0$.

The demand–supply equality condition for commodity 2 is
$D_2 = X_2$. Using (3.93), this can be rewritten as follows:

$$X_2 = \underset{\quad(-)\,(+)\,(+)}{D_2\left(P_2, P_3^*, Y\right)} \tag{3.94}$$

The demand for the importables (commodity 3), D_3, and the volume of import, M, are given by the following two equations, respectively:

$$D_3 = \underset{\quad(+)\,(-)\,(+)}{D_3\left(P_2, P_3^*, Y\right)} \tag{3.95}$$

$$M = D_3\left(P_2, P_3^*, Y\right) - X_3 \tag{3.96}$$

The national income of the economy at domestic prices is given by

$$Y = X_1 + P_2X_2 + P_3^*X_3 + tP_3M - rK_{\mathrm{F}} \tag{3.97.1}$$

or equivalently,

$$Y = WL + RN + rK_{\mathrm{D}} + tP_3M \tag{3.97.2}$$

In Eq. (3.97.2), WL gives the aggregate wage income of the workers employed in the different sectors of our HT economy. RN is the rental income from land-capital. rK_{D} is the domestic capital income. Finally, tP_3M is the tariff revenue earned by the government from import of commodity 3, which is handed over to the consumers in a lump-sum manner.

Using (3.90), Eq. (3.92) can be written as

$$\left(\frac{W^*a_{L3}K}{Wa_{K3}}\right) + a_{L2}X_2 + a_{L1}X_1 = L \tag{3.92.1}$$

The working of the model is as follows. The production structure does not satisfy the decomposition property, but sectors 1 and 2 together form a Heckscher–Ohlin subsystem. r is determined from Eq. (3.88) since W^* is exogenously given. W and R are found from Eqs. (3.86) and (3.87) as functions of P_2. The values of X_1 and X_2 can be solved from Eqs. (3.89) and (3.92.1) in terms of P_2. X_3 is obtained from Eq. (3.90). The values of Y, D_3 and M are obtained from (3.95), (3.96) and (3.97.2) as functions of P_2. D_2 is determined as function of P_2 from Eq. (3.93). Then, P_2 is solved from (3.94). As P_2 is now known, the equilibrium values of all endogenous variables are known. Finally, L_{U} is found from Eq. (3.91).

The demand side of the model is represented by a strictly quasi-concave social utility function. Let U denote the social utility that depends on the consumption demands for the three commodities[25] denoted by D_1, D_2 and D_3, respectively. Thus, we have

$$U = U\left(D_1, D_2, D_3\right). \tag{3.98}$$

The foreign capital income is fully repatriated. The balance-of-trade equilibrium requires that

$$D_1 + P_3 D_3 = X_1 + P_3 X_3 - rK_{\mathrm{F}}, \tag{3.99}$$

or equivalently,

$$D_1 + P_2 D_2 + P_3^* D_3 = X_1 + P_2 X_2 + P_3^* X_3 - rK_{\mathrm{F}} + tP_3 M \tag{3.99.1}$$

Note that commodity 2 is a non-traded final good. So, we have $D_2 = X_2$ in equilibrium (see Eq. 3.94).

Now suppose that the aggregate stock of capital of the economy goes up owing to an inflow of foreign capital. The return to capital, r, does not change as it is determined from the zero-profit condition for sector 3 (see Eq. 3.88). But the other factor prices, W and R, are affected through a change in the price of the non-traded final commodity, P_2. Differentiating Eqs. (3.86), (3.87), (3.89), (3.92.1), (3.94), (3.96) and (3.97.2), the following proposition can be established.[26]

Proposition 3.6 *An inflow of foreign capital leads to (i) an increase in the rural wage rate and (ii) a fall in the return to land-capital. It is likely to raise the price of the non-traded final commodity.*

We explain Proposition 3.6 as follows. An inflow of foreign capital leads to an expansion of the import-competing sector (sector 3) as capital is specific to this sector. This raises the expected urban wage and leads to a fresh migration of labour from the two rural sectors to the urban sector. As the supply of labour to the HOSS decreases, sector 2 (sector 1) contracts (expands) following a *Rybczynski-type effect* as sector 2 is more labour-intensive relative to sector 1 with respect to land-capital. As the supply of the non-traded commodity produced by sector 2 falls given its demand, its price, P_2, should increase to satisfy the demand–supply equality condition (Eq. 3.94). On the other hand, as sector 3 expands, the volume of import of commodity 3 falls and this lowers the tariff revenue. So, other things remaining unchanged, the national income at domestic prices falls. This leads to a decline in the demand for commodity 2 and, therefore, exerts a downward pressure on P_2, given the supply of good 2. Thus, there are two opposite effects on P_2. However, a

[25] All the three sectors produce final commodities in this model.

[26] Mathematical proofs are available in Chaudhuri (2007).

sufficient condition can be derived[27] under which the first effect dominates over the second effect. So subject to the fulfilment of the sufficient condition, P_2 increases as foreign capital flows in. Then, an increase in P_2 produces a *Stolper–Samuelson effect* in the HOSS leading to an increase in the rural wage rate, W, and a fall in the return to land-capital, R, as sector 2 is labour-intensive relative to sector 1.

Now differentiating Eqs. (3.98) and (3.99.1), the following proposition can be proved.

Proposition 3.7 *In an economy with a non-traded final commodity and a tariff-protected import-competing sector, an inflow of foreign capital with full repatriation of its earnings may improve social welfare. Nevertheless, in the absence of any tariff, social welfare unambiguously improves.*

We explain Proposition 3.7 in the following fashion. An inflow of foreign capital with full repatriation of its earnings produces two effects on welfare: labour reallocation effect and tariff revenue effect. The wage rates in different sectors are dissimilar although the average wage of all workers in the HT economy is the rural sector wage. As the rural wage rises, the aggregate wage income also rises. This we call the labour reallocation effect that produces a positive impact on social welfare through an increase in the aggregate factor income. On the other hand, the tariff revenue, which is transferred to the consumers in a lump-sum manner, also changes. As the price of the non-traded final commodity P_2 rises, the relative domestic price of the importables in terms of P_2 falls. This leads to an increase in the demand for the importables since different commodities are substitutes. Besides, the increase in aggregate factor income also raises the demand for commodity 3. But the domestic production of the importables has increased as well. So the net effect on the volume of import of commodity 3 is somewhat uncertain. Therefore, the direction of change in the tariff revenue effect is ambiguous. Nonetheless, alternative sufficient conditions can be found out[28] subject to which the positive labour reallocation effect outweighs the tariff revenue effect. So subject to the fulfilment of any one of those sufficient conditions, national welfare improves owing to an inflow of foreign capital. However, in the absence of any tariff, the tariff revenue effect does not exist, and hence welfare improves unequivocally due to positive labour reallocation effect.

Appendix 3.1: Derivation of Eq. (3.76)

National income at world prices in this case is given by

$$I = P_1X_1 + P_2X_2 - P_3M - rK_F \tag{3.A.1}$$

[27] This has been derived in Chaudhuri (2007).

[28] See Chaudhuri (2007) for the conditions and their derivations.

Using (3.69) and (3.70) from (3.A.1), one gets

$$\begin{aligned} I = &\, Wa_{L1}X_1 + Ra_{N1}X_1 + Wa_{L2}X_2 + Ra_{N2}X_2 \\ &+ P_3(1+t)\,a_{32}X_2 - P_3M - rK_{\mathrm{F}} \end{aligned}$$

With the help of (3.71), the above expression becomes

$$I = W(a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3) + R(a_{N1}X_1 + a_{N2}X_2) + tP_3M \quad \text{(Note that } a_{32}X_2 = X_3 + M\text{)}$$

Finally, using (3.72) and (3.73), we obtain

$$I = WL + RN + tP_3M \tag{3.76}$$

References

Bardhan PK (1973) A model of growth of capitalism in a dual agrarian economy. In: Bhagwati JM, Eckaus RS (eds) Development and planning: essays in honour of Paul Rosenstein-Rodan. MIT Press, Cambridge, MA

Batra RN (1973) Studies in the pure theory of international trade. Macmillan, London

Beladi H, Marjit S (1992a) Foreign capital and protectionism. Can J Econ 25:233–238

Beladi H, Marjit S (1992b) Foreign capital, unemployment and national welfare. Jpn World Econ 4:311–317

Borensztein E, De Gregorio J, Lee JW (1998) How does foreign direct investment affect economic growth? J Int Econ 45:115–135

Brecher RA, Diaz Alejandro CF (1977) Tariffs, foreign capital and immiserizing growth. J Int Econ 7:317–322

Chandra V, Khan MA (1993) Foreign investment in the presence of an informal sector. Economica 60:79–103

Chaudhuri S (2001a) Foreign capital inflow, technology transfer, and national income. Pak Dev Rev 40(1):49–56

Chaudhuri S (2001b) Foreign capital inflow, non-traded intermediary, urban unemployment, and welfare in a small open economy: a theoretical analysis. Pak Dev Rev 40(3):225–235

Chaudhuri S (2005) Labour market distortion, technology transfer and gainful effects of foreign capital. Manch Sch 73(2):214–227

Chaudhuri S (2007) Foreign capital, welfare and unemployment in the presence of agricultural dualism. Jpn World Econ 19(2):149–165

Chaudhuri S, Mukhopadhyay U (2009) Revisiting the informal sector: a general equilibrium approach. Springer, New York

Corden WM, Findlay R (1975) Urban unemployment, intersectoral capital mobility and development policy in a dual economy. Economica 42:59–78

Edison H, Levine R, Ricci L, Slok T (2002) International financial integration and economic growth. J Int Money Financ 21:749–776

Grinols EL (1991) Unemployment and foreign capital: the relative opportunity cost of domestic labour and welfare. Economica 57:107–121

Gupta MR (1997) Foreign capital and informal sector: comments on Chandra and Khan. Economica 64:353–363

Harris JR, Todaro MP (1970) Migration, unemployment and development: a two-sector analysis. Am Econ Rev 60:126–142

Hein S (1992) Trade strategy and the dependency hypothesis: a comparison of policy, foreign investment, and economic growth in Latin America. Econ Dev Cult Chang 40(3):495–521

Jones RW, Marjit S (1992) International trade and endogenous production structures. In: Neuefeind W, Riezman R (eds) Economic theory and international trade: essays in memoriam J. Trout Rader. Springer, New York, pp 173–196

Khan MA (1982) Tariffs, foreign capital and immiserizing growth with urban unemployment and specific factors of production. J Dev Econ 10:245–256

Marjit S, Beladi H (1996) Protection and gainful effects of foreign capital. Econ Lett 53:311–326

Martinez CA, Allard G (2009) Foreign direct investment and social policy: the links in developing countries. J Bus Dev Nations 11(2008–09):77–112

Singh RD (1998) The multinational's economic penetration, growth, industrial output and domestic savings in developing countries: another look. J Dev Stud 25(1):55–82

Soumare I (2013) Does foreign direct investment improve welfare in North African countries?' Available at SSRN: http://ssrn.com/abstract=2361470 or http://dx.doi.org/10.2139/ssrn.2361470

UNCTAD (1999) Foreign direct investment in Africa: performance and potential. United Nations, New York

UNCTAD (2008) World investment report: transnational corporations and the infrastructure challenge. United Nations, New York/Geneva

UNCTAD (2013) The world investment report: global value chains: investment and trade for development. United Nations, New York

Chapter 4
FDI, SEZ and Agriculture

Special economic zone (SEZ) has been a widely adopted development strategy intending to attract foreign capital, boost exports, facilitate transfer of advanced technology and generate employment. The zones are usually contained geographic regions within countries, adopting liberal laws and economic policies including trade operations, duties and tariffs to encourage foreign-invested manufacturing and services for export (see Shah 2008). They may serve as catalysts for facilitating trade and financial liberalization, enhancing resource utilization and promoting economic growth and structural changes (Ge 1999). The SEZs were initiated in China, but their success provided an impetus to other countries like India, Mexico and Brazil to follow the Chinese trajectory. In 2008, there were approximately 3,000 SEZs in 135 countries, accounting for over 68 million direct jobs and over $500 billion of direct trade-related value added within the zones (World Bank 2008).

4.1 Country Experiences

The key objective behind promoting SEZs in developing countries is to attract FDI and foster the development process. However, there is no conclusive evidence on the role of the zones in development; individual country experiences with respect to SEZs have been mixed.[1] Let us briefly discuss the performances of SEZ, particularly in relation to FDI inflows in China and India, the two of the largest FDI destinations among the developing countries.

---

[1]There is a large literature on SEZs in different countries, like Willmore (1996) on the Caribbean; Rolfe et al. (2004) on Kenya; Li et al. (2005) and Bontempi and Prodi (2009) on China; and Aggarwal (2005) and Aggarwal et al. (2008) on the comparative performances in India, Sri Lanka and Bangladesh.

S. Chaudhuri and U. Mukhopadhyay, *Foreign Direct Investment in Developing Countries: A Theoretical Evaluation*, DOI 10.1007/978-81-322-1898-2_4,

4.1.1 China

The first SEZs were set up in 1980 as an integral part of economic reform and open policy led by Deng Xiaoping. By providing preferential treatment and broader facilities for foreign investment and trade, the SEZs marked the turning point from the self-reliant, inward-looking strategy of the Maoist period to the outward-looking strategy. The term "special economic zone" was conceptualized after considerable intellectual debate in China, to represent a complex of related economic activities and services rather than uni-functional entities (Wong 1987) and differed from export-processing zones and similar special areas in Asia[2] by being more functionally diverse and covering much larger land areas.

From the outset, SEZs resulted in unprecedented high rates of economic growth in China, with the four initial SEZs accounting for 59.8 % of total FDI. The most remarkable performance in attracting FDI was that of Shenzhen,[3] which might be attributed to its independent adoption of measures like focus on private sector-led sustainable self-renewal, technological upgrading to improve its competitive position and a balanced approach between global and local in its development (Tang 2001). By 1998, high-tech industries accounted for almost 40 % of the industrial output within Shenzhen SEZ (Wei 2000), reflecting the goal since the late 1980s of moving towards a more technology intensive, higher-value-added stage of development. Overall, the SEZ experiment transformed China into one of the largest FDI recipients, exporters and foreign exchange reserve holders in the world (Prasad and Wei 2007; Feenstra and Wei 2010). The local economy also gained through increase in physical capital stock and boost in total factor productivity growth (Wang 2010). The success of SEZ has been mainly due to institutional flexibility, combination of favourable policies and the right mix of production factors (Zheng 2006; Yeung et al. 2009).

4.1.1.1 FDI in SEZs

The initial opening-up policy of China could do little to attract considerable FDI, since it restricted foreign investment on a sectoral basis and many of the regulations and restrictions were non-transparent (Rosen 1999). However, the FDI witnessed a spectacular surge with the establishment of SEZs, which were mostly set up in the coastal provinces with well-developed infrastructure, including human capital and access to ports and airports. Between 1979 and 1991, about 43 % of all FDI in China flowed to the provinces where the SEZs were located. However, the benefits of FDI

[2]SEZ covers a broad range of specific zone types like export-processing zones (EPZ), free trade zones (FTZ), free zones (FZ), industrial estates (IE) and urban enterprise zones. See Ranjan (2006) for differences between EPZ and SEZ.

[3]In 2007, Shenzhen accounted for about 14 % of China's total exports (Huang 2008), and by 2008 FDI inflows came from as many as 82 countries.

were rather limited – there were small linkage effect, with few export-processing units in SEZs using inputs from local firms and little technology transfer, since investment was largely concentrated in relatively labour-intensive activities.[4]

After the liberalization of 1991, the favourable policies and privileges enjoyed only by SEZs were extended to other parts of the country and got a further boost with China's admission to the WTO. The flow of FDI into China increased dramatically, with it becoming the nation receiving the largest amounts of foreign direct investment. There was a shift in the sectoral mix of FDI, with an increasing proportion of the new investment in higher-technology activities (Lemoine 2000). Nonetheless, the contribution of the zones in accelerating economic growth within China by popularizing new policies, marketing capital flows and spreading successful new practices and policies cannot be overlooked or underestimated (Yeung et al. 2009). Through global production chains, China grabbed the opportunity to enter the world market in manufactured goods, in turn facilitating urban and regional change within the country (Yeung 2000). According to the World Bank (2001), EPZs are a second-best solution vis-à-vis generalized countrywide reforms, but when countrywide reforms are difficult to implement, they can indeed be useful vehicles in the development process. The Chinese success story of SEZs perhaps exemplifies the hypothesis.

4.1.2 India

The first export-processing zone (EPZ) in Asia was set up in Kandla in India in 1965, and subsequently seven more were set up in different parts of the country, but they, however, failed in terms of export performance, employment generation and FDI inflow. The economic reforms in 1991 also did not result in sustainable growth in manufacturing, due to multiplicity of controls and clearances, rigid labour laws, absence of infrastructure and unstable fiscal regime. To overcome these shortcomings and to further boost foreign investment, the SEZ was incorporated in the Export–Import (EXIM) policy of India in April 2000, and the SEZ Act was introduced in 2005. The SEZ policy offered incentives like tax benefits, single window clearance, flexibility in export and import rules regulations and preferential land policy.

In the initial phases of the SEZ policy, growth with respect to flow of foreign investment, exports and employment was rather slow. The share of FDI in total investment increased slowly from 12 % in 1989 to slightly over 18 % in 2000 (Aggarwal 2004). In 2004–2005, India's export from the SEZs was 5 % of its total exports. They accounted for only 1 % of factory sector employment and 0.32 % of factory investment in the same year. However, after 2005, the growth of SEZs in India has been phenomenal, with faster increases in FDI inflows. There are presently

[4] See Graham (2004) for details.

389 notified SEZs in different states of India. Total investment and employment in these zones amount to Rs. 2,01,874.76 crores and 8,44,916 persons, respectively, in 2012. Exports in 2009–2010 stood at Rs. 2,20,711.39 crores which grew by 121.40 % over the 2008–2009 figure. This further increased to Rs. 3,64,477.73 crores in 2011–2012 registering a growth rate of 15.39 % over the 2010–2011 figure. The overall growth of exports has been 1,493 % over the period 2003–2010.[5] Although SEZs had a significant role in giving a boost to the Indian economy, their contribution in the national figures is below the expected level. Its comparison with other countries shows that its potential in attracting FDI and promoting exports and economic activities have not been fully exploited.

On the other hand, the SEZs in India have been subjected to substantial controversies on a number of grounds: firstly, there is rampant relocation of industries simply to take advantage of tax concessions without any significant addition to economic activities; secondly, the government already suffering from financial crisis incurs massive revenue loss due to tax exemption; thirdly, large-scale acquisition of agricultural land leads to displacement of farmers with meagre compensation and has serious implications for food security; fourthly, the land obtained at concessional rates on the pretext of setting up SEZs by developers is misused for real estate development and speculation; and fifthly, setting up of SEZs in regions already having superior infrastructure and with high contributions in manufacturing and exports leads to uneven growth, aggravating regional inequalities. Thus, the failure of SEZs in India to deliver the benefits to its full extent has been due to improper policies pertaining to location of SEZs, land acquisition and rehabilitation.

4.2 Theoretical Literature on SEZ

The neoclassical theory views SEZs as distortionary trade instruments that promote unfair competition between domestic and SEZ firms. It is the second-best policy that offers welfare gains when free trade is not viable but loses significance as countrywide reforms are implemented. The political economy approach contends that SEZs benefit a few capitalists through tax incentives and land acquisition at the cost of the rest of the population, leading to overall welfare reduction. According to the heterodox approach, SEZs attract FDI inflows and facilitate spillover of improved technologies and managerial skills. The rising importance of offshore outsourcing of parts or whole of the production process, as part of globalization, necessitates favourable investment climate for integration of domestic markets into these global value chain so as to strengthen the competitiveness and productivity of domestic firms. SEZs can be effective tools in attracting offshore outsourcing and gaining access to a global pool of new technologies, skills and

[5] See ‘Fact Sheet on Special Economic Zones’ at http://www.sezindia.nic.in.

markets. The agglomeration of firms in SEZs provides a stimulus to productivity and innovation through specialization, linkages and demonstration effects and facilitates the development of global cities where resources can be utilized at local, national and global scales.[6]

There exists a large theoretical literature that examines the welfare aspect of forming SEZs or other export zones. This includes works of Hamada (1974), Hamilton and Svennson (1982, 1983), Miyagiwa (1986, 1993), Young and Miyagiwa (1987), Beladi and Marjit (1992a, b), Yabuuchi (2000), etc., which have found formation of export zones to be welfare worsening in the presence of tariff-protected and capital-intensive import-competing sectors. However, Devereux and Chen (1995) have shown that welfare effects of export zones can be of two types: volume of trade effect and a factor terms-of-trade effect. The second effect raises welfare, while the first effect is ambiguous and depends crucially on factor intensities of the protected sectors in the economy. The earlier works in the literature have ignored the second effect which is, however, quite crucial and may prove the formation of export zone to be welfare improving. On the other hand, Schweinberger (2003) has derived a necessary and sufficient condition for the establishment of an SEZ resulting in Pareto improvement. If the formation of an SEZ is accompanied by suitable taxes on factors located in the SEZ, the government can earn more tax revenues that may make the setting up of an SEZ desirable even when foreign investment has a welfare-worsening effect.

4.3 Controversies Regarding SEZ, Agriculture and Land Acquisition

Of late, fierce debates have sparked off over the welfare effects of SEZs. The harshest criticism has been levelled against land acquisition for SEZs. Although setting up of SEZs on nonagricultural and barren land is likely to have beneficial effects in attracting FDI and employment generation, as in the case of China, if they are set up on fertile agricultural land, they are likely to reduce agricultural production and impinge on food security. In some countries like India, agricultural land is being acquired, sometimes forcibly by the government, from the farmers at a price lower than that prevailing in the market and given to the developers of SEZs at a subsidized rate. There had been dissension and protests by the farmers, claiming that they had not been compensated adequately. Besides, the problems of displacement and rehabilitation of farmers and agricultural labourers have also cropped up. They are essentially unskilled, so that they cannot relocate easily to other jobs, thereby accentuating the unemployment situation. Such a dilemma

[6]See Aggarwal (2010) for a detailed discussion.

has been observed in many predominantly agricultural countries that intend to industrialize using agricultural land.[7]

A pertinent policy debate among economists and policymakers has emerged as to whether the SEZ policy is at all beneficial for a largely agricultural economy. The major concerns are as follows: (1) Can industry (SEZs) and agriculture grow simultaneously without hurting one another? (2) Would this policy affect the unemployment situation adversely? (3) How would the economic condition of the workers in the rural sector be affected due to this policy? Since agriculture and industry are the main wheels of a country's economy, these concerns need to be addressed first before proceeding further with the SEZ policy.

4.4 The Model

We attempt to provide answers to the above questions in terms of a three-sector HT type general equilibrium model with an SEZ located in the rural sector. The analysis reveals that agriculture and SEZ can grow simultaneously under certain conditions. However, in the absence of any government spending on irrigation projects and other infrastructural development designed for improving the efficiency of land, formation of the SEZ affects agriculture adversely. It shows that both agricultural wage and aggregate employment in the economy may improve if government assistance to agriculture exceeds a critical level. Thus, a certain balance has to be maintained between agriculture and industry so as to reap the full benefits of the SEZ policy.

A small open HT type economy with three sectors is considered.[8] Sector 1 is an agricultural sector and produces good X_1 by means of labour and land. Sector 2 is an industry in the SEZ located in the rural sector that manufactures an industrial good, X_2 by using labour, land and capital. Sector 3 is the urban sector that produces a manufacturing commodity, X_3, with the help of labour and capital. All markets except the urban sector labour market are perfectly competitive. The production functions display constant returns to scale with positive but diminishing marginal productivity to each factor.[9] All the three sectors produce final commodities, and their prices are given by the small open economy assumption. Finally, commodity 1 is taken as the numeraire.

The notations and the equations of the general equilibrium model are as follows:

W = rural sector wage
h = productivity (efficiency) of land
R = return to land in efficiency unit
hR = return to land in physical unit (say, per acre)

---

[7] See, for example, Sarma (2007), Reddy and Reddy (2007), Bhaduri (2007) and Fernandes (2007) in this context.

[8] This section is based on Chaudhuri and Yabuuchi (2010).

[9] See footnote 10 in this context.

r = return to capital
W^* = unionized urban wage of labour
s = rate of price subsidy given to encourage formation of SEZ
$\overline{N}$ = given endowment of land in physical unit
$h(.)\overline{N}$ = land endowment in efficiency unit
t = ad valorem tax rate on foreign capital income
K_F = supply of foreign capital

Price–unit cost equality in perfectly competitive markets imply

$$Wa_{L1} + Ra_{N1} = 1 \tag{4.1}$$

$$Wa_{L2} + h(.)Ra_{N2} + ra_{K2} = P_2(1+s) \tag{4.2}$$

$$W^*a_{L3} + ra_{K3} = P_3 \tag{4.3}$$

where a_{ji} is the amount of the jth factor used in the ith industry to produce one unit of the output and P_i is the price of the ith good ($i = 2,3$). It is assumed for the sake of analytical simplicity that a_{N2} is technologically given.[10] Note that s is the rate of price subsidy given to encourage formation of the SEZ.

The capital stock of the economy includes both domestic capital and foreign capital, which are perfect substitutes. It is assumed that the income on foreign capital is subject to taxation. Since investment by the multinational enterprises (MNEs) in developing countries is primarily motivated by the higher rate of return that may be earned on their capital in these countries vis-à-vis the international market, the tax rate on return to foreign capital is likely to affect the magnitude of FDI. Besides, local laws, approval mechanisms and procedural delays, quality of governance and overall accountability in public office are also extremely important determinants of FDI flow in a developing economy. Therefore, we assume that the supply of foreign capital is a positive function of the net rate of return to foreign capital and a decreasing function of the degree of restrictions prevailing in the way to free movements of capital from the international market to the capital-receiving country.[11] The supply function of foreign capital is given by

[10]The constant land–output ratio in the SEZ sector is a simplifying assumption, which rules out substitution of land by other factors of production. However, labour and capital are substitutes and the production function displays constant returns to scale in these two inputs.

[11]Although, over the last two decades, the investment policy has significantly been liberalized in the developing economies like India, there still exists a considerable degree of restrictions in the process of free inflow of foreign capital in these countries. For example, in India, barring some sectors kept under the automatic route, foreign investors are required to secure prior permissions or approvals from the Government of India or the Reserve Bank of India (RBI) or the Foreign Investment Promotion Board (FIPB) and go through a time-consuming bureaucratic process for the purpose of making an investment. There are also sectoral caps in many sectors limiting the maximum levels of foreign investment that can be made in those sectors.

$$K_{\mathrm{F}} = K_{\mathrm{F}}\left(r(1-t), \gamma\right) \quad \text{with} \quad \left(\frac{\partial K_{\mathrm{F}}}{\partial r\,(1-t)}\right) > 0; \left(\frac{\partial K_{\mathrm{F}}}{\partial \gamma}\right) < 0 \tag{4.4}$$

where $r(1-t)$ and γ are the net return to foreign capital and the parameter denoting the magnitude of restrictions that prevents free international movements of capital in the host country, respectively. A liberalized investment policy implies both easing of FDI norms[12] and betterment of quality of governance, which ensures a larger inflow of foreign capital, and is captured by a decline in the value of γ.

The revenue of the government from tax on foreign capital income, denoted by T, is given as

$$T = trK_{\mathrm{F}}(.) \tag{4.5}$$

It is assumed that the tax revenue of the government is entirely spent for providing subsidies to both the agricultural sector and the SEZ. A part of the government revenue is spent on agriculture for improving the efficiency of land. This assumption is justified on the ground that the government in developing economies often spend substantial amounts on major irrigation projects and construction of roads and for building up social infrastructure to raise the productivity of land. Simultaneously, in order to embark on the trajectory of industrial growth through outward-looking policies, preferential fiscal concessions are extended for formation of SEZ. It is assumed that fraction β of T is given to the SEZ while the remaining $(1-\beta)$ fraction is spent for improvement of agriculture. The government spending on irrigation projects, and so on; and so forth; and the rest, improves the land efficiency, h. Therefore,

$h = h\left((1-\beta)\,trK_{\mathrm{F}}(.)\right); h = \overline{h}$ for $(1-\beta)T = 0$ i.e. for $\beta = 1$, and $h' > 0$ for $(1-\beta)T > 0$.

When the government does not spend anything for agricultural development, i.e. when $\beta = 1$, $h = \overline{h}$ (given exogenously). However, if the government's expenditure on agriculture is positive, i.e. if $\beta < 1, h' > 0$ and $h > \overline{h}$.

In this model, it is assumed that the wage rate in urban (manufacturing) sector 3 (W^*) is rigid and relatively high due to institutional considerations, while the wage rate in rural (agricultural and SEZ)[13] sectors (W) is flexible. In this situation, the rural workers have the alternatives of staying back in the rural area to be employed at a low wage rate or migrating to the urban area in order to seek a high wage income but at the risk of remaining unemployed. Thus, the labour allocation mechanism between the sectors is shown as follows:

[12]Easing of FDI norms includes bringing of more sectors under the automatic route for which no prior permissions from the FDI regulatory authorities are required, increasing of FDI caps in different sectors, simplification of procedural delays, etc.

[13]In fact one of the incentives for formation of SEZ in the rural areas is the ready availability of labour at low wage rates.

$$W = W^* \left(\frac{a_{L3}X_3}{a_{L3}X_3 + L_U} \right) \tag{4.6}$$

where, $a_{L3}X_3$ and L_U are the employed and unemployed labour in the urban sector, respectively. In the labour market equilibrium, therefore, the wage rate in the rural sectors (W) equals the expected wage income in sector 3, which is equal to the urban wage rate (W^*) times the probability of finding a job in the urban manufacturing sector, i.e. $(a_{L3}X_3/(a_{L3}X_3 + L_U))$.[14]

Full employment of capital implies

$$a_{K1}X_1 + a_{K2}X_2 = K_D + K_F(r(1-t), \gamma) = K \tag{4.7}$$

We assume that the SEZ is more capital-intensive vis-à-vis the urban manufacturing sector with respect to labour in value sense, i.e. $(a_{K2}/Wa_{L2}) > (a_{K3}/W^*a_{L3})$. So if any foreign capital inflow takes place, it automatically goes to the SEZ sector following a Rybczynski effect.

Full utilization of land in efficiency unit implies

$$a_{N1}X_1 + ha_{N2}X_2 = h\overline{N} \tag{4.8}$$

where $\overline{N}$ is the given endowment of land in physical unit and $h\overline{N}$ is land endowment in efficiency unit.

The labour endowment is given by

$$a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 + L_U = L \tag{4.9}$$

From Eqs. (4.6) and (4.9) we obtain

$$a_{L1}X_1 + a_{L2}X_2 + \left(\frac{W^*}{W} \right) a_{L3}X_3 = L \tag{4.10}$$

This completes the specification of our model with the fixed factor endowments and the internationally determined commodity prices. There are seven endogenous variables, W, R, r, X_1, X_2, X_3 and L_U. This is an indecomposable system. Since W^* is given, r can be obtained from (4.3). Then W, R, X_1, X_2 and X_3 are simultaneously solved from five equations, Eqs. (4.1), (4.2), (4.7), (4.8) and (4.10). Finally, L_U is found from (4.9). The values of the endogenous variables, except r, are obtained in terms of all the system parameters: $W^*, P_2, P_3, t, \gamma, L, K_D, N$ and β. The equilibrium value of r depends only on P_3 and W^*.

[14]See, for example, Harris and Todaro (1970), Corden and Findlay (1975), Beladi and Naqvi (1988) and Chaudhuri (2007) for the Harris–Todaro model and the labour allocation mechanism.

4.4.1 FDI Promotion, Tax Revenue and Production

If due to liberalized investment policy, the government eases the entry criteria for FDI, the inflow of foreign capital increases, leading to changes in the tax revenue of the government, public spending in different fiscal schemes and in the sectoral composition of output. Easing of entry criteria for foreign capital in this model is captured by a fall in the value of the parameter, γ.[15] This policy influences the SEZ sector in two ways. First, as the tax revenue goes up, the fiscal concessions given to the SEZ increase. Second, additional foreign capital that flows in due to this policy moves automatically to sector 2, thereby causing it to expand. Therefore, the easing of FDI norms may be viewed as a policy to encourage growth of the SEZ sector.

Differentiating (4.5) with respect to γ, we obtain

$$\left(\frac{dT}{d\gamma}\right) = tr\left(\frac{\partial K_F}{\partial \gamma}\right) < 0 \tag{4.11}$$

Thus, a fall in γ leads to an increase in T. This establishes the following proposition.

Proposition 4.1 *Easing of entry criteria for foreign capital raises the tax revenue of the government.*

FDI promotional measures lead to an increase in the supply of foreign capital, K_F, in the economy which in turn raises the public revenue given the tax rate on foreign capital income. For determining the effects of FDI promotional measures on the intersectoral composition of output, we differentiate Eqs. (4.1), (4.2), (4.7), (4.8) and (4.10) and obtain

$$\begin{bmatrix} \theta_{L1} & \theta_{N1} & 0 & 0 & 0 \\ \theta_{L2} & \theta_{N2} & 0 & \overline{s} & 0 \\ B & 0 & 0 & \lambda_{K2} & \lambda_{K3} \\ D & -D & \lambda_{N1} & \lambda_{N2} & 0 \\ -F & G & \lambda_{L1} & \lambda_{L2} & \overline{\lambda}_{L3} \end{bmatrix} \begin{bmatrix} \widehat{W} \\ \widehat{R} \\ \widehat{X}_1 \\ \widehat{X}_2 \\ \widehat{X}_3 \end{bmatrix} = \begin{bmatrix} 0 \\ A \\ C \\ E \\ 0 \end{bmatrix} \widehat{\gamma} \tag{4.12}$$

[15]The formation of SEZ may alternatively be encouraged by lowering the tax rate on foreign capital income, t. As t falls, the net return to foreign capital, $r(1-t)$, rises which leads to more foreign capital inflows, K_F. Consequently, the economy's aggregate capital stock, $(K_D + K_F)$, rises. However, the effect of a fall in t on the aggregate tax revenue is ambiguous. It depends on the elasticity of the supply function of foreign capital. If the tax revenue falls, the SEZ still grows as foreign capital supply increases, but agriculture suffers as the amount spent on infrastructural development falls. Therefore, SEZ and agriculture can grow simultaneously and the same qualitative results go through only if the tax revenue increases despite a drop in t.

where,

$$\left.\begin{aligned}
&\bar{s} = \frac{s}{(1+s)} > 0; \bar{\lambda}_{L3} = \left(\frac{W^*}{W}\right)\lambda_{L3} > 0;\\
&A = e\left(\bar{s} - \theta_{N2}\varepsilon_h\right); \varepsilon_h = \left(\frac{(1-\beta)\, rtK_{\mathrm{F}}h'}{h}\right) > 0;\\
&e = \left(\left(\frac{\partial K_{\mathrm{F}}}{\partial \gamma}\right)\left(\frac{\gamma}{K_{\mathrm{F}}}\right)\right) < 0; B = \lambda_{K2}S_{KL}^2 > 0;\\
&C = e\lambda_{K_{\mathrm{F}}} < 0; \lambda_{K_{\mathrm{F}}} = \left(\frac{K_{\mathrm{F}}}{K}\right) > 0; D = \lambda_{N1}S_{NL}^1 > 0;\\
&E = \lambda_{N1}e\varepsilon_h < 0; F = \left(\lambda_{L1}S_{LN}^1 + \lambda_{L2}S_{LK}^2 + \bar{\lambda}_{L3}\right) > 0; G = \lambda_{L1}S_{LN}^1 > 0;\\
&S_{NL}^1 = \left(\frac{W}{a_{N1}}\right)\left(\frac{\partial a_{N1}}{\partial W}\right) \text{ and so on.}
\end{aligned}\right\} \tag{4.13}$$

The value of the determinant of the coefficient matrix of the system (4.12) is

$$\begin{aligned}
\Delta = &-|\theta|_{LN}\left[\lambda_{N1}|\lambda|_{LK} + \lambda_{K3}\lambda_{N2}\lambda_{L1}\right]\\
&-\bar{s}\left[\lambda_{K3}\left\{D\lambda_{L1} + \lambda_{N1}\left(\theta_{L1}G + \theta_{N1}F\right)\right\} + B\theta_{N1}\lambda_{N1}\bar{\lambda}_{L3}\right]
\end{aligned} \tag{4.14}$$

where,

$$|\theta|_{LN} = \left(\theta_{L1}\theta_{N2} - \theta_{L2}\theta_{N1}\right); \text{and, } |\lambda|_{LK} = \left(\lambda_{K2}\bar{\lambda}_{L3} - \lambda_{K3}\lambda_{L2}\right)$$

From (4.14) it is evident that

$$\Delta < 0 \quad \text{if} \quad |\theta|_{LN} > 0 \tag{4.15}$$

where $|\theta|_{LN} > 0$ implies that sector 1 is more labour-intensive than sector 2 with respect to land.[16,17] Note that $|\theta|_{LN} > 0$ implies $|\lambda|_{LN} > 0$. Also $|\lambda|_{LK} =$

[16]It may be noted that the usages of both labour and land in SEZ are lower than agriculture. However, the SEZ can use any one of the two factors more intensively with respect to the other relative to agriculture.

[17]According to the report of the Ministry of Commerce and Industry, India, dated 4 September 2009, the amount of land acquired so far for different SEZs is 150,000 ha that has evicted 10,00,000 agricultural workers from land. If these people were engaged in agriculture the labour–land ratio in agriculture would have been 6.66. On the contrary, in 150,000 ha of land in SEZs, 100,885 persons have so far been employed. So the labour–land ratio in SEZ is 0.67. These figures, therefore, indicate that agriculture is far more labour-intensive (i.e. less land-intensive) relative to SEZ. See also http://business.mapsofindia.com/sez/land-acquisition.html and http://www.sezindia.nic.in/ in this context.

$\left(\lambda_{K2}\overline{\lambda}_{L3} - \lambda_{K3}\lambda_{L2}\right) > 0$ since sector 2 (SEZ) is more capital-intensive vis-à-vis sector 3 in both physical sense and value sense.

Let us first consider the effect of FDI promotional measures on the output of the SEZ.

From (4.12) we obtain

$$\left(\frac{\widehat{X}_2}{\widehat{\gamma}}\right) = -\underset{(-)}{\left(\frac{1}{\Delta}\right)}\left[\underset{(+)}{|\theta|_{LN}}\left(\lambda_{N1}\overline{\lambda}_{L3}\underset{(-)}{C} + \lambda_{K3}\lambda_{L1}\underset{(-)}{E}\right)\right]$$
$$-\underset{(-)}{\left(\frac{A}{\Delta}\right)}\left[\lambda_{K3}\{\underset{(+)}{D}\lambda_{L1} + \lambda_{N1}(\theta_{L1}\underset{(+)}{G} + \theta_{N1}\underset{(+)}{F})\} + \underset{(+)}{B}\theta_{N1}\overline{\lambda}_{L3}\lambda_{N1}\right] \tag{4.16}$$

Using (4.13), from (4.16) it follows that

$$\left(\frac{\widehat{X}_2}{\widehat{\gamma}}\right) < 0 \quad \text{if } A \leq 0 \text{ i.e.} \quad \text{if } 1 \geq \frac{\theta_{N2}\varepsilon_h}{\overline{s}}$$

This leads to the following proposition.

Proposition 4.2 *Easing of FDI norms raises the output of the SEZ if $A \leq 0$, i.e. if $1 \geq \theta_{N2}\varepsilon_h/\overline{s}$.*

Now, let us examine the effect on the output of sector 1. Solving (4.12) for $\widehat{X}_1$ with respect to $\widehat{\gamma}$, we obtain

$$\left(\frac{\widehat{X}_1}{\widehat{\gamma}}\right) = \underset{(-)}{\left(\frac{1}{\Delta}\right)}\left[(A\lambda_{N2} - \overline{s}E)\underset{(+)}{\left\{\theta_{N1}\left(B\overline{\lambda}_{L3} + F\lambda_{K3}\right) + \theta_{L1}G\lambda_{K3}\right\}}\right.$$
$$\left. + \underset{(+)}{|\theta|_{LN}}\left(C\overline{\lambda}_{L3}\lambda_{N2} - |\lambda|_{LK}E\right) + \underset{(+)}{D}\left(C\overline{\lambda}_{L3}\overline{s} - |\lambda|_{LK}A\right)\right] \tag{4.17}$$

Using (4.13) and (4.15) from (4.17), the following proposition can be proved.[18]

Proposition 4.3 *FDI promotional measures increase the output of sector 1 if (i) $\left(1 - \lambda_{K_F}\overline{\lambda}_{L3}/|\lambda|_{LK}\right) \geq (\theta_{N2}\varepsilon_h/\overline{s}) \geq (1 - \lambda_{N1}\varepsilon_h/\lambda_{N2})$ and (ii) any one of the relationships stated in (i) is a strict inequality.*

Finally, we consider the change in output in sector 3. From (4.12) we obtain the following expression:

[18]This is shown in Appendix 4.1.

$$\left(\frac{\widehat{X}_3}{\widehat{\gamma}}\right) = \left(\frac{1}{\Delta}\right) \underset{(-)}{[|\theta|_{LN}} \underset{(+)}{(\lambda_{L1}\lambda_{K2}E} - \underset{(-)}{|\lambda|_{LN}} \underset{(+)}{C)} + \underset{(-)}{\theta_{N1}B} \underset{(+)}{(\lambda_{L1}\overline{s}E} - \underset{(-)}{|\lambda|_{LN}A)}$$

$$+ \underset{(-)}{(A\lambda_{K2} - \overline{s}C)} \underset{(+)}{\{D\lambda_{L1}} + \underset{(+)}{\theta_{L1}G\lambda_{N1}} + \underset{(+)}{\theta_{N1}F\lambda_{N1}\}]} \tag{4.18}$$

With the help of (4.13) and (4.15) from Eq. (4.18), the following proposition can be established.[19]

Proposition 4.4 *Easing of FDI norms decreases the output of sector 3 if (i)* $(1 - \lambda_{K_F}/\lambda_{K2}) \geq (\theta_{N2}\varepsilon_h/\overline{s}) \geq (1 - \lambda_{N1}\lambda_{L1}\varepsilon_h/|\lambda|_{LN})$ *and (ii) anyone of the relationships stated in (i) is a strictly inequality.*

Propositions 4.2–4.4 can be explained as follows. Inflows of foreign capital due to FDI promotional measures affect the output of different sectors in a number of ways. First, an inflow of foreign capital, ceteris paribus, leads to an expansion of the capital-intensive SEZ (sector 2) and a contraction of sector 3 following a Rybczynski effect (we call it **R1**). Sector 2 now uses more labour and land. Land is released by sector 1 leading to its contraction. So **R1** lowers both X_1 and X_3 and raises X_2. On the other hand, owing to a contraction of sector 3, the expected urban wage falls, thereby leading to a reverse migration of workers from the urban to the rural sector. Second, an increase in FDI raises the aggregate tax revenue of the government. Since fixed fractions of the tax revenue are spent on providing subsidies to both SEZ and agriculture, the effective price of output of sector 2 ($P_2(1+s)$) and the land endowment of the economy in efficiency unit ($h\overline{N}$) increase. The latter produces another Rybczynski effect (let us call it **R2**) which raises X_2 and lowers X_1 as sector 2 is assumed to be more land-intensive vis-à-vis sector 1 with respect to labour. Sector 2 absorbs more capital, which is released by sector 3. Consequently, sector 3 contracts. Thus **R2** causes both X_1 and X_3 to fall and X_2 to increase. We have already discussed why the availability of labour in the rural sector increases following a reverse migration of labour to the rural sector, which generates another Rybczynski effect (**R3**). This leads to an expansion (contraction) of sector 1 (sector 2) as it is labour-intensive relative to sector 2. The contracting sector 2 releases capital that goes to sector 3 leading to its expansion. So **R3** leads to increases in both X_1 and X_3 and a decrease in X_2. Finally, a Stolper–Samuelson effect and a consequent Rybczynski effect[20] take place as the rate of price subsidy to the SEZ rises. Consequently, the return to land (R) rises and the wage rate (W) falls. On the other hand, R falls as the land endowment of the economy in efficiency

[19] See Appendix 4.1 for the proof.

[20] It is a well-known result in the international trade theory that a Stolper–Samuelson effect is followed by a Rybczynski type effect if the technologies of production are of the variable coefficient type. See any standard textbook on international trade for more details.

unit goes up. Saving on land input causes W to rise (see Eq. 4.1). Besides, as the supply of labour to the HOSS rises, the wage rate falls while the return to land rises. Therefore, the consequences on the factor prices are ambiguous. This causes the input price ratios to change, which in turn alters the factor coefficients, $a_{ji}s$. This produces a Rybczynski-type effect (**RTE**) that also affects the output composition.

Thus, we find that both **R1** and **R2** work favourably and cause the SEZ to expand. On the contrary, **R3** tends to lower X_2. Besides, the effect of the **RTE** on the output composition is uncertain. However, our analysis finds that the net outcome of all these effects would be an expansion of the SEZ sector under the sufficient condition that $1 \geq \theta_{N2}\varepsilon_h/\overline{s}$. On the other hand, while **R3** expands sector 1 both **R2** and **R3** exert downward pressures on X_1. But **R3** dominates over the combined effect of **R1**, **R2** and **RTE** under the sufficient condition as mentioned in Proposition 4.3. This causes sector 1 to expand. Thus, both agriculture and SEZ can grow simultaneously although both of them compete for the same two inputs – land and labour. This is possible because the effective land endowment of the economy rises following an increase in the spending of the government on irrigation and other infrastructure development projects and the supply of labour to these two sectors increases following a contraction of the urban sector. Finally, while **R3** causes sector 3 to expand, both **R1** and **R2** tend to contract this sector. However, the positive effect of **R3** would be outweighed by the combined effect of **R1** and **R2** under the sufficient condition as stated in Proposition 4.4.

4.4.2 Liberalized Investment Policy, Wage Rate and Unemployment

The liberalized FDI policy is likely to have significant consequences on the competitive wage rate and unemployment of the developing economies, which suffer from the problems of chronic unemployment and poor economic conditions of the informal sector workers. We now investigate how these two are affected by the FDI policy and examine the relation between the production structure and the labour market.

From (4.12) we obtain the effect of the liberalized FDI policy on the wage rate as

$$\left(\frac{\widehat{W}}{\widehat{\gamma}}\right) = \underset{(-)}{\left(\frac{\theta_{N1}}{\Delta}\right)}\left[\underset{(+)}{A\left(\lambda_{N1}\overline{\lambda}_{L3}\lambda_{K2} + \lambda_{K3}|\lambda|_{LN}\right)} - \underset{(-)}{\lambda_{K3}\lambda_{L1}\overline{s}E} - \underset{(-)}{\lambda_{N1}\overline{\lambda}_{L3}\overline{s}C}\right] \tag{4.19}$$

Using (4.13) and (4.15) from Eq. (4.19), one can now prove the following proposition.[21]

[21] See Appendix 4.1 for the mathematical proof.

Proposition 4.5 *Liberalized FDI policy raises the competitive wage in the rural sector if* $(\theta_{N2}\varepsilon_h/\overline{s}) \geq \left[1 - \left(\lambda_{N1}\lambda_{K3}\lambda_{L1}\varepsilon_h/\lambda_{N1}\overline{\lambda}_{L3}\lambda_{K2} + \lambda_{K3}|\lambda|_{LN}\right)\right]$.

Liberalized investment policy affects the rural sector wage (W) in three ways. First, due to **R1** the urban sector contracts and releases labour to the two rural sectors following a reverse migration. This causes W to fall. Second, as the effective land endowment of the economy ($h\overline{N}$) rises due to higher government spending on agricultural infrastructure, the return to land (R) falls. Cost saving on land input raises W to satisfy the zero-profit condition in agriculture (sector 1) (see Eq. 4.1). Finally, an increase in the rate of price subsidy given to the SEZ sector produces a Stolper–Samuelson effect and raises R and lowers W. So there are three opposing forces on W. The positive force outweighs the combined negative forces under the sufficient condition as stated in Proposition 4.5.

For examining the outcome of the policy on urban unemployment after subtracting (4.9) from (4.10), we obtain

$$L_{\mathrm{U}} = a_{L3}X_3\left(\frac{W^*}{W} - 1\right) \tag{4.20}$$

Differentiating (4.20) one gets

$$\left(\frac{\widehat{L}_{\mathrm{U}}}{\widehat{\gamma}}\right) = \left(\frac{\widehat{X}_3}{\widehat{\gamma}}\right) - \left(\frac{\lambda_{L_{\mathrm{U}}} + \lambda_{L3}}{\lambda_{L_{\mathrm{U}}}}\right)\left(\frac{\widehat{W}}{\widehat{\gamma}}\right)$$

where $\lambda_{L_{\mathrm{U}}} = L_{\mathrm{U}}/L$. Using (4.18) and (4.19) from the above equation, we obtain

$$\begin{aligned}\left(\frac{\widehat{L}_{\mathrm{U}}}{\widehat{\gamma}}\right) = \left(\frac{1}{\Delta}\right)\Big[&\underset{(-)}{|\theta|_{LN}}\,(\underset{(+)}{\lambda_{L1}\lambda_{K2}E} - \underset{(-)}{|\lambda|_{LN}}\underset{(+)}{C}) + \underset{(-)}{\theta_{N1}B}\,(\underset{(+)}{\lambda_{L1}\overline{s}E} - \underset{(-)}{|\lambda|_{LN}A}) \\ &+ \underset{(-)}{(A\lambda_{K2} - \overline{s}C)}\,\underset{(+)}{\{D\lambda_{L1}} + \lambda_{N1}\,\underset{(+)}{(\theta_{L1}G} + \underset{(+)}{\theta_{N1}F)\}} \\ &- \left(\frac{\lambda_{L_{\mathrm{U}}} + \lambda_{L3}}{\lambda_{L_{\mathrm{U}}}}\right)\theta_{N1}\Big\{A\,\underset{(+)}{\left(\lambda_{N1}\overline{\lambda}_{L3}\lambda_{K2} + \lambda_{K3}|\lambda|_{LN}\right)} \\ &- \underset{(-)}{\lambda_{K3}\lambda_{L1}\overline{s}E} - \underset{(-)}{\lambda_{N1}\overline{\lambda}_{L3}\overline{s}C}\Big\}\Big]\end{aligned} \tag{4.21}$$

From (4.21) the following proposition can easily be established.

Proposition 4.6 *Liberalized investment policy decreases unemployment if (i)* $(1 - \lambda_{K_{\mathrm{F}}}/\lambda_{K2}) \geq \theta_{N2}\varepsilon_h/\overline{s} \geq (1 - \lambda_{N1}\lambda_{L1}\varepsilon_h/|\lambda|_{LN})$*; (ii)* $\theta_{N2}\varepsilon_h/\overline{s} \geq \left[1 - \left(\lambda_{N1}\lambda_{K3}\lambda_{L1}\varepsilon_h/\left(\lambda_{N1}\overline{\lambda}_{L3}\lambda_{K2} + \lambda_{K3}|\lambda|_{LN}\right)\right)\right]$*; and (iii) there is at least one strict inequality in the relationships.*

In the HT framework, the consequence of any policy on urban unemployment crucially hinges on the relative strengths of the centrifugal and centripetal forces. Condition (i) as stated in Proposition 4.6 is sufficient for the contraction of sector 3 (in terms of both output and employment) following a liberalized investment policy. If sector 3 contracts, the expected urban wage decreases for each worker thereby leading to a reverse migration from the urban to the two rural sectors. Therefore, the strength of the centrifugal force that draws rural workers into the urban sector weakens. On the other hand, the availability of more workers in the rural sectors exerts a downward pressure on the rural wage, W. On the contrary, there will also be a positive effect on W as both the rural sectors expand. The second effect outweighs the first negative effect and the rural wage rises if condition (ii) is satisfied. Thus, the strength of the centripetal force that keeps the workers in the rural sector increases as W rises. Thus, we find that if the sufficient conditions, as stated above, are satisfied, both the centrifugal and the centripetal forces work in the same direction and a part of the additional workers in the rural workers is supplied from the pool of unemployed workers in the urban sector.[22] Consequently, the level of urban unemployment falls.

4.4.3 Investment Liberalization and Volume of Export by SEZ

Finally, we examine how liberalized FDI policy affects the volume of export by the SEZ.

The domestic demand function for commodity 2 is given by

$$D_2 = D_2\left(P_2, P_3, Y\right) \tag{4.22}$$

where Y is national income at domestic prices which is given by

$$Y = WL + Rh\left(\left(1-\beta\right) rtK_{\mathrm{F}}\left(r\left(1-t\right)\right)\right)\overline{N} + rK_{\mathrm{D}} \tag{4.23}$$

Export of commodity 2 is

$$Z = X_2 - D_2\left(P_2, P_3, Y\right) \tag{4.24}$$

Differentiating (4.23), we obtain

$$dY = LdW + h\overline{N}dR + RNdh = WL\widehat{W} + hRN\widehat{R} + hRN\widehat{h} \tag{4.25}$$

[22]The other part of the additional labour in the rural sectors comes from the group of retrenched urban workers.

On the other hand, from the definition of h we have

$$\widehat{h} = \varepsilon_h e \widehat{\gamma}. \tag{4.26}$$

Solving for $\widehat{R}$ from (4.12), using (4.19) and (4.26) and simplifying from (4.25), we obtain

$$\begin{aligned}\left(\frac{\widehat{Y}}{\widehat{\gamma}}\right) = &\left(\frac{\theta_L\theta_{N1} - \theta_N\theta_{L1}}{\Delta}\right)\left[\lambda_{N1}\overline{\lambda}_{L3}\left(A\lambda_{K2} - \overline{s}C\right) + \lambda_{K3}\left(A|\lambda|_{LN} - \overline{s}E\lambda_{L1}\right)\right] \\ &+\varepsilon_h e\left[\left(\theta_N - \frac{\theta_L\theta_{L1}\overline{s}\lambda_{N1}\lambda_{L1}}{\Delta}\right)\right]\end{aligned} \tag{4.27}$$

where $\theta_N = (hRN/Y)$ and $\theta_L = (WL/Y)$ are the distributive shares of rent and wage incomes in the whole economy, respectively.

Differentiating (4.24), we obtain

$$\left(\frac{dZ}{d\gamma}\right) = \left(\frac{dX_2}{d\gamma}\right) - \left(\frac{\partial D_2}{\partial Y}\right)\left(\frac{dY}{d\gamma}\right) \tag{4.28}$$

Using (4.16) and (4.27) and simplifying from (4.28), one finds

$$\begin{aligned}\left(\frac{dZ}{d\gamma}\right) = &-\underset{(-)}{\left(\frac{X_2}{\Delta\gamma}\right)}\Big[\underset{(+)}{|\theta|_{LN}}\lambda_{N1}\overline{\lambda}_{L3}\underset{(-)}{C} + A\left\{\lambda_{K3}\left(\underset{(+)}{D}\lambda_{L1} + \lambda_{N1}\left(\theta_{L1}\underset{(+)}{G} + \theta_{N1}\underset{(+)}{F}\right)\right)\right. \\ &\left. + \underset{(+)}{B}\theta_{N1}\overline{\lambda}_{L3}\lambda_{N1}\right\}\Big] \\ &- \underset{(+)}{\left(\frac{\partial D_2}{\partial Y}\right)}\left[\lambda_{N1}\overline{\lambda}_{L3}\left(A\lambda_{K2} - \overline{s}\underset{(-)}{C}\right) + \lambda_{K3}\left(A\underset{(+)}{|\lambda|_{LN}} - \overline{s}\underset{(-)}{E}\lambda_{L1}\right)\right] \\ &\times \underset{(-)}{\left(\frac{\theta_L\theta_{N1} - \theta_N\theta_{L1}}{\Delta}\right)} \\ &- \underset{(-)}{\left(\frac{\lambda_{L1}\lambda_{N1}e\varepsilon_h}{\Delta\gamma}\right)}\left[\left(X_2\lambda_{K3}\underset{(+)}{|\theta|_{LN}}\right) + D_2\underset{(+)}{E_Y}\underset{(-)}{\left(\Delta\theta_N - \theta_L\theta_{L1}\overline{s}\lambda_{N1}\lambda_{L1}\right)}\right]\end{aligned} \tag{4.29}$$

where $E_Y = [(\partial D_2/\partial Y)(Y/D_2)]$ is the income elasticity of demand for good 2.

From (4.29) it can be shown that $(dZ/d\gamma) < 0$ if (1) $(\theta_L/\theta_N \leq \theta_{L1}/\theta_{N1})$; (2) $1 \geq (\theta_{N2}\varepsilon_h/\overline{s}) \geq (1 - \lambda_{K_F}/\lambda_{K2}), (1 - \lambda_{L1}\lambda_{N1}\varepsilon_h/|\lambda|_{LN})$; and (3) $[(X_2\lambda_{K3}|\theta|_{LN}) + D_2E_Y(\Delta\theta_N - \theta_L\theta_{L1}\overline{s}\lambda_{N1}\lambda_{L1})] \geq 0$. This leads to the final proposition of the model.

Proposition 4.7 *FDI promotional measures boost up export by the SEZ if (i)* $(\theta_L/\theta_N \leq \theta_{L1}/\theta_{N1})$*; (ii)* $1 \geq (\theta_{N2}\varepsilon_h/\overline{s}) \geq (1 - \lambda_{K_F}/\lambda_{K2}), (1 - \lambda_{L1}\lambda_{N1}\varepsilon_h/|\lambda|_{LN})$*; and (iii)* $E_Y \cong 0$.

FDI promotional measures affect the export of sector 2 in two ways: (1) through an increase in the production of sector 2 (X_2) and (2) via a change in the domestic demand for commodity 2 (D_2) that arises due to a change in national income at domestic prices (Y). From Proposition 4.2 we note that X_2 rises if $1 \geq \theta_{N2}\varepsilon_h/\overline{s}$. On the other hand, Y changes due to changes in W, R and h. The wage rate, W, rises under the sufficient condition that $(\theta_{N2}\varepsilon_h/\overline{s}) \geq \left[1 - \left(\lambda_{N1}\lambda_{K3}\lambda_{L1}\varepsilon_h/\lambda_{N1}\overline{\lambda}_{L3}\lambda_{K2} + \lambda_{K3}|\lambda|_{LN}\right)\right]$. If W rises the return to land in efficiency unit must fall to satisfy the competitive profit condition in sector 1 (Eq. 4.1). Besides, h rises as the government spending on agricultural infrastructure rises. If the net effect is a fall in Y, the domestic demand for good 2 (D_2) falls and the volume of export of sector 2 (Z) rises subject to the sufficient condition that $1 \geq \theta_{N2}\varepsilon_h/\overline{s}$. However, Z can increase even when Y and hence D_2 increase if the rise in X_2 is greater than the increase in D_2. If conditions (i) and (ii), as stated in Proposition 4.7, are satisfied, Y rises but the domestic demand does not rise much if the income elasticity of good 2 is sufficiently low, i.e. if $E_Y \cong 0$. This raises the export of sector 2.

4.5 Concluding Remarks and Policy Implications of Results

The advocates of the SEZ policy envisage that the zones would usher in an industrial revolution and trigger an overall economic development of the country. On the other hand, the opponents express doubts over the perceived favourable effects of SEZ since they assert that the costs of the privileges extended to SEZ far outweigh the benefits percolated to the rest of the economy. This is mainly due to the fact that given the land size of the economy, the formation of SEZs using agricultural land is likely to hurt agriculture and the people dependent on it. In this chapter we make an attempt to theoretically challenge this contention in terms of a three-sector HT-type model. The analysis finds that both the agricultural sector and the SEZ may grow simultaneously if the FDI and the subsidy policies of the government are appropriately designed. A sizeable part of the government revenue must be spent on irrigation projects and other infrastructure development to raise the productivity of land and hence the effective land endowment of the economy. The fraction of the aggregate subsidy allocated to the SEZ must depend on the institutional, technological and trade-related factors of the economy. The unemployment problem and the economic conditions of the common people may also improve in the process. The final outcomes, however, depend much on the political will of the government.

Appendix 4.1

From (4.17) we find that $\left(\widehat{X}_1/\widehat{\gamma}\right) < 0$ if

$$\left.\begin{array}{l} \text{(i)}\ \ (A\lambda_{N2} - \bar{s}E) \geq 0;\ \text{(ii)}\ \ \left(C\bar{\lambda}_{L3}\lambda_{N2} - |\lambda|_{LK}E\right) \geq 0; \\ \text{(iii)}\ \ \left(C\bar{\lambda}_{L3}\bar{s} - |\lambda|_{LK}A\right) \geq 0;\ \text{and,}\ \ \text{(iv)}\ \ \text{anyone of the relationships,} \\ \ \text{(i)} - \text{(iii)},\ \ \text{is a strict inequality.} \end{array}\right\} \quad (4.A.1)$$

Now using (4.13) we can write

$$(A\lambda_{N2} - \bar{s}E) \geq 0 \Rightarrow \frac{A}{E} \leq \frac{\bar{s}}{\lambda_{N2}} \Rightarrow \frac{(\bar{s} - \theta_{N2}\varepsilon_h)}{\lambda_{N1}\varepsilon_h} \leq \frac{\bar{s}}{\lambda_{N2}}$$

$$\Rightarrow \left(1 - \frac{\lambda_{N1}\varepsilon_h}{\lambda_{N2}}\right) \leq \left(\frac{\theta_{N2}\varepsilon_h}{\bar{s}}\right) \quad (4.A.2)$$

$$\left(C\bar{\lambda}_{L3}\bar{s} - |\lambda|_{LK}A\right) \geq 0 \Rightarrow \frac{C}{A} \leq \frac{|\lambda|_{LK}}{\bar{\lambda}_{L3}\bar{s}} \Rightarrow \left(\frac{\lambda_{K_F}}{\bar{s} - \theta_{N2}\varepsilon_h}\right) \leq \frac{|\lambda|_{LK}}{\bar{\lambda}_{L3}\bar{s}}$$

$$\Rightarrow \frac{\theta_{N2}\varepsilon_h}{\bar{s}} \leq \left(1 - \frac{\lambda_{K_F}\bar{\lambda}_{L3}}{|\lambda|_{LK}}\right) \quad (4.A.3)$$

$$\left(C\bar{\lambda}_{L3}\lambda_{N2} - |\lambda|_{LK}E\right) \geq 0 \Rightarrow \frac{C}{E} \leq \frac{|\lambda|_{LK}}{\bar{\lambda}_{L3}\lambda_{N2}} \Rightarrow \frac{\lambda_{K_F}}{\lambda_{N1}\varepsilon_h} \leq \frac{|\lambda|_{LK}}{\bar{\lambda}_{L3}\lambda_{N2}} \quad (4.A.4)$$

Note that if (4.A.2) and (4.A.3) hold, (4.A.4) automatically holds.

From (4.A.1), (4.A.2), (4.A.3) and (4.A.4), it then follows that $\left(\widehat{X}_1/\widehat{\gamma}\right) < 0$ if (i) $\left(1 - \lambda_{K_F}\bar{\lambda}_{L3}/|\lambda|_{LK}\right) \geq (\theta_{N2}\varepsilon_h/\bar{s}) \geq (1 - \lambda_{N1}\varepsilon_h/\lambda_{N2})$ and (ii) anyone of the relationships stated in (i) is a strict inequality.

Again from (4.18) we find that

$$\left.\begin{array}{l} \left(\widehat{X}_3/\widehat{\gamma}\right) > 0\ \ \text{if} \\ \text{(i)}\ \ (\lambda_{L1}\lambda_{K2}E - |\lambda|_{LN}C) \leq 0;\ \text{(ii)}\ \ (\lambda_{L1}\bar{s}E - |\lambda|_{LN}A) \leq 0; \\ \text{(iii)}\ \ (A\lambda_{K2} - \bar{s}C) \leq 0;\ \text{(iv)}\ \ \text{anyone of the relationships,} \\ \text{(i)} - \text{(iii)},\ \text{is a strict inequality.} \end{array}\right\} \quad (4.A.5)$$

Using (4.13) we write

$$(\lambda_{L1}\lambda_{K2}E - |\lambda|_{LN}C) \le 0 \Rightarrow \frac{\lambda_{L1}\lambda_{K2}}{|\lambda|_{LN}} \ge \frac{C}{E} = \frac{\lambda_{K_F}}{\lambda_{N1}\varepsilon_h} \tag{4.A.6}$$

$$(\lambda_{L1}\bar{s}E - |\lambda|_{LN}A) \le 0 \Rightarrow \frac{\lambda_{L1}\bar{s}}{|\lambda|_{LN}} \ge \frac{A}{E} = \left(\frac{\bar{s} - \theta_{N2}\varepsilon_h}{\lambda_{N1}\varepsilon_h}\right)$$

$$\Rightarrow \frac{\theta_{N2}\varepsilon_h}{\bar{s}} \ge \left(1 - \frac{\lambda_{L1}\lambda_{N1}\varepsilon_h}{|\lambda|_{LN}}\right) \tag{4.A.7}$$

$$(A\lambda_{K2} - \bar{s}C) \le 0 \Rightarrow \frac{A}{C} \ge \frac{\bar{s}}{\lambda_{K2}} \Rightarrow \frac{(\bar{s} - \theta_{N2}\varepsilon_h)}{\lambda_{K_F}} \ge \frac{\bar{s}}{\lambda_{K2}} \Rightarrow \left(1 - \frac{\lambda_{K_F}}{\lambda_{K2}}\right) \ge \frac{\theta_{N2}\varepsilon_h}{\bar{s}} \tag{4.A.8}$$

Note that if (4.A.7) and (4.A.8) hold, (4.A.6) automatically holds.

From (4.A.5), (4.A.6), (4.A.7) and (4.A.8), it then follows that $\left(\widehat{X}_3/\widehat{\gamma}\right) > 0$ if (i) $(1 - \lambda_{K_F}/\lambda_{K2}) \ge \theta_{N2}\varepsilon_h/\bar{s} \ge (1 - \lambda_{L1}\lambda_{N1}\varepsilon_h/|\lambda|_{LN})$ and (ii) anyone of the relationships stated in (i) is a strict inequality.

From (4.19) we find that

$$\left(\frac{\widehat{W}}{\widehat{\gamma}}\right) < 0 \quad \text{if} \left[A\left(\lambda_{N1}\bar{\lambda}_{L3}\lambda_{K2} + \lambda_{K3}|\lambda|_{LN}\right) - \lambda_{K3}\lambda_{L1}\bar{s}E\right] \ge 0 \tag{4.A.9}$$

Using (4.13) we write

$$\left[A\left(\lambda_{N1}\bar{\lambda}_{L3}\lambda_{K2} + \lambda_{K3}|\lambda|_{LN}\right) - \lambda_{K3}\lambda_{L1}\bar{s}E\right] \ge 0$$

$$\Rightarrow \frac{A}{E} \le \frac{\lambda_{K3}\lambda_{L1}\bar{s}}{\left(\lambda_{N1}\bar{\lambda}_{L3}\lambda_{K2} + \lambda_{K3}|\lambda|_{LN}\right)}$$

$$\Rightarrow \left(\frac{\bar{s} - \theta_{N2}\varepsilon_h}{\lambda_{N1}\varepsilon_h}\right) \le \frac{\lambda_{K3}\lambda_{L1}\bar{s}}{\left(\lambda_{N1}\bar{\lambda}_{L3}\lambda_{K2} + \lambda_{K3}|\lambda|_{LN}\right)}$$

$$\Rightarrow \left(\frac{\theta_{N2}\varepsilon_h}{\bar{s}}\right) \ge \left[1 - \left(\frac{\lambda_{N1}\lambda_{K3}\lambda_{L1}\varepsilon_h}{\lambda_{N1}\bar{\lambda}_{L3}\lambda_{K2} + \lambda_{K3}|\lambda|_{LN}}\right)\right] \tag{4.A.10}$$

From (4.A.9) and (4.A.10), it then follows that

$$\left(\frac{\widehat{W}}{\widehat{\gamma}}\right) < 0 \quad \text{if} \left(\frac{\theta_{N2}\varepsilon_h}{\bar{s}}\right) \ge \left[1 - \left(\frac{\lambda_{N1}\lambda_{K3}\lambda_{L1}\varepsilon_h}{\lambda_{N1}\bar{\lambda}_{L3}\lambda_{K2} + \lambda_{K3}|\lambda|_{LN}}\right)\right]$$

References

Aggarwal A (2004) Export processing zones in India: analysis of the export performance, Working paper no. 148. Indian Council for Research on International Economic Relations, New Delhi

Aggarwal A (2005) Performance of export processing zones: a comparative analysis of India, Sri Lanka, and Bangladesh, Working paper no. 155. Indian Council for Research on International Economic Relations, New Delhi

Aggarwal A (2010) Economic impacts of SEZs: theoretical approaches and analysis of newly notified SEZs in India. MPRA paper 20902, University Library of Munich, Germany

Aggarwal A, Hoppe M, Walkenhorst P (2008) Special economic zones and economic diversification: some evidence from South Asia. In: Newfarmer R, Shaw W, Walkenhorst P (eds) Breaking into new markets: emerging lessons for export diversification. World Bank, Washington, DC

Beladi H, Marjit S (1992a) Foreign capital and protectionism. Can J Econ 25:233–238

Beladi H, Marjit S (1992b) Foreign capital, unemployment and national welfare. Japan World Econ 4:311–317

Beladi H, Naqvi N (1988) Urban unemployment and non-immiserizing growth. J Dev Econ 28:365–376

Bhaduri A (2007) Development or developmental terrorism. Econ Polit Wkly 42(7)

Bontempi ME, Prodi G (2009) Entry strategies into China: the choice between joint ventures and wholly foreign-owned enterprises: an application to the Italian manufacturing sector. Int Rev Econ Financ 18:11–19

Chaudhuri S (2007) Foreign capital, welfare and unemployment in the presence of agricultural dualism. Jpn World Econ 19(2):149–165

Chaudhuri S, Yabuuchi S (2010) Formation of special economic zone, liberalized FDI policy and agricultural productivity. Int Rev Econ Finance 19(4):779–788

Corden WM, Findlay R (1975) Urban unemployment, intersectoral capital mobility and development policy in a dual economy. Economica 42:59–78

Devereux J, Chen LL (1995) Export zones and welfare: another look. Oxf Econ Pap 47:704–713

Feenstra RC, Wei SJ (2010) Introduction to China's growing role in world trade. Published as NBER chapters. In: China's growing role in world trade. University of Chicago Press, Chicago, pp 1–31

Fernandes W (2007) Singur and the displacement scenario. Econ Polit Wkly 42(3):203–206

Ge W (1999) Special economic zones and the opening of the Chinese economy: some lessons for economic liberalization. World Dev 27(7):1267–1285

Graham EM (2004) Do export processing zones attract FDI and its benefits: the experience from China. IEEP 1:87–103

Hamada K (1974) An economic analysis of the duty free zone. J Int Econ 4:225–241

Hamilton C, Svennson L (1982) On the welfare effects of a free trade zone. J Int Econ 13:45–64

Hamilton C, Svennson L (1983) On the choice between capital import and labour export. Eur J Econ 20:167–192

Harris JR, Todaro MP (1970) Migration, unemployment and development: a two-sector analysis. Am Econ Rev 60:126–142

Huang LS (2008) The paradigm of tracing socialism with Chinese characteristics. Guangdong Dangshi Hist CCP Guangdong) 3:22–28

Lemoine F (2000) FDI and opening up the Chinese economy, Working paper no.11. Centre d'Etudes Prospectives et d'Information Internationale, Paris

Li K, Whitewell J, Yao S (2005) A growth model for China's special economic zone. Pac Econ Rev 10:439–449

Miyagiwa K (1986) A reconsideration of the welfare economics of the free trade zone. J Int Econ 21:337–350

Miyagiwa K (1993) The locational choice for free trade zones: rural versus urban options. J Dev Econ 40:187–203

Prasad E, Wei SJ (2007) The Chinese approach to capital inflows: patterns and possible explanations. In: Prasad E, Wei SJ (eds) Capital controls and capital flows in emerging economies: policies, practices and consequences. University of Chicago Press, Chicago, pp 421–480

Ranjan P (2006) Preferential trade areas, multinational enterprises, and welfare. Can J Econ 39(2):493–515

Reddy VR, Reddy BS (2007) Land alienation and local communities. Econ Polit Wkly 42(31):3233–3240

Rolfe RJ, Woodward DP, Kagira B (2004) Footloose and tax free: incentive preferences in Kenyan export processing zones. S Afr J Econ 72(4):784–807

Rosen DH (1999) Behind the open door: foreign enterprises in the Chinese marketplace. Institute for International Economics, Washington, DC

Sarma EAS (2007) Help the rich, hurt the poor. Econ Polit Wkly 42(21):1900–1902

Schweinberger AG (2003) Special economic zones in developing/or transition economies: a policy proposal. Rev Int Econ 11:619–629

Shah S (2008) Special economic zones in South Asia: comparative analysis of Bangladesh, Sri Lanka, and India. Harvard University/Mimeo, Cambridge, MA, pp 1–27

Tang W (2001) Urban development and planning in Shenzhen special economic zone: elements for an informed understanding, Occasional paper no. 2. Centre for China Urban and Regional Studies, Hong Kong Baptist University, Hong Kong

Wang J (2010) The economic impact of special economic zones: evidence from Chinese municipalities. J Dev Econ 101(1):133–147

Wei X (2000) Acquisition of technological capability through Special Economic Zones (SEZs): the case of Shenzhen SEZ. Ind Innov 7(2):199–221

Willmore L (1996) Export processing in the Caribbean: lessons from four case studies, Working paper no. 42. United Nations Economic Commission for Latin America and the Caribbean, Santiago

Wong K (1987) China's special economic zone experiment: an appraisal. Geografiska Annaler Ser B Hum Geogr 69(1):27–40

World Bank (2001) Export processing zones in Sub-Saharan Africa, Economic and social policy findings 193. World Bank, Washington, DC

World Bank (2008) Special economic zones: performance, lessons learned, and implications for zone development. World Bank, Washington, DC

Yabuuchi S (2000) Export processing zones, backward linkages, and variable returns to scale. Rev Dev Econ 4:268–278

Yeung Y (2000) Globalization and networked societies: urban-regional change in Pacific Asia. University of Hawaii Press, Honolulu

Yeung Y, Lee J, Kee G (2009) China's special economic zones at 30. Eurasian Geogr Econ 50(2):222–240

Young L, Miyagiwa K (1987) Unemployment and the formulation of free-trade zones. J Dev Econ 26:397–405

Zheng Y (2006) Institutions matter: how do special economic zones attract foreign direct investment in China? Paper presented at the annual meeting of the International Studies Association, Town & Country Resort and Convention Center, San Diego, CA, 22 Mar. (http://www.allacademic.com/meta/p98978_index.html)

Chapter 5
FDI and Relative Wage Inequality

5.1 Introduction

An important manifestation of inequality in the labour market is the inequality between the wages of skilled and unskilled workers. The skilled wage (W_S) is greater than the unskilled wage (W) so long as the return to education is positive. Therefore, the absolute wage gap is given by ($W_S - W$). The relative wage inequality is defined as $\left(\widehat{W}_S - \widehat{W}\right)$ where '$\widehat{\ }$' denotes proportional change.

A country's abundant factor of production is underpriced in the situation of autarky. But when international trade opens up, the income distribution should go in favour of the abundant factor. The developed countries are oversupplied with skilled labour while in the developing economies unskilled labour is the abundant factor of production. According to the Heckscher–Ohlin (HO) model with Stolper–Samuelson theorem at its core after trade liberalization, the wage inequality was expected to deteriorate in the developed nations and improve in the developing countries following increases in the prices of the export commodities as the latter are generally exporters of commodities that are intensive in the use of unskilled labour. It is observed that the wage inequality has increased in the developed countries in line with the predictions of the HO model. However, from the empirical studies of Robbins (1994a, b, 1995a, b, 1996a, b) and Wood (1997), it has been found that while the inequality has narrowed in the East Asian countries, the Latin American countries like Mexico, Chile, Costa Rica and Columbia have experienced increasing skilled–unskilled wage inequality following the liberalized trade and investment policies. On the other hand, there are some indirect studies, which point out that economic reforms have led to a widening of the skilled–unskilled wage inequality also in the South Asian countries including India. For example, Khan (1998) and Tendulkar et al. (1996) have found that the incidence of poverty has increased in the post-reform period. As unskilled workers belong to the poorer section of the population, an increase in poverty indirectly implies deterioration in the wage inequality.

S. Chaudhuri and U. Mukhopadhyay, *Foreign Direct Investment in Developing Countries: A Theoretical Evaluation*, DOI 10.1007/978-81-322-1898-2_5,

According to the empirical literature, the prime factors responsible for the widening of wage inequality in the Latin American countries are (1) removal of tariff restrictions from the sectors which were relatively intensive in the use of unskilled labour, (2) growth in foreign direct investment which is positively correlated with the relative demand for skilled labour and (3) falling real minimum wages and decline of union strength of the unskilled workers. Among these growth in foreign direct investment associated with increased demand for skilled labour is a very significant factor. See, for example, Robbins (1994a, b), Currie and Harrison (1997), Feenstra and Hanson (1997), Harrison and Hanson (1999), Hanson and Harrison (1999) and Beyer et al. (1999). As the magnitude of FDI to developing economies has increased considerably during the last two decades, the link between FDI and the relative wage inequality needs close scrutiny.

There is considerable theoretical literature explaining the deteriorating wage inequality in the developing economies in terms of specific structural characteristics of the less developed countries, such as features of labour markets, structures of production and nature of capital mobility. This literature includes of the works of Feenstra and Hanson (1996), Marjit and Acharyya (2003), Marjit et al. (2004), Chaudhuri and Yabuuchi (2007) and Yabuuchi and Chaudhuri (2007). They have shown how trade liberalization, inflows of foreign capital and international mobility of labour, both skilled and unskilled, might produce unfavourable effects on the wage inequality in the developing world given their specific structural characteristics as mentioned above. The paper of Feenstra and Hanson (1996), which is based on the famous Dornbusch–Fischer–Samuelson continuum-of-goods framework, shows that inflow of foreign capital has induced greater production of high-skill commodities in Mexico, thereby leading to a relative decrease (and an increase) in the demand for unskilled labour (skilled labour). Quite naturally, the wage inequality has deteriorated. On the contrary, the works of Chaudhuri and Yabuuchi (2007), Chaudhuri (2008) and Chaudhuri and Yabuuchi (2008) have obtained different results.[1] The differences in the findings of these above-mentioned papers necessitate detail examination of these models to determine the basis of such contradictions. In the subsequent sections, we briefly discuss some of these works one by one.

5.2 Three-Sector Model with Labour Market Imperfection

We consider a small open developing economy with three sectors.[2] Sector 1 produces a primary agricultural commodity using unskilled labour and land. Sector 2 produces a high-skill manufacturing commodity with the help of skilled labour

---

[1] Another important paper in this context is that of Chaudhuri and Banerjee (2010a, b). They have found that inflows of foreign capital unambiguously improve the economic conditions of the unskilled working class. However, the effects of FDI on skilled–unskilled wage inequality and extent of unemployment of both types of labour crucially hinge on the properties implied by the efficiency function of the skilled workers.

[2] This section draws upon excerpts of Chaudhuri and Yabuuchi (2007).

and capital. Sector 3 uses unskilled labour and capital to produce a low-skill manufacturing product. So land and skilled labour are specific factors in sectors 1 and sector 2, respectively. Production functions exhibit constant returns to scale with positive but diminishing marginal productivity to each factor. Markets, except the low-skill manufacturing sector labour market, are perfectly competitive. Unskilled workers employed in sector 3 earn a unionized wage, W^*, while their counterparts in the agricultural sector earn a competitive wage, W, with $W^* > W$. Therefore, among the two sectors using unskilled labour, sector 1 can be identified as the informal sector while sector 3 is the formal sector due to existence of unionized wages. Due to our small open economy, assumption product prices are given internationally. The low-skill manufacturing sector (sector 3) is the import-competing sector and is protected by an import tariff, while commodities 1 and 2 are the two export goods. A developing country which is appropriate for this type of comparative advantage is India.[3] However, the results of this section do not depend on trade patterns. Commodity 1 is assumed to be the numeraire.

The following symbols have been used in the equations:

a_{Ki} = capital–output ratio in the ith sector, $i = 2, 3$; a_{N1} = land–output ratio in sector 1; a_{Li} = unskilled labour–output ratio in the ith sector, $i = 1, 3$; a_{S2} = skilled labour–output ratio in sector 2; t = ad valorem rate of tariff on the import of commodity 3; P_i = exogenously given relative price of the ith commodity, $i = 2, 3$; $P_3{}^* = P_3(1 + t)$ = domestic or tariff-inclusive relative price of commodity 3; X_i = level of output of the ith sector, $i = 1, 2, 3$; W_S = wage rate of skilled labour; W^* = institutionally determined (or unionized) unskilled wage rate in sector 3; W = competitive wage rate of unskilled labour in sector 1; R = return to land; r = return to capital; U = parameter denoting the extent of bargaining power of the trade unions; E_W = elasticity of the unionized wage rate, W^*, with respect to the informal sector wage rate, W; E_U = elasticity of W^* with respect to the trade union bargaining power, U; L = endowment of unskilled labour; S = endowment of skilled labour; N = endowment of land; K = endowment of capital of the economy (domestic plus foreign); θ_{ji} = distributive share of the jth input in the ith sector for $j = L, S, N, K$ and $i = 1, 2, 3$; λ_{ji} = proportion of the jth input employed in the ith sector for $j = L, K$ and $i = 1, 2, 3$; $W_A = (\lambda_{L1} W + \lambda_{L3} W^*)$ = average unskilled wage; and '∧' = relative change.

A general equilibrium of the system is represented by the following set of equations:

$$W a_{L1} + R a_{N1} = 1 \tag{5.1}$$

$$W_S a_{S2} + r a_{K2} = P_2 \tag{5.2}$$

$$W^* a_{L3} + r a_{K3} = P_3{}^* \tag{5.3}$$

[3] It may be mentioned that besides primary agricultural commodities, India is also a large exporter of high-skill products like computer software.

$$a_{N1} X_1 = N \tag{5.4}$$

$$a_{S2} X_2 = S \tag{5.5}$$

$$a_{L1} X_1 + a_{L3} X_3 = L \tag{5.6}$$

$$a_{K2} X_2 + a_{K3} X_3 = K \tag{5.7}$$

Equations (5.1), (5.2) and (5.3) state that unit cost of production of each commodity must be equal to its relative domestic price in equilibrium. In other words, these are the competitive industry equilibrium conditions in the three sectors. On the other hand, Eqs. (5.4), (5.5), (5.6) and (5.7) are the full-employment conditions of the four factors of production.

The formal sector faces a unionized labour market. The relationship for the unionized wage rate is specified as[4]

$$\begin{aligned} &W^* = W^*\underset{(+)}{(W},\underset{(+)}{U)} \\ &W^* = W \text{ for } U = 0 \text{ and } W^* > W \text{ for } U > 0 \end{aligned} \tag{5.8}$$

Equation (5.8) states that in the absence of any bargaining power of the trade unions, i.e. when $U = 0$, the unskilled wage rates are equal in sectors 1 and 3. However, the unionized unskilled wage rate in sector 3, W^*, exceeds the competitive unskilled wage rate, W, when there is at least some power to the trade unions. The unionized wage is scaled upwards as the competitive wage rate rises.[5] Also with an

[4]Assuming that each formal sector firm has a separate trade union, the unionized wage function may be derived as a solution to the Nash bargaining game between the representative firm and the representative labour union in the low-skill manufacturing sector. For detailed derivation, see Chaudhuri (2003) and Chaudhuri and Mukhopadhyay (2009).

[5]On one hand, the trade union requires a higher wage rate than the competitive one as usual, and on the other, the competitive wage rate itself rises as the union wage rate increases if the collective bargaining institutions exist and have some effects on the unskilled labour market. See Carruth and Oswald (1981) in this context. Besides, the informal sector is not generally a free-entry sector in the developing countries as it is thought to be. Several authors, including Banerjee (1986) in case of India and Gandhi-Kingdon and Knight (2001) in case of South Africa, have noted that many activities in the so-called informal sector of the developing countries are highly stratified, requiring skills, experience and contacts, with identifiable barriers to entry. Even when skill and capital are not required, entry can be difficult because of the presence of cohesive networks, which exercise control over location and zone of operation. Thus, various impediments to entry make the wage rate downwardly rigid in many cases. Also, in the case of agriculture, there are cases of downward wage rigidity that can be explained by the 'collusive theory of unemployment' (Osmani 1991). However, as a first step to address the role of trade unionism on wage inequality, we emphasize in this chapter the role of trade union in the formal sector only.

increase in the bargaining power, the unions bargain for a higher wage.[6] The union power, denoted by U, is amenable to policy measures. If the government undertakes labour market reform measures, e.g. partial or complete ban on resorting to strikes by the trade unions, reformation of employment security laws to curb union power, U takes a lower value.

5.2.1 The General Equilibrium

There are eight endogenous variables in the system: W, W^*, W_S, R, r, X_1, X_2 and X_3. There are eight independent equations, namely, Eqs. (5.1), (5.2), (5.3), (5.4), (5.5), (5.6), (5.7) and (5.8). Equations (5.1), (5.2) and (5.3) together form the price system of the model. This production structure does not possess the decomposition property. So the input prices cannot be solved from the price system alone independent of the output system. From Eqs. (5.4), (5.5), (5.6) and (5.7), it is easy to derive the following equation:

$$\left[\left\{\left(\frac{a_{L1}}{a_{N1}}\right)N\right\} + \left(\frac{a_{L3}}{a_{K3}}\right)\left\{K - \left(\frac{a_{K2}}{a_{S2}}\right)S\right\}\right] = L \tag{5.9}$$

The working of the general equilibrium model is as follows. The five input prices, W, W_S, W^*, R and r are determined by solving Eqs. (5.1), (5.2), (5.3), (5.8) and (5.9) simultaneously. Once the factor prices are known, the factor coefficients, $a_{ji}s$, are also known. X_1 and X_2 are solved from Eqs. (5.4) and (5.5), respectively. Finally, X_3 is found from either Eqs. (5.6) or (5.7).

Unskilled workers in this system earn two different wages – either the unionized wage, W^*, in sector 3 or a lower competitive wage, W, in sector 1. The average wage for unskilled labour is given by

$$W_A \equiv \left(W\lambda_{L1} + W^*\lambda_{L3}\right) \tag{5.10}$$

where λ_{L1} and λ_{L3} denote the proportion of unskilled labour employed in sectors 1 and 3, respectively. Here, the skilled–unskilled wage gap improves (worsens)

[6]It should be pointed out, in this context, that the channels through which unionization of the unskilled labour market affects the skilled–unskilled wage dispersion are far more complex (covering wages and benefits, work rules limiting the intensity of work, stabilizing hours, reducing arbitrariness in management actions, etc.) than has been worked out here. Although the unionized wage function used in the present analysis is simple in form and does not consider some of the complex issues relating to collective bargaining, it does have a strong micro-foundation based on Nash bargaining. Besides, the use of this function provides us a theory (though not derived here) of wage differential between the sectors and helps to derive some interesting results which are new in the literature on trade and development.

in absolute terms if the gap between W_S and W_A falls (rises). On the other hand, the wage inequality improves (deteriorates) both in absolute and relative terms if $\left(\widehat{W}_S - \widehat{W}_A\right) < (>) \, 0$.

5.2.2 FDI and Wage Inequality

We now examine the consequence of an inflow of foreign capital on the relative wage inequality.

By totally differentiating Eqs. (5.1), (5.2), (5.3), (5.8) and (5.9), solving by Cramer's rule and using envelope conditions, we can derive the following proposition.[7]

Proposition 5.1 *An inflow of foreign capital produces a favourable effect on the skilled–unskilled wage inequality if* $(\theta_{S2}\theta_{K3} \geq \theta_{K2}\theta_{L3})$.[8,9]

The intuitive explanations of this result are as follows. As the system does not possess the decomposition property and the five unknown factor prices are obtained by solving Eqs. (5.1), (5.2), (5.3), (5.8) and (5.9) simultaneously, any parametric changes in the system can affect all factor prices and output levels. An inflow of foreign capital, ceteris paribus, leads to a decrease in the return to capital, r. Both sectors 2 and 3 expand as they use capital. The demand for skilled labour rises in sector 2 and that of unskilled labour increases in sector 3. A higher demand for skilled labour in sector 2 raises the skilled wage, W_S. On the other hand, the additional unskilled labour in the expanding sector 3 must come from sector 1. This lowers the availability of unskilled labour in sector 1 that pushes up the competitive unskilled wage, W, and leads to a contraction of this sector. A rise in W implies an increase in the unionized unskilled wage rate, W^*. The proportion of unskilled labour employed in the higher (lower) wage-paying sector increases (decreases). The average unskilled wage, W_A, rises as a consequence. What happens to the skilled–unskilled wage inequality crucially depends on the rates of increase in W_S and W_A. However, if sector 3 is capital-intensive in a sense that $(\theta_{K3} > \theta_{K2})$, the

[7]For mathematical proofs, see Chaudhuri and Yabuuchi (2007) or Chaudhuri and Mukhopadhyay (2009).

[8]While examining the consequence of emigration of skilled and unskilled labour on the wage inequality in an otherwise 2×3 specific factor model of Jones (1971), Marjit and Kar (2005) have shown that with international factor flows, factor shares matter in determining the trend in wage distribution.

[9]Here sectors 2 and 3 use two different types of labour. However, there is one intersectorally mobile input which is capital. So, these two industries cannot be classified in terms of factor intensities that are usually used in the Heckscher–Ohlin–Samuelson model. Despite this, a special type of factor intensity classification in terms of the relative distributive shares of the mobile factor, capital, may be used for analytical purposes. The industry in which this share is higher relative to the other may be considered as capital-intensive in a special sense. See Jones and Neary (1984) for details.

decrease in the cost of capital in sector 3 is higher than that in sector 2.[10] This, from Eqs. (5.2) and (5.3), implies that the increase in W^* is larger than the increase in W_S. This improves the wage inequality. When the distributive shares of capital of sectors 2 and 3 are equal (i.e. $\theta_{K3} = \theta_{K2}$), the rates of increases in W^* and W_S would be equal. As both W and λ_{L3} have also increased, the rate of increase in W_A would be greater than that in W_S. So, the wage inequality improves even in this situation.

5.3 FDI and Wage Inequality: Do Factor Intensities Always Matter?

The model in the preceding section shows that factor intensities play a crucial role in determining the direction of change in the relative wage inequality. Besides, the theoretical literature on trade and development has so far adopted the full-employment framework and hence ignored the problem of unemployment, especially that of unskilled labour which is a salient feature of the developing countries. These economies are plagued by significant degree of skilled–unskilled wage inequality and high levels of unemployment of unskilled labour, especially in the urban areas. We would now like to enquire whether factor intensities always matter in predicting the consequences of different policies on the relative wage inequality even in the presence of unemployment of unskilled labour.[11] The objectives of this section are to (1) construct a three-sector, specific-factor model with HT-type unemployment of unskilled labour that can be useful in analysing the consequences of international mobility of capital on the skilled–unskilled wage inequality in a dual economy set-up and (2) examine the necessity of the factor intensity condition in predicting the relative wage movements.

5.3.1 FDI, Wage Inequality and Factor Intensities

We consider a small open dual economy with two broad sectors: rural and urban.[12] The urban sector is further subdivided into two sub-sectors: low-skill sector and high-skill sector so that in total we have three sectors. There are two types of labour

[10]Note that $(\theta_{S2}\theta_{K3} > \theta_{K2}\theta_{L3})$ implies $(\theta_{K3} > \theta_{K2})$ and that the result in proposition 5.1 is valid even if $(\theta_{S2}\theta_{K3} = \theta_{K2}\theta_{L3})$, i.e. $(\theta_{K3} = \theta_{K2})$.

[11]For an analysis of the consequence of FDI on the relative wage inequality in the presence of both skilled and unskilled unemployment, see Chaudhuri and Banerjee (2010b). They have found that the effect of FDI on the skilled–unskilled wage inequality crucially hinges on the properties implied by the efficiency function of the skilled workers.

[12]This section draws upon Chaudhuri (2008).

in the economy: unskilled and skilled. The rural sector is the origin of all unskilled labour. Unskilled workers are employed in the rural sector (sector 1) and in the urban low-skill manufacturing sector (sector 3), and there is imperfect mobility of unskilled labour between these two sectors. Unskilled workers employed in sector 3 earn a unionized wage, W^*, while their counterparts in the rural sector earn a competitive wage, W, with $W^* > W$. Owing to the existence of the intersectoral wage differential, unskilled workers migrate to the urban sector for securing jobs in sector 3. But the number of unskilled workers competing for urban jobs exceeds the number of jobs available in that sector. Consequently, some of the unskilled workers remain unemployed in the urban sector. The model, therefore, takes care of rural–urban migration and the prevalence of market imperfection and unemployment of unskilled labour, which are some of the essential features of a developing economy. On the contrary, urban sector is the origin of all skilled workers who are fully employed in the high-skill sector (sector 2).[13] There are some theoretical papers in the literature on trade and development that have taken into consideration some of these distinguishing characteristics between skilled and unskilled labour for different purposes.[14]

The rural sector (sector 1) produces a primary agricultural commodity using unskilled labour and land. Sector 2 produces a high-skill commodity with the help of skilled labour and capital. Sector 3 uses unskilled labour and capital to produce a low-skill manufacturing product. So land and skilled labour are specific factors in sectors 1 and 2, respectively. Capital is perfectly mobile between sectors 2 and 3. Unskilled labour is perfectly mobile between sectors 1 and 3. The two unskilled wage rates are related by the Harris and Todaro (1970) condition of migration equilibrium where the expected urban unskilled wage equals the rural wage rate. Production functions exhibit constant returns to scale with positive but diminishing marginal productivity to each factor. Markets, except the urban unskilled labour market, are perfectly competitive. All the three commodities are traded internationally. Hence, their prices are given internationally. The diverse trade pattern of the economy is reflected in the fact that it exports the primary agricultural and the high-skill commodities while it is a net importer of the low-skill manufacturing commodity. Commodity 1 is chosen as the numeraire.

A general equilibrium of the system is represented by the following set of equations.

$$W a_{L1} + R a_{N1} = 1 \tag{5.11}$$

$$W_S a_{S2} + r a_{K2} = P_2 \tag{5.12}$$

[13]Unemployment of skilled labour is also a disconcerting problem in the developing economies particularly after the global economic slowdown. The role of FDI on both skilled and unskilled unemployment has been analysed in Chaudhuri and Banerjee (2010a, b).

[14]See Yabuuchi (2007), Chaudhuri and Yabuuchi (2007) and Yabuuchi and Chaudhuri (2007), among others.

$$W^* a_{L3} + r a_{K3} = P_3 \tag{5.13}$$

$$a_{N1} X_1 = N \tag{5.14}$$

$$a_{S2} X_2 = S \tag{5.15}$$

$$a_{K2} X_2 + a_{K3} X_3 = K \tag{5.16}$$

$$a_{L1} X_1 + a_{L3} X_3 + L_U = L \tag{5.17}$$

Equations (5.11), (5.12) and (5.13) are the competitive industry equilibrium conditions in the three sectors. On the other hand, Eqs. (5.14), (5.15) and (5.16) are the full-employment conditions for land, skilled labour and capital,[15] respectively. The unskilled labour endowment is given by (5.17).

Since the probability of finding a job in the low-skill urban manufacturing sector is $a_{L3}X_3/(a_{L3}X_3 + L_U)$, the expected unskilled wage in the urban area is $(W^* a_{L3}X_3)/(a_{L3}X_3 + L_U)$. Therefore, the allocation mechanism of unskilled labour between rural and urban areas is expressed as

$$\left(W^* a_{L3} X_3\right) / \left(a_{L3} X_3 + L_U\right) = W,$$

or equivalently,

$$\left(\frac{W^*}{W}\right) a_{L3} X_3 + a_{L1} X_1 = L \tag{5.18}$$

The low-skill urban sector faces a unionized unskilled labour market. The relationship for the unionized wage rate is specified as follows[16]:

$$W^* = b + F(\alpha W); \quad \textit{with } b > 0; F(0) = 0; \quad F'(.) > 0 \quad \text{and} \quad \alpha = [0, 1]. \tag{5.19}$$

If $\alpha = 0$ and $\alpha W = 0$, then $F(0) = 0$ and hence $W^* = b$. However, if $\alpha > 0$, $\alpha W > 0$, $F(\alpha W) > 0$ and $W^* > b$.

Here, b can be interpreted as the minimum wage of the unskilled workers as set by the government. Verbally, if the bargaining power of the labour union is zero, $\alpha = 0$ and then $W^* = b$. However, if there is some bargaining strength of the unions, i.e. when $\alpha > 0$, the unionized wage is greater than the minimum wage. So in the

[15]It is assumed that the capital stock of the economy consists of both domestic and foreign capital that are perfect substitutes. This assumption has been widely used in the theoretical literature on trade and development.

[16]See footnote 4 in this context.

absence of any bargaining power to the trade unions, the unionized unskilled wage in sector 3 becomes insensitive to the rural sector wage.

The firms in the low-skill urban sector have well-organized trade unions. One of the most important roles of the labour unions is to bargain with their respective employers in respect of the betterment of the working conditions. Trade union activities ensure that the minimum wage legislation of the government is binding so that the unskilled workers in the urban sector receive at least the minimum unskilled wage. Furthermore, through offer of negotiation, threat of strike, actual strike, etc., they exert pressure on the employers (firms) in order to secure higher wages, reduced hours of work, share in profits and other benefits. Organized workers in large firms leave no stones unturned so as to reap wages higher than the stipulated minimum wage.[17] Therefore, it is sensible to assume that the unionized unskilled wage in sector 3 exceeds the competitive rural unskilled wage, i.e. $W^* > W$. The unionized wage may increase if the rural sector wage rises. Finally, $E_W = ((\partial W^*/\partial W)/(W/W^*))$ and $1 > E_W \geq 0$, where E_W is the elasticity of W^* with respect to W. When $\alpha = 0$ and $W^* = b$, $E_W = 0$. On the contrary, $E_W > 0$ when $\alpha > 0$.

Using (5.19), Eq. (5.13) can be rewritten as follows:

$$(b + F(\alpha W))\, a_{L3} + r a_{K3} = P_3 \tag{5.13.1}$$

Besides, using Eqs. (5.14) and (5.15), Eqs. (5.16) and (5.18) can be rewritten as follows:

$$a_{K3} X_3 + \left(\frac{a_{K2} S}{a_{S2}}\right) = K \tag{5.16.1}$$

$$\left(\frac{W^*}{W}\right) a_{L3} X_3 + \left(\frac{a_{L1} N}{a_{N1}}\right) = L \tag{5.18.1}$$

There are nine endogenous variables in the system: W, W^*, W_S, R, r, X_1, X_2, X_3 and L_U.[18] We note that this production structure does not possess the decomposition property. W, W_S, R, r and X_3 are determined by solving Eqs. (5.11), (5.12), (5.13.1), (5.16.1) and (5.18.1) simultaneously. W^* is found from (5.19) once W is obtained. When the factor prices are known, the factor coefficients, a_{ji}s, are also known. X_1 and X_2 are obtained from Eqs. (5.14) and (5.15), respectively. Finally, L_U is found from (5.17).

There are three groups of unskilled workers in this system earning different wages. Unskilled workers employed in the rural sector and the low-skill urban sector receive a competitive wage, W, and the unionized wage, W^*, respectively, while the unemployed urban workers earn nothing.

---

[17] The stipulated minimum wage is at least equal to the competitive rural sector wage. See Bhalotra (2002) in this context.

[18] W^* is an endogenous variable only if it is a function of the rural unskilled wage, W, i.e. if $\alpha > 0$. Otherwise, it is a parameter.

In Sect. 5.2, it has already been mentioned that the average wage for unskilled labour is given by

$$W_{\mathrm{A}} \equiv \left(W\lambda_{L1} + W^{*}\lambda_{L3}\right) \tag{5.10}$$

where λ_{L1} and λ_{L3} denote the proportion of unskilled workers employed in sectors 1 and 3, respectively. Using (5.18.1), Eq (5.10) can be simplified to[19]

$$W_{\mathrm{A}} = W \tag{5.10.1}$$

Totally differentiating Eqs. (5.11), (5.12), (5.13.1), (5.16.1) and (5.18.1) and solving by Cramer's rule, we derive the following expressions:[20]

$$\widehat{W} = \underset{(+)}{\left(\frac{\theta_{N1}\theta_{S2}\theta_{K3}}{\Delta}\right)}\left(\frac{W^{*}\lambda_{L3}}{W}\right)\widehat{K} \tag{5.20}$$

$$\widehat{W}_{\mathrm{S}} = \underset{(+)\,(+)}{\left(\frac{\theta_{N1}\theta_{K2}E_{W}\theta_{L3}}{\Delta}\right)}\left[\left(\frac{W^{*}\lambda_{L3}}{W}\right)\widehat{K}\right] \tag{5.21}$$

$$\widehat{r} = -\underset{(+)\,(+)}{\left(\frac{\theta_{N1}\theta_{S2}E_{W}\theta_{L3}}{\Delta}\right)}\left(\frac{W^{*}\lambda_{L3}}{W}\right)\widehat{K} \tag{5.22}$$

$$\widehat{X}_{3} = \underset{(+)}{\left(\frac{\theta_{S2}}{\Delta}\right)}\widehat{K}\,[\underset{(+)}{\theta_{L1}\theta_{K3}A_{5}} + \underset{(+)}{\theta_{N1}E_{W}}\underset{(+)}{\theta_{L3}A_{6}} - \underset{(-)}{\theta_{N1}\theta_{K3}A_{4}}] \tag{5.23}$$

where

$$\left.\begin{aligned}
A_{1} &= \lambda_{K3}S_{KL}^{3}E_{W} > 0\\
A_{2} &= \left[\lambda_{K3}S_{KL}^{3} + \lambda_{K2}\left(S_{KS}^{2} + S_{SK}^{2}\right)\right] > 0\\
A_{3} &= \lambda_{K2}\left(S_{KS}^{2} + S_{SK}^{2}\right) > 0\\
A_{4} &= [(W^{*}\lambda_{L3}/W)(E_{W} - 1 - S_{LK}^{3}E_{W}) - \lambda_{L1}(S_{LN}^{1} + S_{NL}^{1})] < 0\\
A_{5} &= \lambda_{L1}\left(S_{LN}^{1} + S_{NL}^{1}\right) > 0\\
A_{6} &= \left(W^{*}\lambda_{L3}S_{LK}^{3}/W\right) > 0\\
S_{NL}^{1} &= (W/a_{N1})\left(\partial a_{N1}/\partial W\right) \text{ and so on.}
\end{aligned}\right\} \tag{5.24}$$

[19]The average wage of the workers (unskilled workers in this case) in an HT economy is equal to the rural sector wage. This is known as the 'envelope property'.

[20]For detailed derivations, see Chaudhuri (2008).

Also,

$$\Delta = \theta_{S2}\theta_{K3}\left[\underset{(+)}{\theta_{L1}\lambda_{K3}A_5} + \underset{(+)}{\theta_{N1}}\left(A_1\frac{W^*}{W}\lambda_{L3} - \underset{(-)}{\lambda_{K3}A_4}\right)\right]$$

$$+ \underset{(\geq 0)}{\theta_{N1}E_W\theta_{L3}}\left[\theta_{S2}\left(\underset{(+)}{A_2\frac{W^*}{W}\lambda_{L3}} + \underset{(+)}{A_6\lambda_{K3}}\right) + \underset{(+)}{\theta_{K2}A_3\frac{W^*}{W}\lambda_{L3}}\right] > 0 \tag{5.25}$$

Using (5.10.1), (5.20) and (5.21), one can write

$$\left(\widehat{W}_S - \widehat{W}_A\right) = \left(\widehat{W}_S - \widehat{W}\right) = \underset{(+)}{\left(\frac{\theta_{N1}}{\Delta}\right)}\underset{(\geq 0)}{(\theta_{K2}E_W\theta_{L3} - \theta_{S2}\theta_{K3})}\left(\frac{W^*}{W}\right)\lambda_{L3}\widehat{K} \tag{5.26}$$

Noting that $1 > E_W \geq 0$, from (5.26), one can easily obtain the following result:

$$\left(\widehat{W}_S - \widehat{W}\right) < 0 \quad \text{when} \quad \widehat{K} > 0 \quad \text{if} \quad (\theta_{K2}\theta_{L3} < \theta_{S2}\theta_{K3}) \tag{5.27}$$

We can now establish the following proposition.

Proposition 5.2 *An inflow of foreign capital improves the skilled–unskilled wage inequality if the low-skill manufacturing sector is capital-intensive vis-à-vis the high-skill sector (in the Jones–Neary sense).*[21]

Proposition 5.2 can be intuitively explained as follows. An inflow of foreign capital causes both the urban sectors to expand. The return to capital falls as its availability rises given its demand. Higher demand for skilled labour in the expanding high-skill sector raises the skilled wage, W_S. On the other hand, as the demand for unskilled labour in sector 3 rises, the expected urban wage for a prospective rural migrant rises that results in a fresh migration of unskilled labour to the urban sector. The rural sector unskilled wage, W, rises as a consequence, which in turn pulls up the unionized unskilled wage in sector 3. Thus, we find that both W and W_S rise following an inflow of foreign capital. Wages increase because of saving on capital cost. The saving on capital cost would be higher in the sector in which capital is used more intensively. From (5.26), it is evident that the proportionate increase in the rural wage would be greater than that of the skilled wage if the low-skill manufacturing sector (sector 3) is capital-intensive (in a special sense), thereby causing the relative wages to move in favour of unskilled labour.

[21] See footnote 9.

5.3.2 FDI and Unemployment of Unskilled Labour

We now analyse the effect of inflows of foreign capital on the level of urban unemployment of unskilled labour.

Subtraction of (5.17) from (5.18) yields

$$\left(\frac{W^*}{W} - 1\right) a_{L3} X_3 = L_U \tag{5.28}$$

Differentiating Eq. (5.28), using Eqs. (5.20) and (5.22), (5.23) and (5.24) and simplifying, we can derive the following expression[22]:

$$\underset{(+)}{\widehat{L}_U = \left(\frac{\widehat{K}}{\Delta}\right)} \left[\underset{(+)}{\lambda_{L1}\left(S^1_{LN} + S^1_{NL}\right)} - \underset{(+)}{\left(\frac{W^*\lambda_{L3}}{W^* - W}\right)} \underset{(\geq 0)}{(1 - E_W)\,\theta_{N1}}\right] (\theta_{S2}\theta_{K3}) \tag{5.29}$$

From (5.29), the following result trivially follows:

$$\widehat{L}_U < 0 \quad \text{when} \quad \widehat{K} > 0 \text{ iff } \left[\underset{(+)}{\lambda_{L1}\left(S^1_{LN} + S^1_{NL}\right)} < \underset{(+)}{\left(\frac{W^*\lambda_{L3}}{W^* - W}\right)} \underset{(\geq 0)}{(1 - E_W)\theta_{N1}}\right] \tag{5.30}$$

One can now establish the following proposition:

Proposition 5.3 *An inflow of foreign capital mitigates the problem of urban unemployment of unskilled labour iff* $\left[\lambda_{L1}\left(S^1_{LN}+S^1_{NL}\right)<\left(\frac{W^*\lambda_{L3}}{W^*-W}\right)(1-E_W)\,\theta_{N1}\right]$.

We explain Proposition 5.3 in the following manner. An inflow of foreign capital raises both the skilled and unskilled rural wage and causes both the urban sectors (sectors 2 and 3) to expand. This leads to an increase in the number of unskilled jobs available in this sector, inducing more migration from the rural sector to the urban sector. Owing to scarcity of unskilled labour in the rural sector, the competitive unskilled wage rises. This raises the unionized urban wage. Hence, the expected urban wage for a prospective rural migrant goes up paving way for a fresh migration from the rural to the urban sector. This is the *centrifugal force* that drives the rural unskilled workers to move away from the rural sector. But, as the competitive unskilled wage in the rural sector has also increased, there is also the *centripetal force* that prevents rural workers from migrating to the urban sector. Thus, there are two opposite effects working on the determination of the size of unemployed urban unskilled workforce. Our analysis shows that in the present

---

[22] For further details, see Chaudhuri (2008).

case, the *centripetal force* is stronger than the *centrifugal force* under the necessary and sufficient condition as stated in Proposition 5.3. Hence, the level of urban unemployment of unskilled labour may fall following an inflow of foreign capital.

5.3.3 FDI and Wage Inequality in a Fixed Unionized Wage Case

We now consider the case where the unionized unskilled wage is exogenously given[23] and is strictly equal to the stipulated minimum wage. This implies that the unionized wage is insensitive to the competitive unskilled wage rate in the rural sector, W. This implies that $E_W = 0$. This happens when $\alpha = 0$. Putting $E_W = 0$ in Eqs. (5.26) and (5.29), one finds the following two expressions, respectively:

$$\left(\widehat{W}_{\mathrm{S}} - \widehat{W}_{\mathrm{A}}\right) = \left(\widehat{W}_{\mathrm{S}} - \widehat{W}\right) = -\underset{(+)}{\left(\frac{\theta_{N1}\theta_{S2}\theta_{K3}}{\Delta}\right)}\left(\frac{W^*}{W}\right)\lambda_{L3}\widehat{K} \tag{5.26.1}$$

and

$$\widehat{L}_U = \underset{(+)}{\left(\frac{\widehat{K}}{\Delta}\right)}\left[\underset{(+)}{\lambda_{L1}\left(S^1_{LN} + S^1_{NL}\right)} - \underset{(+)}{\left(\frac{W^*\lambda_{L3}}{W^* - W}\right)}\theta_{N1}\right](\theta_{S2}\theta_{K3}) \tag{5.29.1}$$

From Eqs. (5.26.1) and (5.29.1), the following proposition can be established.

Proposition 5.4 *When the unionized unskilled wage is insensitive to the rural sector wage, an inflow of foreign capital unambiguously improves the skilled–unskilled wage inequality and lowers the level of urban unemployment of unskilled labour iff* $\lambda_{L1}\left(S^1_{LN} + S^1_{NL}\right) < \left(\frac{W^*\lambda_{L3}}{W^*-W}\right)\theta_{N1}$.

We, therefore, find that unlike the previous case, the Jones–Neary relative factor intensity ranking condition between the two urban sectors for predicting the outcomes of international factor movements on the skilled–unskilled wage inequality in our small open dual economy is no longer required. The verbal explanations are as follows. As the unionized unskilled wage is now given exogenously, the return to capital and the skilled wage are determined from Eqs. (5.13) and (5.12), respectively, and are insensitive to any changes in factor endowments. An inflow of

[23] There are several theoretical papers in the trade and development literature where the unionized wage in the urban sector has been assumed to be exogenously given. See, for example, Corden and Findlay (1975), Grinols (1991), Chandra and Khan (1993), Gupta (1995, 1997) and Chaudhuri (2007).

foreign capital leads to an expansion of sector 3, but it leaves sector 2 unaffected as the endowment of skilled labour has not changed. The availability of unskilled labour in the rural sector declines, which in turn raises the rural unskilled wage. Consequently, the skilled–unskilled wage inequality improves. Besides, we find that both the rural wage and the expected urban wages of unskilled labour have increased. So, there are again two opposite effects working on the determination of the size of the unemployed urban workforce of unskilled labour. The level of urban unemployment of unskilled labour falls if the proportionate increase in the rural wage (*the centripetal force*) is greater (stronger) than that in the expected urban wage (*the centrifugal force*). This happens under the condition as stated in the proposition.

5.3.4 Policy Implications of the Results

The policy implications of the results of the previous section are as follows. We find that inflows of foreign capital are desirable both on the grounds of deteriorating wage inequality and the problem of urban unemployment of unskilled labour unless the unionized wage is linked to the rural wage and the high-skill sector is more capital-intensive (in a special sense) than the low-skill urban sector. In the latter circumstances, since the government cannot influence the factor intensities of the two urban sectors without providing any employment and/or capital subsidies, it can fairly resort to labour market reforms and not allow trade unions to link up the wages of their members to the rural wage. Besides, incentive schemes for attracting foreign capitalists may be undertaken so that foreign capital inflows take place in abundance. Thus, if the urban unskilled wage is insensitive to the rural wage, abundant inflows of foreign capital might be a solution to both deteriorating skilled–unskilled wage inequality and increasing urban unemployment problem of unskilled labour in the liberalized regime.

5.4 FDI, Wage Inequality and Non-traded Goods

The existence of non-traded goods, the prices of which are determined domestically by demand–supply forces, is an essential feature of a developing economy. Liberalized economic policies are supposed to move resources away from the non-traded sectors to the traded sectors of the economy. The importance of non-traded goods has been recognized by Marjit and Acharyya (2003) who have used a four-sector general equilibrium model to study the consequences of import liberalization and an increase in the world price of agricultural exports on the relative wage inequality in the developing countries. Interestingly, if the non-traded good is produced in a formal sector, import liberalization accentuates the inequality while an increase in the price of the exportable, either agricultural or manufacturing, is likely to improve the relative wage inequality. The worsening effect of trade liberalization is magnified if the non-traded good is produced in an informal sector. However, Marjit and Acharyya (2003) have neither examined the consequence of an inflow of foreign capital in the presence of non-traded goods nor have they taken into consideration the nature of capital mobility that may exist between the traded and the non-traded sectors which are exceedingly important from policy perspective. Furthermore, they have not considered non-traded final commodities, which is also important for policymaking.

Non-traded goods may be either inputs or final commodities. A non-traded sector that produces an intermediate good for a traded sector lives or dies with the latter. On the contrary, a final good-producing non-traded sector expands or contracts with an increase or a decrease in the purchasing power of the people who consume the commodity. Hence, how the prices of non-traded goods change in response to policy changes plays crucial roles in determining the direction of relative wage movements. Furthermore, capital mobility between the traded and the non-traded sectors may be of different types. If the non-traded sector produces an agricultural commodity, there should be capital mobility between the non-traded sector and the primary export sector, while capital is likely to flow between the non-traded low-skill manufacturing sector and the high-skill sector if the non-traded sector produces a manufacturing good. The outcomes of any policy change on the relative wages should depend on the type of the non-traded good and the nature of capital mobility between the traded and the non-traded sectors.

Keeping all these into consideration, in the present section, we analyse the consequence of an inflow of foreign capital on the skilled–unskilled wage inequality in a developing economy in the presence of non-traded goods. Two four-sector general equilibrium models[24] have been used for analytical purpose. First, the case of non-traded input is taken up where one of the four sectors produces an intermediate good for another sector. Both these sectors use unskilled labour, and capital flows freely between them. There is also capital mobility between these two sectors and the high-skill sector, while in the latter skilled labour is a specific input. Secondly, we deal with the case of final commodity where capital[25] is mobile only between the primary export sector and the non-traded sector. These two sectors, however, cannot receive capital from the other sectors, i.e. from the low-skill manufacturing sector and the high-skill sector. There is imperfection in the market for unskilled labour in the low-skill sector (formal sector) where unskilled workers receive a high unionized wage while their counterparts in the other two sectors receive only a low competitive wage. The capital endowment of the economy

[24]One should ideally make use of a four-sector general equilibrium for capturing simultaneously both non-traded goods and imperfections in the market for unskilled labour. These draw upon Chaudhuri and Yabuuchi (2008).

[25]These two sectors use land which is one type of capital in a broader sense. To avoid confusion, however, we can call this input land-capital which is broadly conceived to include durable capital equipments of all kinds. See Bardhan (1973) and Chaudhuri (2007) in this context.

consists of both domestic and foreign capital and these are perfect substitutes.[26] The inflow of foreign capital is conceptualized in the form of exogenous capital flows.[27]

5.4.1 A Model with Non-traded Intermediate Input

Let us consider a four-sector full-employment model for a small open economy. Sector 1 is the primary export sector that produces an agricultural commodity using unskilled labour and land-capital. The input 'land-capital' is broadly conceived to include durable capital equipments of all kinds.[28] Sector 2, a low-skill informal manufacturing sector, produces a non-traded input for the low-skill formal manufacturing sector (sector 3) with the help of unskilled labour and capital. Sector 3, on the other hand, uses unskilled labour and capital apart from the non-traded input to produce a final manufacturing commodity. The per-unit requirement of the intermediate input, a_{23}, is assumed to be technologically fixed.[29] Sector 3 is the import-competing sector of the economy. Finally, sector 4, another export sector, produces a high-skill product using skilled labour and capital. So land-capital and skilled labour are specific factors in sectors 1 and 4, respectively. Capital is perfectly mobile between the non-traded, low-skill sector and the high-skill sector. Unskilled workers employed in the low-skill formal manufacturing sector (sector 3) earn a unionized wage, W^*, while their counterparts in the other two sectors earn a

[26]This assumption has been widely used in the theoretical literature on foreign capital and welfare. See Brecher and Diaz Alejandro (1977), Yabuuchi (1982), Chandra and Khan (1993) and Chaudhuri (2007), among others.

[27]Although the mobility of capital has increased considerably across countries owing to the liberalized investment policies, it is still far from being complete. In the developing countries like India, the FDI proposals are considered and approved on a case-to-case basis. Hence, due to incomplete and restricted mobility of capital, the world rate of return and the domestic rate of return to capital do not get equalized. We should note that if capital were perfectly mobile internationally, a large capital inflow would have brought down the domestic return to capital thereby raising the wage rates unambiguously.

[28]See footnote 25 in this context.

[29]It rules out the possibility of substitution between the non-traded input and other factors of production in sector 3. Although this is a simplifying assumption, it is not totally unrealistic. In industries like shoemaking and garments, large formal sector firms farm out their production to small informal sector firms under the system of subcontracting. So the production is done in the informal sector, while labelling, packaging and marketing are done by the formal sector firms. One pair of shoes produced in the informal sector does not change in quantity when it is marketed by the formal sector as a final commodity. Thus, there remains a fixed proportion between the use of the intermediate good and the quantity of the final commodity produced and marketed by the formal sector. On the other hand, if sector 2 produces an agricultural product like sugarcane or cotton, there might exist a fixed proportion between the quantity of input used and the quantity of output produced in the sugar mills/textile firms. It may be noted that Gupta (1994), Chaudhuri (2003), Chaudhuri et al. (2006), Chaudhuri and Mukhopadhyay (2009) and Marjit (2003) have also made this assumption for different purposes.

competitive wage, W with $W^* > W$. Production functions exhibit constant returns to scale with positive but diminishing marginal productivity to each factor. Perfect competition prevails in all markets, except the unskilled labour market in sector 3. The prices of the traded commodities are given by the small open economy assumption. But the price of the non-traded input is determined domestically. The diverse trade pattern of the economy is reflected in the fact that it exports both primary agricultural and high-skill commodities while it is a net importer of the low-skill manufacturing commodity. A developing country which fits this type of comparative advantage is India.[30] Commodity 1 is chosen as the numeraire.

Given the assumption of perfectly competitive commodity markets, the usual price–unit cost equality conditions relating to the four sectors of the economy are given by the following four equations, respectively:

$$Wa_{L1} + Ra_{N1} = 1 \tag{5.31}$$

$$Wa_{L2} + ra_{N2} = P_2 \tag{5.32}$$

$$W^*(W, U)\, a_{L3} + ra_{K3} + P_2 a_{23} = P_3 \tag{5.33}$$

$$W_S a_{S4} + ra_{K4} = P_4 \tag{5.34}$$

The formal low-skill sector (sector 3) faces a unionized labour market. The relationship for the unionized wage rate once more is specified as[31]

$$W^* = W^*(W, U) \quad \text{with} \quad W^* = W \quad \text{for} \quad U = 0, \quad W^* > W \quad \text{for} \quad U > 0$$

where U denotes the bargaining strength of the trade unions.

For the sake of analytical simplicity, we consider the following specific algebraic form of the unionized wage function:

$$W^* = \alpha W \quad \text{with} \quad \alpha > 1 \tag{5.35}$$

Here, α captures the degree of imperfection in the market for unskilled labour.[32] The more is the mark-up of the wage over the alternative (informal sector) wage, the higher is the union power, the lower is the competitiveness in the product market and the lower is the labour intensity. Thus, the mark-up depends on the rents coming from product market power and the quasi-rents coming from fixed capital – together

[30]It may be mentioned that besides primary agricultural commodities, India is also a large exporter of high-skill products like computer software. However, one may also consider alternative trade patterns as results of this paper do not depend on the pattern of trade of the economy.

[31]See footnote 4.

[32]One may alternatively consider $\alpha = (1 + \alpha_0)$ where α_0 includes the institutional characteristics of the formal sector labour market.

with the power of the union to appropriate these rents. In the present competitive product market structure, the rent coming from the product market is zero. During recession, when the alternative income is low, the unions are prepared to accept a lower wage.[33]

Using (5.35), Eq. (5.33) can be rewritten as follows:

$$\alpha W a_{L3} + r a_{K3} + P_2 a_{23} = P_3 \tag{5.33.1}$$

Full-employment conditions for unskilled labour, capital, land-capital and skilled labour are as follows, respectively:

$$a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 = L \tag{5.36}$$

$$a_{K2}X_2 + a_{K3}X_3 + a_{K4}X_4 = K \tag{5.37}$$

$$a_{N1}X_1 = N \tag{5.38}$$

$$a_{S4}X_4 = S \tag{5.39}$$

The output of sector 2, X_2, is used up entirely for producing X_3, so that the supply of X_2 is circumscribed by its total demand by sector 3. The demand–supply equality condition is given by

$$X_2^D = a_{23}X_3 = X_2 \tag{5.40}$$

There are nine endogenous variables in the system, W, W_S, R, r, P_2, X_1, X_2, X_3 and X_4, and nine independent equations, namely, Eqs. (5.31), (5.32), (5.33.1), (5.34), (5.36), (5.37), (5.38), (5.39) and (5.40). This is an indecomposable production system. Hence, factor prices depend on both commodity prices and factor endowments. Using (5.38) and (5.39), Eqs. (5.36) and (5.37) can be rewritten as follows, respectively:

$$\left(\frac{a_{L1}N}{a_{N1}}\right) + \tilde{a}_{L3}X_3 = L \tag{5.36.1}$$

$$\left(\frac{a_{K4}S}{a_{S4}}\right) + \tilde{a}_{K3}X_3 = K \tag{5.37.1}$$

where $\tilde{a}_{L3} = (a_{L2}a_{23} + a_{L3})$ and $\tilde{a}_{K3} = (a_{K2}a_{23} + a_{K3})$. Note that $\tilde{a}_{L3}$ and $\tilde{a}_{K3}$ are both the direct and indirect uses of unskilled labour and capital in sector 3, respectively. The indirect uses take place through the application of the non-traded input.

[33] See Layard et al. (2005) for details.

The working of the general equilibrium model is as follows. The five input prices, W, W_S, r, R and P_2 and X_3 are determined by solving Eqs. (5.31), (5.32), (5.33.1), (5.34), (5.36.1) and (5.37.1) simultaneously. Once the factor prices are known, the factor coefficients, a_{ji}s, are also known. Then X_1, X_4 and X_2 are obtained from Eqs. (5.38), (5.39) and (5.40), respectively.

Unskilled workers in this economy earn two different wages − either the unionized wage W^* in sector 3 or the competitive wage W in sectors 1 and 2. The average wage of unskilled labour must be a weighted average of the two wage rates and is given by

$$W_A \equiv \left(W\left(\lambda_{L1} + \lambda_{L2}\right) + W^* \lambda_{L3}\right)$$

Using (5.35), the above can be rewritten as follows:

$$W_A = W\left[1 + (\alpha - 1)\lambda_{L3}\right] \tag{5.41}$$

where λ_{Li} denotes the proportion of unskilled labour employed in sector i, $i = 1, 2, 3$.

It is reasonable to assume that the low-skill formal manufacturing sector (sector 3) is more capital-intensive vis-à-vis the low-skill informal manufacturing sector (sector 2) with respect to unskilled labour in both physical sense and value sense. This implies $\left(\dfrac{a_{K3}}{W^* a_{L3}} > \dfrac{a_{K2}}{W a_{L2}}\right)$.

Differentiating Eqs. (5.31), (5.32), (5.33.1), (5.34), (5.36.1) and (5.37.1), the following expression can be derived:[34,35]

$$\begin{aligned}\left(\widehat{W}_S - \widehat{W}_A\right) = \left(\frac{\widehat{K}}{\Delta}\right)\Bigg[&\left(\theta_{N1}\lambda_L\right)\left(\theta_{K4}\tilde{\theta}_{L3} - \theta_{S4}\tilde{\theta}_{K3}\right)\\ &- \left\{\frac{W\lambda_{L3}\theta_{S4}}{W_A}(\alpha - 1)\right\}\left\{\lambda_{L1}\tilde{\theta}_{K3}\left(S^1_{LN} + S^1_{NL}\right) + \theta_{N1}\left(S^2_{LK} - S^3_{LK}\right)\lambda_{L2}\right\}\Bigg]\end{aligned} \tag{5.42}$$

where $\tilde{\theta}_{L3} = (\theta_{L2}\theta_{23} + \theta_{L3})$ and $\tilde{\theta}_{K3} = (\theta_{K2}\theta_{23} + \theta_{K3})$. The expression for Δ has been presented in Appendix 5.1 and it is found that

$$\Delta > 0 \tag{5.43}$$

[34]See Appendix 5.1 for detailed derivation of this expression.

[35]Note that S^i_{jk} is the degree of substitution between factors in the ith sector, $i = 1, 2, 3, 4$. For more details, see Chap. 2.

From (5.42), it is evident that $\left(\widehat{W}_S - \widehat{W}_A\right) < 0$ when $\widehat{K} > 0$ if (1) $S^2_{LK} \geq S^3_{LK}$ and (2) $(\theta_{K4}/\theta_{S4}) < \left(\tilde{\theta}_{K3}/\tilde{\theta}_{L3}\right)$. On the contrary, $\left(\widehat{W}_S - \widehat{W}_A\right) > 0$ when $\widehat{K} > 0$ if (1) $\lambda_{L3} \cong 0$ and (2) $(\theta_{K4}/\theta_{S4}) > \left(\tilde{\theta}_{K3}/\tilde{\theta}_{L3}\right)$. This establishes the following proposition.

Proposition 5.5 *When the non-traded informal sector produces an input for the low-skill manufacturing sector, an inflow of foreign capital improves the skilled–unskilled wage inequality if (1) the vertically integrated low-skill formal sector is capital-intensive relative to the high-skill sector (in the Jones–Neary sense) and (2)* $S^2_{LK} \geq S^3_{LK}$. *The relative wage inequality, however, deteriorates if the proportion of unskilled labour employed in the low-skill formal sector is significantly low and the high-skill sector is capital-intensive.*

Proposition 5.5 can be intuitively explained as follows. As the system does not satisfy the decomposition property, factor prices depend on both final commodity prices and factor endowments. An inflow of foreign capital lowers the return to capital, r, since the supply rises given the demand. All the three capital-using sectors expand. Sector 2 expands because sector 3 uses the output of the former as input in fixed proportion. The demand for skilled labour rises in sector 4 and that of unskilled labour increases in both sectors 2 and 3. Consequently, both W_S and W increase. A rise in W implies a boost in the unionized unskilled wage, W^*. What happens to the average unskilled wage, W_A, depends crucially on the change in the proportion of unskilled labour employed in the high wage-paying sector (sector 3), i.e. λ_{L3}. As (W^*/r) has increased, producers in sector 3 would substitute unskilled labour by capital. This lowers the labour–output ratio in sector 3 (i.e. a_{L3}). But as sector 3 has expanded, the aggregate employment of unskilled labour (and hence λ_{L3}) increases if $S^2_{LK} \geq S^3_{LK}$.[36] Under this sufficient condition, W_A also rises. The outcome of foreign capital inflows on the skilled–unskilled wage inequality crucially depends on the rates of increase in W_S and W_A. Our analysis shows that if the vertically integrated low-skill manufacturing sector is capital-intensive relative to the high-skill sector, relative wages move in favour of unskilled labour. On the other hand, when the low-skill formal sector employs a very small proportion of the unskilled workforce,[37] an expansion of sector 3 cannot produce any significant positive effect on λ_{L3} and W_A. The direction of relative wage movements now entirely depends on the rates of increases in the competitive unskilled wage and the skilled wage. Relative wages move against unskilled labour if the vertically integrated low-skill sector is less capital-intensive vis-à-vis the high-skill sector.

[36] See Appendix 5.1.

[37] The proportion of workforce engaged in unorganized sector in India in 1999–2000 was as high as 93.6 %. The corresponding figure for 2009–2010 was 91.2 %. See Papola and Sahu (2012), Table 19. The unorganized sector, commonly known as the informal sector, comprises mainly of unskilled workers. Hence, the percentage of workforce engaged in the formal sector in India has remained very small even after economic reforms.

5.4.2 The Modified System with Non-traded Final Commodity

In this section, we modify the model of Sect. 5.4.1 in two directions. First, sector 2 now produces a non-traded final commodity using unskilled labour and land-capital as two inputs. Thus, sectors 1 and 2 constitute a miniature HOS subsystem. Secondly, we introduce land-capital in the non-traded sector as well as in the primary export sector. Capital flows freely between the low-skill manufacturing sector (sector 3) and the high-skill sector (sector 4). But, there is no capital mobility between the high-skill (or low-skill) sector and the non-traded sector. This set-up fits well to developing countries with agricultural dualism where the input 'land-capital' is mobile between two agricultural sectors (one advanced and the other backward).[38]

The usual zero-profit conditions for the four sectors in the modified setting are as follows:

$$Wa_{L1} + Ra_{N1} = 1 \tag{5.44}$$

$$Wa_{L2} + Ra_{N2} = P_2 \tag{5.45}$$

$$\alpha W a_{L3} + ra_{K3} = P_3 \tag{5.46}$$

$$W_S a_{S4} + ra_{K4} = P_4 \tag{5.47}$$

The demand for commodity 2 (D_2) is a decreasing function of P_2, a positive function of national income at domestic prices (Y). Thus, the demand function is written as follows:[39]

$$D_2 = D_2\underset{(-)\ (+)}{(P_2, Y)} \tag{5.48}$$

The national income at domestic prices is given by

$$Y = WL + \left(W^* - W\right) a_{L3}X_3 + RN + rK_D + W_S S \tag{5.49}$$

In Eq. (5.49), $(WL + (W^* - W)a_{L3}X_3)$ gives the aggregate wage income of the unskilled workers employed in the three sectors of the economy. RN is the rental income from land-capital, while $W_S S$ is the wage income of skilled labour. Finally, rK_D is the domestic capital income. Income from foreign capital, rK_F, is fully repatriated. Hence, it is not included in Eq. (5.49).

---

[38] In Chap. 3, we have already discussed about agricultural dualism and the welfare consequence of FDI in the developing economies.

[39] D_2 depends on prices of the other commodities as well. But, we do not include other prices in the demand function as these are internationally given.

The market for commodity 2 must clear domestically. So in equilibrium, we have

$$D_2\,(P_2, Y) = X_2 \tag{5.50}$$

Full-employment conditions for resources are as follows:

$$a_{N1}X_1 + a_{N2}X_2 = N \tag{5.51}$$

$$a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 = L \tag{5.52}$$

$$a_{K3}X_3 + a_{K4}X_4 = K_D + K_F = K \tag{5.53}$$

$$a_{S4}X_4 = S \tag{5.54}$$

The modified model comprises of the eleven Eqs. (5.44), (5.45), (5.46), (5.47), (5.48), (5.49), (5.50), (5.51), (5.52), (5.53) and (5.54) and exactly the same number of endogenous variables, namely, W, W_S, R, r, P_2, X_1, X_2, X_3, X_4, D_2 and Y. The four unknown factor prices are solved from Eqs. (5.44), (5.45), (5.46) and (5.47) as functions of P_2. As a_{ji}s are functions of factor prices, these are automatically obtained. Then from Eqs. (5.51), (5.52), (5.53) and (5.54), X_i s are found as functions of P_2. Then from equation (5.49), Y is found as function of P_2. Finally, P_2 is solved from (5.50). Once P_2 is obtained, the values of all endogenous variables are obtained.

The average unskilled wage is again given by

$$W_A = W\,[1 + (\alpha - 1)\,\lambda_{L3}] \tag{5.41}$$

Differentiating (5.44), (5.45), (5.46), (5.47), (5.49), (5.50), (5.51), (5.52), (5.53), (5.54) and (5.41), the following expression can be obtained:[40]

$$\left(\widehat{W}_S - \widehat{W}_A\right) = -\left(\frac{\theta_{N1}\widehat{K}}{\Omega}\right)|\lambda^*|\,[(\theta_{K4} - \theta_{K3}) - (\alpha - 1)\lambda_{L3}(\theta_{S4}\theta_{K3} - S^3_{LK})] \\ - \left[W\,(\alpha - 1)\left(\frac{\lambda_{L3}}{W_A}\right)\widehat{X}_3\right] \tag{5.55}$$

where

$$|\lambda^*| = [\{(\lambda_{L2}\lambda_{N1} - \lambda_{N2}\lambda_{L1})\,(E_Y/Y)\,(\alpha - 1)\,Wa_{L3}X_3\} + \lambda_{N1}\lambda_{L3}] \tag{5.56}$$

[40]See Appendices 5.2, 5.3 and 5.4 for mathematical derivation of this expression.

Table 5.1 Effects of FDI on wage inequality under different situations

When (situation)	Sufficient condition (# 1)	Sufficient condition (# 2)	Sufficient condition (# 3)	Consequence (result) Wage inequality
$\lambda_{L3} > 0$	$\lvert\lambda\rvert > 0$ (or $\lvert\lambda\rvert < 0$ but $\lvert\lambda *\rvert > 0$)	$\theta_{K3} \geq \theta_{K4}$	$\theta_{S4}\theta_{K3} \geq S^3_{LK}$	Improves
$\lambda_{L3} \cong 0$	$\lvert\lambda\rvert > 0$	$\theta_{K3} > \theta_{K4}$	–	Improves
		$\theta_{K3} < \theta_{K4}$	–	Deteriorates
	$\lvert\lambda\rvert < 0$	$\theta_{K3} < \theta_{K4}$	–	Improves
		$\theta_{K3} > \theta_{K4}$	–	Deteriorates

In Eq. (5.56), E_Y is the income elasticity of demand for the non-traded final commodity produced in sector 2 and $E_Y > 0$.

The expression for Ω has been presented in Appendix 5.2, and using the static stability condition in the market for the non-traded commodity,[41] it can be shown that in the stable equilibrium we must have[42]

$$\Omega < 0 \quad \text{and} \quad \widehat{X}_3 > 0 \quad \text{when} \quad \widehat{K} > 0 \tag{5.57}$$

The results that we obtain from Eqs. (5.55), (5.56) and (5.57) are summarized in Table 5.1.

From the results, one can now establish the following proposition.

Proposition 5.6 *Inflows of foreign capital are likely to improve the skilled–unskilled wage inequality if (i) the low-skill manufacturing sector is capital-intensive and employs a significant proportion of the unskilled workforce and (ii) the primary export sector is land-intensive. On the contrary, when the low-skill sector employs only a very small proportion of unskilled labour, the wage inequality improves if (a) the primary export sector is land-capital-intensive (or unskilled labour-intensive) and (b) the low-skill manufacturing sector (or high-skill sector) is capital-intensive. Otherwise, the relative wage inequality deteriorates.*

We explain Proposition 5.6 in the following fashion. Here the non-traded sector and the primary export sector use the same two inputs – unskilled labour and land-capital – and together form a Heckscher–Ohlin subsystem (HOSS). It has already been mentioned that the factor prices are determined from the price system as functions of the price of the non-traded good, P_2, and that P_2 is determined by its demand and supply forces. Therefore, all factor prices and P_2 depend on all parameters of the system.

An inflow of foreign capital leads to expansion of both sectors 3 and 4. As sector 3 expands, more (less) unskilled workers are now employed in the higher (lower)

[41] The stability condition has been derived in Appendix 5.5.

[42] Mathematical proofs of the two results have been provided in Appendices 5.5 and 5.6, respectively.

wage-paying sector (sectors). This raises the aggregate unskilled wage income. This we call the unskilled labour reallocation effect, which produces a positive effect on the aggregate factor income, Y, and raises the demand for the non-traded good (good 2). As sector 3 draws unskilled labour from the HOSS, a Rybczynski-type effect takes place that results in a contraction of the unskilled labour-intensive sector and an expansion of the land-capital-intensive sector in the HOSS.

If sector 1 is land-capital-intensive, it expands, while sector 2 contracts. P_2 rises[43] as its supply has fallen while the demand has increased. This in turn produces a Stolper–Samuelson effect in the HOSS and raises the competitive unskilled wage, W, if sector 2 is unskilled labour-intensive. The unionized unskilled wage, W^*, also rises. To satisfy the zero-profit condition for sector 3, the return to capital r falls. Saving on capital input raises the skilled wage, W_S, in sector 4. As producers in sector 3 substitute unskilled labour by capital, a_{L3} falls. Despite this, the proportion of unskilled labour employed in the higher wage-paying sector 3 (i.e. λ_{L3}) rises if $\theta_{K3} \geq S^3_{LK}$.[44] We, therefore, find that the average unskilled wage increases due to (i) an increase in W, (ii) an increase in W^* and (iii) an increase in the proportion of unskilled labour employed in the higher wage-paying sector if $\theta_{K3} \geq S^3_{LK}$. Consequently, the average unskilled wage, W_A, rises in this case under the sufficient condition as stated above. What happens to the skilled–unskilled wage inequality depends on the rates of increases in W_S and W_A. If $(\theta_{K3}/\theta_{L3}) > (=)(\theta_{K4}/\theta_{S4})$, the saving on capital cost in sector 3 is more than (equal to) that in sector 4, which, in turn, implies that the rate of increase of the unionized unskilled wage, W^*, is greater than (equal to) that of the skilled wage, W_S. But, there are two other factors working positively on the average unskilled wage.[45] Thus, the wage inequality gets better following inflows of foreign capital under the two sufficient conditions as mentioned above. On the other hand, if the proportion of unskilled labour employed in the high wage-paying sector (sector 3) is considerably small (i.e. $\lambda_{L3} \cong 0$), W_A increases because the competitive unskilled wage, W, rises. If $\theta_{K3} > (<)\theta_{K4}$, saving on capital cost will be higher (lower) in the low-skill manufacturing sector than that in the high-skill sector. Consequently, the wage inequality improves (worsens).

If sector 1 (sector 2) is unskilled labour-intensive (land-capital-intensive), the supply of the non-traded good rises following a Rybczynski-type effect. The larger is the proportion of unskilled labour employed in the low-skill sector, the higher would be the magnitude of the Rybczynski-type effect in the HOSS. Although both the demand and the supply of the non-traded good increase, the Rybczynski-type effect of a sufficiently high magnitude (consequence of a high λ_{L3}) will make the expansionary supply side effect of the non-traded good stronger than the demand side effect. The price of the non-traded good P_2 falls, which in turn raises W following the Stolper–Samuelson effect as sector 1 is now unskilled labour-intensive. The qualitative effects on $W^*, r, W_S, \lambda_{L3}$ and W_A would exactly be the

[43] See Appendix 5.3.

[44] This has been shown in Appendix 5.4.

[45] These have already been discussed under (i) and (iii) above.

same as in the earlier case. Consequently, the skilled–unskilled wage inequality improves under the same set of sufficient conditions.

Finally, if sector 1 (sector 2) is unskilled labour-intensive (land-capital-intensive) but the proportion of the unskilled workforce employed in the low-skill sector is significantly low (i.e. $\lambda_{L3} \cong 0$), the magnitude of the Rybczynski-type effect in the HOSS would be very small, and consequently the supply of good 2 rises only by a small magnitude. P_2 increases in this case as the demand side effect dominates over the supply side effect. The competitive unskilled wage, W, decreases following the Stolper–Samuelson effect as sector 2 is land-capital-intensive.[46] The return to capital rises despite an increase in the endowment of capital as sector 3 expands and the allocative share of capital in this sector is sufficiently high. Sector 4 contracts for want of capital[47], and the skilled wage, W_S, falls as its demand falls. Since $\lambda_{L3} \cong 0$, the average unskilled wage, W_{A}, decreases as W falls. If $\theta_{K4} > (<) \theta_{K3}$, the increase in capital cost will be higher (lower) in the high-skill sector vis-à-vis the low-skill manufacturing sector. Consequently, the wage inequality improves (worsens).

5.4.3 Policy Implications of the Results

Growth in foreign direct investment, positively correlated with the relative demand for skilled labour, has been one of the prime factors responsible for widening of wage inequality in the Latin American countries like Mexico. But, foreign capital may not be held accountable for the worsening of wage inequality in other developing economies like India. It is extremely important to judge the consequences of foreign capital in the light of the typical structural characteristics of these economies, e.g. presence of non-traded goods, imperfections in the market for unskilled labour and the nature of intersectoral capital mobility. This has been carried out in the previous section using two four-sector, specific factors, full-employment general equilibrium models.

We find that barring a few special cases, inflows of foreign capital in general improve the wage inequality when the low-skill manufacturing sector is capital-intensive. But the relative wage gap may widen if the high-skill sector is capital-intensive. A capital subsidy policy to the low-skill manufacturing sector may be undertaken so as to increase the capital-intensity of production in that sector. On the other hand, when the non-traded sector produces a final commodity, wage inequality worsens if the low-skill sector is capital-intensive and employs only a very small proportion of the unskilled workforce and if the primary export sector is unskilled labour-intensive. In such a case, the policy prescription should be to provide a wage subsidy to the low-skill manufacturing sector so as to increase (decrease) its labour

[46]The return to land-capital rises.

[47]This has been shown in Appendix 5.7.

(capital) intensity of production.[48] This policy would also help in increasing the proportion of employment of unskilled labour in the low-skill sector. Furthermore, this would lend a hand in raising the competitive unskilled wage. If these policies are followed whenever necessary, abundant inflows of foreign capital might be a solution to deteriorating skilled–unskilled wage in the developing nations during the liberalized regime.

Appendices

Appendix 5.1: Derivation of the Expression for Change in Relative Wage Inequality

Totally differentiating Eqs. (5.31), (5.32), (5.33.1), (5.34), (5.36), (5.37), (5.38), (5.39) and (5.40); keeping all parameters, except K, unchanged; and arranging in a matrix notation, one gets

$$\begin{pmatrix} \theta_{L1} & \theta_{N1} & 0 & 0 & 0 & 0 \\ \theta_{L2} & 0 & \theta_{K2} & 0 & -1 & 0 \\ \theta_{L3} & 0 & \theta_{K3} & 0 & \theta_{23} & 0 \\ 0 & 0 & \theta_{K4} & \theta_{S4} & 0 & 0 \\ -A_1 & A_2 & A_3 & 0 & 0 & \lambda_L \\ A_4 & 0 & -A_5 & A_6 & 0 & \lambda_K \end{pmatrix} \begin{pmatrix} \widehat{W} \\ \widehat{R} \\ \widehat{r} \\ \widehat{W}_S \\ \widehat{P}_2 \\ \widehat{X}_3 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ \widehat{K} \end{pmatrix} \tag{5.A.1}$$

where

$$\left.\begin{aligned} A_1 &= \left(\lambda_{L1}S^1_{LN} + \lambda_{L2}S^2_{LK} + \lambda_{L3}S^3_{LK} + \lambda_{L1}S^1_{NL}\right) > 0 \\ A_2 &= \lambda_{L1}\left(S^1_{LN} + S^1_{NL}\right) > 0; A_3 = \left(\lambda_{L2}S^2_{LK} + \lambda_{L3}S^3_{LK}\right) > 0 \\ A_4 &= \left(\lambda_{K2}S^2_{KL} + \lambda_{K3}S^3_{KL}\right) > 0 \\ A_5 &= \left(\lambda_{K2}S^2_{KL} + \lambda_{K3}S^3_{KL} + \lambda_{K4}S^4_{KS} + \lambda_{K4}S^4_{SK}\right) > 0 \\ A_6 &= \lambda_{K4}\left(S^4_{KS} + S^4_{SK}\right) > 0 \\ \lambda_L &= (\lambda_{L2} + \lambda_{L3}) > 0; \lambda_K = (\lambda_{K2} + \lambda_{K3}) > 0 \end{aligned}\right\} \tag{5.A.2}$$

[48] This is, of course, not a WTO-compliant policy. In fact, the developing countries have been advised to remove all tariffs, quotas, subsidies and other impediments to free trade so as to completely reap the benefits of economic reforms. However, in a developing country with high degree of income and wealth inequalities, the distributional and growth aspects are equally important for economic development. These economies, therefore, need not follow all the WTO recommendations so as to protect the interest of the poorer section of the working population.

The determinant to the coefficient matrix in (5.A.1) is given by

$$\Delta = \theta_{L1}\theta_{S4}A_2\lambda_K(\theta_{23}\theta_{K2}+\theta_{K3}) + \theta_{N1}[\theta_{S4}(\theta_{23}\theta_{K2}+\theta_{K3})(A_1\lambda_K + A_4\lambda_L) + (\theta_{23}\theta_{L2}+\theta_{L3})\{\theta_{K4}A_6\lambda_L + \theta_{S4}(A_3\lambda_K + A_5\lambda_L)\}] > 0 \quad (5.A.3)$$

As commodity 2 is internationally non-traded, its market must clear domestically through adjustments in its price, P_2. The stability condition in the market for commodity 2 requires that

$(\mathrm{d}(X_2^D - X_2)/\mathrm{d}P_2) < 0$. This implies around equilibrium, initially, $X_2^D = X_2$. Thus, $\left(\left(\widehat{X}_2^D/\widehat{P}_2\right) - \left(\widehat{X}_2/\widehat{P}_2\right)\right) < 0$. This requires that $\Delta > 0$. In this case, of course, the stability condition is automatically satisfied. This is because from (5.A.2) and (5.A.3), it follows that $\triangle$ is unconditionally positive.

Solving (5.A.1) by Cramer's rule, the following expressions are obtained:

$$\widehat{W} = \left(\theta_{N1}\theta_{S4}\lambda_L\tilde{\theta}_{K3}\right)\widehat{K}/\Delta \quad (5.A.4)$$

$$\widehat{W}_\mathrm{S} = (\theta_{N1}\theta_{K4}\lambda_L\theta_{L3})\widehat{K}/\Delta \quad (5.A.5)$$

$$\widehat{r} = -(\theta_{N1}\theta_{S4}\lambda_L\theta_{L3})\widehat{K}/\Delta \quad (5.A.6)$$

$$\widehat{X}_3 = \theta_{S4}\left[\tilde{\theta}_{K3}(\theta_{L1}A_2 + \theta_{N1}A_1) + \left(\theta_{N1}\tilde{\theta}_{L3}\right)A_3\right]\widehat{K}/\Delta \text{ and} \quad (5.A.7)$$

$$\widehat{P}_2 = (\theta_{N1}\theta_{S4}\lambda_L)(\theta_{L2}\theta_{K3} - \theta_{L3}\theta_{K2})\widehat{K}/\Delta \quad (5.A.8)$$

where $\tilde{\theta}_{L3} = (\theta_{L2}\theta_{23} + \theta_{L3})$ and $\tilde{\theta}_{K3} = (\theta_{K2}\theta_{23} + \theta_{K3})$. Differentiating (5.41), using (5.A.4), (5.A.6) and (5.A.7), and simplifying, one can derive the following expression:

$$\widehat{W}_A = \left(\frac{W\widehat{W}}{W_A}\right)[1 + (\alpha - 1)\lambda_{L3}] + \frac{W}{W_A}(\alpha - 1)\lambda_{L3}\theta_{S4}\frac{\widehat{K}}{\Delta}\left[\lambda_{L1}\tilde{\theta}_{K3}\left(S_{LN}^1 + S_{NL}^1\right) + \theta_{N1}\left(S_{LK}^2 - S_{LK}^3\right)\lambda_{L2}\right] \quad (5.A.9)$$

Using (5.A.2) and (5.A.3) from (5.A.4), (5.A.5), (5.A.6), (5.A.7), (5.A.8) and (5.A.9), the following results are obtained.

When $\widehat{K} > 0$, (1) $\widehat{W} > 0$; (2) $\widehat{W}_\mathrm{S} > 0$; (3) $\widehat{r} < 0$; (4) $\widehat{X}_3 > 0$; (5) $\widehat{W}_\mathrm{A} > 0$ if $S_{LK}^2 \geq S_{LK}^3$; and (6) $\widehat{P}_2 > 0$ (as $\theta_{L2}\theta_{K3} > \theta_{L3}\theta_{K2}$, i.e. sector 3 is more capital-intensive relative to sector 2 with respect to unskilled labour in value sense).

Subtracting (5.A.9) from (5.A.5), using (5.A.4) and after a little manipulation, one obtains the following expression:

$$\left(\widehat{W}_{\mathrm{S}}-\widehat{W}_{\mathrm{A}}\right)=\left(\frac{\widehat{K}}{\Delta}\right)\Big[(\theta_{N1}\lambda_L)\left(\theta_{K4}\tilde{\theta}_{L3}-\theta_{S4}\tilde{\theta}_{K3}\right)$$
$$-\left\{\frac{W\lambda_{L3}\theta_{S4}}{W_A}(\alpha-1)\right\}\lambda_{L1}\tilde{\theta}_{K3}\left(S^1_{LN}+S^1_{NL}\right)+\theta_{N1}\left(S^2_{LK}-S^3_{LK}\right)\lambda_{L2}\Big\}\Big] \tag{5.42}$$

Appendix 5.2: Derivations of Certain Useful Expressions

Total differentials of (5.44), (5.45), (5.46) and (5.47) holding the parameters unaffected yield the following expressions, respectively:

$$\theta_{L1}\widehat{W}+\theta_{N1}\widehat{R}=0 \tag{5.A.10}$$

$$\theta_{L2}\widehat{W}+\theta_{N2}\widehat{R}-\widehat{P}_2=0 \tag{5.A.11}$$

$$\theta_{L3}\widehat{W}+\theta_{K3}\widehat{r}=0 \tag{5.A.12}$$

$$\theta_{S4}\widehat{W}_S+\theta_{K4}\widehat{r}=0 \tag{5.A.13}$$

Using (5.54), Eq. (5.53) may be rewritten as follows:

$$a_{K3}X_3+\left(\frac{a_{K4}S}{a_{S4}}\right)=K \tag{5.A.14}$$

Differentiating totally Eqs. (5.51), (5.52) and (5.A.14) and allowing only parameter K to change, one gets, respectively,

$$B_1\widehat{W}-B_2\widehat{R}+\lambda_{N1}\widehat{X}_1+\lambda_{N2}\widehat{X}_2=0 \tag{5.A.15}$$

$$-B_3\widehat{W}+B_4\widehat{R}+B_5\widehat{r}+\lambda_{L1}\widehat{X}_1+\lambda_{L2}\widehat{X}_2+\lambda_{L3}\widehat{X}_3=0 \tag{5.A.16}$$

$$B_6\widehat{W}-B_7\widehat{r}+B_8\widehat{W}_S+\lambda_{K3}\widehat{X}_3=\widehat{K} \tag{5.A.17}$$

Also differentiating (5.49) and (5.50), one may obtain

$$B_9\widehat{W}+B_{10}\widehat{R}+B_{11}\widehat{r}+B_{12}\widehat{r}+B_{13}\widehat{X}_3+E_P\widehat{P}_2-\widehat{X}_2+B_{13}\widehat{X}_3=0 \tag{5.A.18}$$

where

$$\left.\begin{aligned}
&B_1 = B_2 = \left(\lambda_{N1} S^1_{NL} + \lambda_{N2} S^2_{NL}\right) > 0\\
&B_3 = \left(\lambda_{L1} S^1_{LN} + \lambda_{L2} S^2_{LN} + \lambda_{L3} S^3_{LK}\right) > 0\\
&B_4 = \left(\lambda_{L1} S^1_{LN} + \lambda_{L2} S^2_{LN}\right) > 0;\ B_5 = \left(\lambda_{L3} S^3_{LK}\right) > 0;\ B_6 = \left(\lambda_{K3} S^3_{KL}\right) > 0\\
&B_7 = \left(\lambda_{K3} S^3_{KL} + \lambda_{K4}\left(S^4_{KS} + S^4_{SK}\right)\right) > 0;\ B_8 = \lambda_{K4}\left(S^4_{KS} + S^4_{SK}\right) > 0\\
&B_9 = (E_Y W/Y)\,[L + (\alpha - 1)a_{L3} X_3 (1 - S^3_{LK})]\,;\ B_{10} = \left(E_Y RN/Y\right) > 0\\
&B_{11} = (E_Y/Y)\left[rK_D + (\alpha - 1) W a_{L3} X_3 S^3_{LK}\right] > 0;\ B_{12} = \left(E_Y W_S S/Y\right) > 0 \text{ and}\\
&B_{13} = [(E_Y/Y)(\alpha - 1) W a_{L3} X_3] > 0
\end{aligned}\right\} \tag{5.A.19}$$

Arranging (5.A.10), (5.A.11), (5.A.12), (5.A.13) and (5.A.15), (5.A.16), (5.A.17) and (5.A.18) in a matrix notation, we get the following:

$$\begin{pmatrix}
\theta_{L1} & \theta_{N1} & 0 & 0 & 0 & 0 & 0 & 0\\
\theta_{L2} & \theta_{N2} & 0 & 0 & -1 & 0 & 0 & 0\\
\theta_{L3} & 0 & \theta_{K3} & 0 & 0 & 0 & 0 & 0\\
0 & 0 & \theta_{K4} & \theta_{S4} & 0 & 0 & 0 & 0\\
B_1 & -B_2 & 0 & 0 & 0 & \lambda_{N1} & \lambda_{N2} & 0\\
-B_3 & B_4 & B_5 & 0 & 0 & \lambda_{L1} & \lambda_{L2} & \lambda_{L3}\\
B_6 & 0 & -B_7 & B_8 & 0 & 0 & 0 & \lambda_{K3}\\
B_9 & B_{10} & B_{11} & B_{12} & E_P & 0 & -1 & B_{13}
\end{pmatrix}
\begin{pmatrix}\widehat{W}\\ \widehat{R}\\ \widehat{r}\\ \widehat{W}_S\\ \widehat{P}_2\\ \widehat{X}_1\\ \widehat{X}_2\\ \widehat{X}_3\end{pmatrix}
=
\begin{pmatrix}0\\0\\0\\0\\0\\0\\ \widehat{K}\\0\end{pmatrix} \tag{5.A.20}$$

where

$$\begin{aligned}
\Omega = &-[(|\theta|\,|\lambda|\,E_P) - \{(B_9 \theta_{N1}\theta_{K3}\theta_{S4}\,|\lambda|) - (B_{10}\theta_{L1}\theta_{K3}\theta_{S4}\,|\lambda|) - (B_{11}\theta_{N1}\theta_{L3}\theta_{S4}\,|\lambda|)\\
&+ (B_{12}\theta_{N1}\theta_{L3}\theta_{K4}\,|\lambda|)\\
&- B_{13}\,(\lambda_{L2}\lambda_{N1} - \lambda_{N2}\lambda_{L1})\,\theta_{N1}\,(\theta_{K3}\theta_{S4} B_6 + \theta_{L3}\theta_{K4} B_8 + \theta_{L3}\theta_{S4} B_7)\\
&- (\theta_{N1}\theta_{K3}\theta_{S4})\,(\lambda_{N1}\lambda_{K3} B_3 + \lambda_{N1}\lambda_{L3} B_6 + \lambda_{L1}\lambda_{K3} B_1)\\
&- (\lambda_{K3}\theta_{K3}\theta_{S4}\theta_{L1})\,(B_2\lambda_{L1} + B_4\lambda_{N1}) - (\lambda_{N1}\theta_{N1}\theta_{L3}\theta_{S4})\,(B_5\lambda_{K3} + B_7\lambda_{L3})\\
&- (\lambda_{N1}\lambda_{L3}\theta_{N1}\theta_{L3}\theta_{K4} B_8)\,\}]
\end{aligned} \tag{5.A.21}$$

$$|\theta| = \theta_{K3}\theta_{S4}\,(\theta_{L1}\theta_{N2} - \theta_{N1}\theta_{L2}) \quad \textit{and} \tag{5.A.22}$$

$$|\lambda| = \lambda_{K3}\,(\lambda_{N1}\lambda_{L2} - \lambda_{N2}\lambda_{L1}) \tag{5.A.23}$$

So, we always have

$$|\theta|\,|\lambda| < 0 \tag{5.A.24}$$

Using the stability condition in the market for commodity 2 (see Appendix 5.5), it can be shown that $\Omega < 0$.

Appendix 5.3: Effects on Factor and Non-traded Commodity Prices

Solving (5.A.20) by Cramer's rule, the following expressions are obtained:

$$\widehat{W} = -\left(\theta_{N1}\theta_{K3}\theta_{S4}\,|\lambda^*|\,\widehat{K}/\Omega\right) \tag{5.A.25}$$

$$\widehat{W}_{\mathrm{S}} = -\left(\theta_{N1}\theta_{L3}\theta_{K4}\,|\lambda^*|\,\widehat{K}/\Omega\right) \tag{5.A.26}$$

$$\widehat{r} = \left(\theta_{N1}\theta_{L3}\theta_{S4}\,|\lambda^*|\,\widehat{K}/\Omega\right) \tag{5.A.27}$$

$$\widehat{P}_2 = \left(\theta_{K3}\theta_{S4}\,|\lambda^*|\,\widehat{K}/\Omega\right)(\theta_{L1}\theta_{N2} - \theta_{N1}\theta_{L2}) \tag{5.A.28}$$

where

$$|\lambda^*| = [(\lambda_{L2}\lambda_{N1} - \lambda_{N2}\lambda_{L1})\,B_{13} + \lambda_{N1}\lambda_{L3}] \tag{5.A.29}$$

$\widehat{X}_3$ also can be solved in the same manner. The final expression for $\widehat{X}_3$ has been derived in Appendix 5.6. Using the stability condition in the market for commodity 2, it can be shown that $\widehat{X}_3 > 0$ when $\widehat{K} > 0$.

From (5.A.25), (5.A.26), (5.A.27) and (5.A.28), the following results can be found:

1. If sector 1 is more land-capital-intensive vis-à-vis sector 2 with respect to unskilled labour (i.e. $|\lambda|, |\lambda*| > 0; |\theta| < 0$) when $\widehat{K} > 0$, (i) $\widehat{W} > 0$, (ii) $\widehat{W}_S > 0$, (iii) $\widehat{r} < 0$ and (iv) $\widehat{P}_2 > 0$.
2. If sector 1 is more labour-intensive (but not sufficiently labour-intensive) than sector 2 (i.e. $|\lambda| < 0$; $|\lambda*|$, $|\theta| > 0$) when $\widehat{K} > 0$, (i) $\widehat{W} > 0$, (ii) $\widehat{W}_S > 0$, (iii) $\widehat{r} < 0$ and (iv) $\widehat{P}_2 < 0$.
3. If sector 1 is sufficiently labour-intensive (i.e. $|\lambda|, |\lambda*| < 0$; $|\theta| > 0$) when $\widehat{K} > 0$, (i) $\widehat{W} < 0$, (ii) $\widehat{W}_S < 0$, (iii) $\widehat{r} > 0$ and (iv) $\widehat{P}_2 > 0$.

Appendix 5.4: Derivation of Expression for Relative Wage Inequality

Differentiating (5.41), one gets:

$$\widehat{W}_{\mathrm{A}} = \left(\frac{W\widehat{W}}{W_{\mathrm{A}}}\right)\left[1 + (\alpha - 1)\,\lambda_{L3}\left(1 - S_{LK}^{3}\right)\right] + W\,(\alpha - 1)\left(\frac{\lambda_{L3}S_{LK}^{3}}{W_{A}}\right)\widehat{r} + W\,(\alpha - 1)\left(\frac{\lambda_{L3}}{W_{A}}\right)\widehat{X}_{3}$$

Using (5.A.25) and (5.A.27), the above expression may be simplified to

$$\widehat{W}_{\mathrm{A}} = \left(\frac{W\widehat{K}}{\Omega W_{A}}\right)\left[(\theta_{N1}\theta_{S4}\,|\lambda *|)\left\{(\alpha - 1)\,\lambda_{L3}\left(S_{LK}^{3} - \theta_{K3}\right) - \theta_{K3}\right\} + \left(\frac{W}{W_{\mathrm{A}}}(\alpha - 1)\,\lambda_{L3}\right)\widehat{X}_{3} \tag{5.A.30}$$

From (5.A.30), it is evident that:

1. When $\widehat{K} > 0$, $\widehat{W}_{A} > 0$ if (i) ($|\lambda| > 0$ and $\lambda_{L3} > 0 \Rightarrow |\lambda *| > 0$)/($|\lambda| < 0$ and $\lambda_{L3} > 0$ such that $|\lambda *| > 0$) and (ii) $\theta_{K3} \geq S_{LK}^{3}$. Note that when sector 2 (sector 1) is labour-intensive (land-capital-intensive) (i.e. $|\lambda| > 0$) and the proportion of unskilled labour employed in sector 3 (i.e. λ_{L3}) is not sufficiently small, this allocative share rises following an inflow of foreign capital under the sufficient condition that $\theta_{K3} \geq S_{LK}^{3}$. The average unskilled wage, W_{A}, also rises in this situation.
2. When $\widehat{K} > 0$, $\widehat{W}_{\mathrm{A}} < 0$ if (i) $|\lambda| < 0$ and $\lambda_{L3} \cong 0$ so that $|\lambda *| < 0$.

Subtracting (5.A.30) from (5.A.26), using (5.A.25) and (5.A.27) and simplifying, we get

$$\left(\widehat{W}_{\mathrm{S}} - \widehat{W}_{\mathrm{A}}\right) = -\left(\frac{\theta_{N1}\widehat{K}}{\Omega}\right)\left[(\lambda_{L2}\lambda_{N1} - \lambda_{N2}\lambda_{L1})\,B_{13} + \lambda_{N1}\lambda_{L3}\right]\left[(\theta_{K4} - \theta_{K3}) - (\alpha - 1)\,\lambda_{L3}\left(\theta_{S4}\theta_{K3} - S_{LK}^{3}\right)\right] - \frac{W\,(\alpha - 1)\,\lambda_{L3}\widehat{X}_{3}}{W_{\mathrm{A}}} \tag{5.A.31}$$

Using (5.A.29), equation (5.A.31) can be rewritten as follows:

$$\left(\widehat{W}_{\mathrm{S}} - \widehat{W}_{\mathrm{A}}\right) = -\left(\frac{\theta_{N1}\widehat{K}}{\Omega}\right)|\lambda *|\left[(\theta_{K4} - \theta_{K3}) - (\alpha - 1)\,\lambda_{L3}\left(\theta_{S4}\theta_{K3} - S_{LK}^{3}\right)\right] - \frac{W\,(\alpha - 1)\,\lambda_{L3}\widehat{X}_{3}}{W_{\mathrm{A}}} \tag{5.55}$$

Appendix 5.5: Stability Condition of the Market for Commodity 2

As commodity 2 is internationally non-traded, its market must clear domestically through adjustments in its price, P_2. The stability condition of the market for commodity 2 requires that $(\mathrm{d}(D_2 - X_2)/\mathrm{d}P_2) < 0$. This implies around equilibrium, initially, $D_2 = X_2$. Thus,

$$\left(\left(\widehat{D}_2/\widehat{P}_2\right) - \left(\widehat{X}_2/\widehat{P}_2\right)\right) < 0 \tag{5.A.32}$$

Totally differentiating Eqs. (5.44), (5.45), (5.46) and (5.47) and solving, one can find out the following expressions:

$$\left(\widehat{W}/\widehat{P}_2\right) = -\left(\theta_{N1}\theta_{K3}\theta_{S4}/\left|\theta\right|\right) \tag{5.A.33}$$

$$\left(\widehat{R}/\widehat{P}_2\right) = \left(\theta_{L1}\theta_{K3}\theta_{S4}/\left|\theta\right|\right) \tag{5.A.34}$$

$$\left(\widehat{r}/\widehat{P}_2\right) = \left(\theta_{N1}\theta_{L3}\theta_{S4}/\left|\theta\right|\right) \quad \textit{and} \tag{5.A.35}$$

$$\left(\widehat{W}_{\mathrm{S}}/\widehat{P}_2\right) = -\left(\theta_{N1}\theta_{L3}\theta_{K4}/\left|\theta\right|\right) \tag{5.A.36}$$

Then differentiating Eqs. (5.51), (5.52), (5.53) and (5.54), using (5.A.33), (5.A.34), (5.A.35) and (5.A.36), putting $\widehat{K} = 0$ and solving by Cramer's rule, the following expressions may be obtained:

$$\begin{aligned}\widehat{X}_2 = \left(\frac{-\widehat{P}_2}{|\theta|\,|\lambda|}\right)&[(\lambda_{N1}\lambda_{K3}B_3 + \lambda_{N1}\lambda_{L3}B_6 + \lambda_{L1}\lambda_{K3}B_1)\,(\theta_{N1}\theta_{K3}\theta_{S4})\\ &+ (\lambda_{N1}B_4 + \lambda_{L1}B_2)\,\lambda_{K3}\,(\theta_{K3}\theta_{S4}\theta_{L1}) + \lambda_{N1}\,(\lambda_{K3}B_5 + \lambda_{L3}B_7)\,(\theta_{N1}\theta_{L3}\theta_{S4})\\ &+\lambda_{N1}\lambda_{L3}B_8\theta_{N1}\theta_{L3}\theta_{K4}]\end{aligned} \tag{5.A.37}$$

$$\widehat{X}_3 = -\left(\frac{\widehat{P}_2}{|\lambda|\,|\theta|}\right)[(\lambda_{N2}\lambda_{L1} - \lambda_{N1}\lambda_{L2})\,(\theta_{K3}B_6 + \theta_{L3}B_7 + \theta_{L3}B_8)\,\theta_{N1}\theta_{S4}] \tag{5.A.38}$$

Differentiating Eqs. (5.48) and (5.49) and considering $\widehat{K} = 0$, one can derive

$$\widehat{D}_2 = E_P\widehat{P}_2 + B_9\widehat{W} + B_{10}\widehat{R} + B_{11}\widehat{r} + B_{12}\widehat{W}_S + B_{13}\widehat{X}_3 \tag{5.A.39}$$

Using (5.A.33), (5.A.34), (5.A.35), (5.A.36), (5.A.38), equation (5.A.39) may be rewritten as follows:

$$\widehat{D}_2 = \left(\widehat{P}_2\right)\Big[E_P - \left(\frac{1}{|\theta|}\right)\{B_9\theta_{N1}\theta_{K3}\theta_{S4} - B_{10}\theta_{K3}\theta_{S4}\theta_{L1} - B_{11}\theta_{N1}\theta_{L3}\theta_{S4} + B_{12}\theta_{N1}\theta_{L3}\theta_{K4}$$
$$- (B_{13}/|\lambda|)(\lambda_{N1}\lambda_{L2} - \lambda_{N2}\lambda_{L1})\theta_{N1}(\theta_{K3}\theta_{S4}B_6 + \theta_{L3}\theta_{S4}B_7 + \theta_{L3}\theta_{S4}B_8)\}\Big] \quad (5.A.40)$$

Substituting the expressions for $\left(\widehat{D}_2/\widehat{P}_2\right)$ and $\left(\widehat{X}_2/\widehat{P}_2\right)$ from (5.A.40) and (5.A.37) in (5.A.32) and simplifying, one obtains

$$\Big[E_P - \left(\frac{1}{|\lambda||\theta|}\right)\Big\{|\lambda|(B_9\theta_{N1}\theta_{K3}\theta_{S4} - B_{10}\theta_{K3}\theta_{S4}\theta_{L1} - B_{11}\theta_{N1}\theta_{L3}\theta_{S4} + B_{12}\theta_{N1}\theta_{L3}\theta_{K4})$$
$$- (B_{13}\theta_{N1})(\lambda_{N1}\lambda_{L2} - \lambda_{N2}\lambda_{L1})(\theta_{K3}\theta_{S4}B_6 + \theta_{L3}\theta_{S4}B_7 + \theta_{L3}\theta_{S4}B_8)$$
$$- (\theta_{N1}\theta_{K3}\theta_{S4})(\lambda_{N1}\lambda_{K3}B_3 + \lambda_{N1}\lambda_{L3}B_6 + \lambda_{L1}\lambda_{K3}B_1) - (\lambda_{K3}\theta_{K3}\theta_{S4}\theta_{L1})(\lambda_{N1}B_4 + \lambda_{L1}B_2)$$
$$- (\lambda_{N1}\theta_{N1}\theta_{L3}\theta_{S4})(\lambda_{K3}B_5 + \lambda_{L3}B_7) - (\lambda_{N1}\lambda_{L3}B_8\theta_{N1}\theta_{L3}\theta_{K4})\Big\}\Big] < 0 \quad (5.A.41)$$

Thus, the stability condition in the market for commodity 2 is given by (5.A.41). Using (5.A.24) and (5.A.41) from (5.A.21), it now trivially follows that

$$\Omega < 0 \quad (5.A.42)$$

Appendix 5.6: Effect on X_3

Solving (5.A.20), we can find the following expression:

$$\widehat{X}_3 = -\left(\frac{\widehat{K}}{\Omega\lambda_{K3}}\right)[|\theta||\lambda|E_P - \{\theta_{K3}\theta_{S4}(\theta_{N1}B_9 - \theta_{L1}B_{10}) + \theta_{N1}\theta_{L3}(\theta_{K4}B_{12} - \theta_{S4}B_{11})\}|\lambda|$$
$$+ \theta_{S4}\lambda_{K3}\{\theta_{N1}\theta_{K3}(\lambda_{N1}B_3 + \lambda_{L1}B_1) + \theta_{K3}\theta_{L1}(B_2\lambda_{L1} + B_4\lambda_{N1}) + \lambda_{N1}\theta_{N1}\theta_{L3}B_5\}] \quad (5.A.43)$$

It may be noted that

$$\left.\begin{aligned} &W_S S = \theta_{P4}X_4; Wa_{L3} = (P_3\theta_{L3}/\alpha);\\ &rK_D = (\theta_{K3}P_3X_3 + \theta_{K4}P_4X_4 - rK_F);\\ &(\theta_{N1}WL - \theta_{L1}RN) = [P_2X_2(\theta_{N1}\theta_{L2} - \theta_{L1}\theta_{N2}) + \theta_{N1}\theta_{L3}P_3X_3];\\ &(\theta_{K4}W_S S - \theta_{S4}rK_D) = \theta_{S4}(rK_F - \theta_{K3}P_3X_3) \end{aligned}\right\} \quad (5.A.44)$$

Inserting the values of B_is from (5.A.19), using (5.A.44) and simplifying, it is easily found that

$$\{\theta_{K3}\theta_{S4}(\theta_{N1}B_9 - \theta_{L1}B_{10}) + \theta_{N1}\theta_{L3}(\theta_{K4}B_{12} - \theta_{S4}B_{11})\}$$
$$= \left(\frac{E_Y}{Y}\right)\{\theta_{N1}\theta_{S4}W(\alpha - 1)a_{L3}X_3(\theta_{K3} - S_{LK}^3) + \theta_{N1}\theta_{S4}\theta_{L3}rK_F - |\theta|\, P_2X_2\} \tag{5.A.45}$$

Using (5.A.45) and simplifying, from (5.A.43), the following expression can be easily derived:

$$\begin{aligned}\widehat{X}_3 = &-\left(\frac{\widehat{K}}{\lambda_{K3}\Omega}\right)\Bigg[|\theta|\,|\lambda|\left(E_P + \frac{E_Y P_2X_2}{Y}\right)\\ &- |\lambda|\left(\frac{E_Y\theta_{N1}\theta_{S4}\theta_{L3}}{Y}\right)\left\{\left(\frac{\alpha-1}{\alpha}\right)P_3X_3\left(\theta_{K3} - S_{LK}^3\right) + rK_F\right\}\\ &+ \theta_{S4}\lambda_{K3}\{\theta_{N1}\theta_{K3}(\lambda_{N1}B_3 + \lambda_{L1}B_1) + \theta_{L1}\theta_{K3}(\lambda_{L1}B_2 + \lambda_{N1}B_4)\\ &+\lambda_{N1}\theta_{N1}\theta_{L3}B_5\}\Bigg]\end{aligned} \tag{5.A.46}$$

Using (5.A.19) and (5.A.41) and comparing terms, we can check that the algebraic sign of the square-bracketed term in (5.A.46) is positive. As $\Omega < 0$, from (5.A.46), it now follows that $\widehat{X}_3 > 0$ when $\widehat{K} > 0$.

Appendix 5.7: Effect on X_4

Differentiating Eq. (5.54), one gets

$$\widehat{X}_4 = -\widehat{a}_{S4} = S_{SK}^4\left(\widehat{W}_S - \widehat{r}\right) \tag{5.A.47}$$

Inserting the values of $\widehat{W}_S$ and $\widehat{r}$ from (5.A.26) and (5.A.27) in (5.A.47) and simplifying, the following expression is finally obtained:

$$\widehat{X}_4 = -\left(\frac{S_{SK}^4\theta_{N1}\theta_{L3}\,|\lambda*|\,\widehat{K}}{\Omega}\right) \tag{5.A.48}$$

From (5.A.48), the following results can be stated:

1. If sector 1 is land-capital-intensive or unskilled labour-intensive (but not sufficiently enough) (such that $|\lambda*| > 0$), $\widehat{X}_4 > 0$ when $\widehat{K} > 0$.
2. If sector 1 is sufficiently unskilled labour-intensive (such that $|\lambda*| < 0$), $\widehat{X}_4 < 0$ when $\widehat{K} > 0$.

References

Banerjee B (1986) Rural to urban migration and the urban labour market: a case study of Delhi. Himalaya Publishing House, Mumbai

Bardhan PK (1973) A model of growth of capitalism in a dual agrarian economy. In: Bhagwati JM, Eckaus RS (eds) Development and planning: essays in honour of Paul Rosenstein-Rodan. MIT Press, Cambridge, MA

Beyer H, Rojas P, Vergara R (1999) Trade liberalization and wage inequality. J Dev Econ 59(1):103–123

Bhalotra S (2002) The impact of economic liberalization on employment and wages in India. ILO, Geneva

Brecher RA, Diaz Alejandro CF (1977) Tariffs, foreign capital and immiserizing growth. J Int Econ 7:317–322

Carruth AA, Oswald AJ (1981) The determination of union and non-union wage rates. Eur Econ Rev 16:285–302

Chandra V, Khan MA (1993) Foreign investment in the presence of an informal sector. Economica 60:79–103

Chaudhuri S (2003) How and how far to liberalize a developing country with informal sector and factor market distortions. J Int Trade Econ Dev 12(4):403–428

Chaudhuri S (2007) Foreign capital, welfare and unemployment in the presence of agricultural dualism. Jpn World Econ 19(2):149–165

Chaudhuri S (2008) Wage inequality in a dual economy and international mobility of factors: do factor intensities always matter? Econ Model 25:1155–1164

Chaudhuri S, Banerjee D (2010a) FDI in agricultural land, welfare and unemployment in a developing economy. Res Econ 64(4):229–239

Chaudhuri S, Banerjee D (2010b) Foreign capital inflow, skilled–unskilled wage inequality and unemployment of unskilled labour in a fair wage model. Econ Model 7(1):477–486

Chaudhuri S, Mukhopadhyay U (2009) Revisiting the informal sector: a general equilibrium approach. Springer, New York

Chaudhuri S, Yabuuchi S (2007) Economic liberalization and wage inequality in the presence of labour market imperfection. Int Rev Econ Finance 16(4):592–603

Chaudhuri S, Yabuuchi S (2008) Foreign capital and skilled–unskilled wage inequality in a developing economy with non-traded goods (Chapter 12). In: Marjit S, ESH Yu (eds) Contemporary and emerging issues in trade theory and policy. Frontiers of economics and globalization, vol 4. Emerald Group Publishing Limited, Bingley, pp 225–250

Chaudhuri S, Yabuuchi S, Mukhopadhyay U (2006) Inflow of foreign capital and trade liberalization in a model with an informal sector and urban unemployment. Pac Econ Rev 11:87–103

Corden WM, Findlay R (1975) Urban unemployment, intersectoral capital mobility and development policy in a dual economy. Economica 42:59–78

Currie J, Harrison A (1997) Trade reform and labor market adjustment in Morocco. J Labour Econ 15(s3):s44–s71

Feenstra RC, Hanson GH (1996) Foreign investment, outsourcing and relative wages. In: Feenstra R, Grossman G, Irwin D (eds) Political economy of trade policies: essays in honor of J. N. Bhagwati. MIT Press, Cambridge, MA

Feenstra RC, Hanson GH (1997) Foreign direct investment and relative wages: evidence from Mexico's Maquiladoras. J Int Econ 42:371–394

Gandhi-Kingdon G, Knight J (2001) Unemployment in South Africa: the nature of the beast. Centre for the Study of African Economies, University of Oxford, WPS/2001-15

Grinols EL (1991) Unemployment and foreign capital: the relative opportunity cost of domestic labour and welfare. Economica 57:107–121

Gupta MR (1994) Duty-free zone, unemployment and welfare: a note. J Econ 59(2):217–236

Gupta MR (1995) Foreign capital, income inequality and welfare in a Harris-Todaro model. J Dev Econ 45(2):407–14

Gupta MR (1997) Foreign capital and informal sector: comments on Chandra and Khan. Economica 64:353–363
Hanson GH, Harrison A (1999) Trade liberalization and wage inequality in Mexico. Ind Labour Relat Rev 52(2):271–288
Harris JR, Todaro MP (1970) Migration, unemployment and development: a two-sector analysis. Am Econ Rev 60:126–142
Harrison A, Hanson G (1999) Who gains from trade reform? some remaining puzzles. J Dev Econ 59(1):125–154
Jones RW (1971) A three-factor model in theory, trade and history. In: Bhagwati J et al (eds) Trade, balance of payments and growth. North-Holland, Amsterdam
Jones RW, Neary P (1984) Positive theory of international trade. In: Jones RW, Kenen PB (eds) Handbook of development economics, vol 1. Northcbrr-Holland, Amsterdam
Khan AR (1998) The impact of globalization in South Asia. In: Bhalla AS (ed) Globalization, growth and marginalization. Macmillan London, London
Layard R, Nickell SJ, Jackman R (2005) Unemployment: macroeconomic performance and the labour market. Oxford University Press, Oxford
Marjit S (2003) Economic reform and informal wage — a general equilibrium analysis. J Dev Econ 72:371–378
Marjit S, Acharyya R (2003) International trade, wage inequality and the developing economy — a general equilibrium approach. Springer, Heidelberg
Marjit S, Kar S (2005) Emigration and wage inequality. Econ Lett 88:141–145
Marjit S, Beladi H, Chakrabarti A (2004) Trade and wage inequality in developing countries. Econ Inq 42(2):295–303
Osmani SR (1991) Wage determination in rural labour markets: the theory of implicit co-operation. J Dev Econ 34:3–23
Papola TS, Sahu PP (2012) 'Growth and structure of employment in India: long-term and post-reform performance and the emerging challenge' ISID. A study prepared as a part of a research programme "Structural changes, industry and employment in the Indian economy" sponsored by ICSSR, New Delhi
Robbins D (1994a) Malaysian wage structure and its causes. Harvard Institute for International Development (HIID),Cambridge, MA
Robbins D (1994b) 'Philippine wage and employment structure, 1978–1983. HIID, Cambridge, MA
Robbins D (1995a) Earnings dispersion in Chile after trade liberalization. HIID, Cambridge, MA
Robbins D (1995b) Trade, trade liberalization and inequality in Latin America and east Asia: synthesis of seven country studies. HIID, Cambridge, MA
Robbins D (1996a) Stolper-samuelson lost in the tropics – trade liberalization and wages in Columbia. HIID, Cambridge, MA
Robbins D (1996b) HOS hits facts: facts win: evidence on trade and wages in developing world. HIID, Cambridge, MA
Tendulkar S, Sundaram DK, Jain LR (1996) Macroeconomic policies and poverty in India: 1966–67 to 1993–94, Monograph. ILO, New Delhi
Wood A (1997) Openness and wage inequality in developing countries: the Latin American challenge to East Asian conventional wisdom. World Bank Research Observer, Washington, DC, January
Yabuuchi S (1982) A note on tariff-induced capital inflow and immiserization in the presence of taxation of foreign profits. J Int Econ 12:183–189
Yabuuchi S (2007) Unemployment and international factor movement in the presence of skilled and unskilled labor. Rev Dev Econ 11:437–449
Yabuuchi S, Chaudhuri S (2007) International migration of labour and skilled–unskilled wage inequality in a developing economy. Econ Model 24(1):128–137

Chapter 6
FDI and Gender Wage Inequality

6.1 Introduction

In most countries, particularly the developing ones, gender differentials in labour markets are manifested in terms of a gap in relative wages among men and women workers. In many countries of Asia and the Middle East and North Africa, the gap is upwards of 40 % in some sectors. In Latin America and the Caribbean, most women earn on average only about 69 % of men's labour (Corley et al. 2005; UNICEF 2007). This prevalent phenomenon has been explained in the literature mainly by three alternative views. First, in accordance with the human capital theory, it is contended that the wage gap stems from skewed endowments of human capital and differences in expected lifetime labour force participation. Secondly, there exists an element of discrimination against women by the employers. Thirdly, it is argued that women tend to concentrate in low paid informal jobs so that it is gender segregation in the labour market that leads to wage gap between men and women (see, e.g. Kao et al. 1994; Fiske 1998; Goldin 2002; Polachek 2004).

Most of the developing countries have experienced huge influx of foreign capital in the aftermath of liberalized investment policies followed by them. The multinational companies (MNCs) are likely to have substantial impact on gendered labour markets due to their greater export orientation, mobility and technological advantage vis-à-vis their domestic counterparts. FDI may have two contrary effects on the gender wage differentials. On the one hand, the gap may widen due to weakened bargaining power of women crowded in the MNCs, while on the other hand, the MNCs may reward the higher education levels of female workers, lowering the gender wage gap (UNCTAD 1999; Seguino 2000).

However, relatively few studies have examined the impact of FDI on gender-differentiated wages.[1] Siegmann (2006) in a study of Indonesia found that FDI

[1]Nonetheless, there exists a vast literature on the correlation between trade liberalization and gender wage gap.

S. Chaudhuri and U. Mukhopadhyay, *Foreign Direct Investment in Developing Countries: A Theoretical Evaluation*, DOI 10.1007/978-81-322-1898-2_6, © Springer India 2014

influences female as well as male wages positively across sectors, but whether it closes the gender wage differential depends on the segregation of female and male workers in FDI-intensive subsectors. Braunstein and Brenner (2007) find that FDI has significant positive effects on both male and female wages in urban China. But while in 1995 women experienced larger gains from FDI than men, the gender-based advantage reversed by 2002, reflecting the shift of foreign enterprises to higher productivity, thereby more benefiting the workers in male-dominated industries. Oostendorp (2004) finds a negative association between openness (measured as either exports plus imports as a percentage of GDP or foreign direct investment net inflows as a percentage of GDP) and the size of the gender wage gap within occupational categories in a sample of both developed and developing countries. On the contrary, Vijaya and Kaltani (2007) in a study of panel data show that FDI has an adverse impact on overall wages in the manufacturing sector and this impact is more pronounced for female wages. Seguino (2000) and Berik et al. (2004) also find that gender wage inequality increases with foreign investment in Taiwan and Korea.

The widening wage gap, mainly due to fall in female wage, has been attributed in the literature to the informalization of labour and lowering of women's bargaining power (Carr et al. 2000; Seguino 2002; Balakrishnan 2002). Since women concentrate in labour-intensive manufacturing firms and services, their relative bargaining power does not rise even as labour demand increases due to globalization. For instance, FDI in labour-intensive export sectors may even lower the workers' bargaining power owing to the potential threat of relocation of firms to lower wage sites. In contrast, men working mainly in non-tradables and capital-intensive industries have more bargaining power to demand higher wages. Secondly, there has been a shift of a large number of formal sector jobs in female-dominated labour-intensive industries, particularly in the East Asian countries, to informal employment arrangements, like subcontracting or home worker arrangements, where women earn much less than in formal sector jobs.

There has been little effort to explain the phenomenon of growing gender wage gap within the neoclassical trade model. Moreover, it is also necessary to study the effects of the policies on the overall welfare of the country along with gender wage gap, since elimination of gender-based wage inequality cannot be aimed at in isolation. While it is widely argued that foreign capital propels an economy towards the trajectory of growth, the objectives of an egalitarian welfare-maximizing state are fulfilled only if economic growth and welfare are accompanied by reduction in gender wage inequality. A proper evaluation of a particular policy can be done only when gendered considerations are made along with its overall welfare effect on the society.

In developing countries there exist two important dimensions of gender-related disparities: gender inequality in access to education and health facilities and differences in the spending patterns of men and women; both of these tend to have significant implications on the relative efficiency or productivity of male and female workers. In these countries with widespread poverty, it often becomes difficult for the poor households to meet the direct costs of schooling, so that if a choice has to be made between sending a boy or a girl to school, the boy gets the preference. Moreover, girls are more likely to have to work in the home, care for siblings, etc., so that their opportunity cost is higher than that of boys (Herz and Sperling 2004). Lack of proper facilities and negligence to women often leads to their ill-health, low nutritional level and life expectancy (Sharma 2007; Sen and Östlin 2007). On the other hand, in these countries, the 'consumption efficiency hypothesis' (Leibenstein 1957; Bliss and Stern 1978) is of particular relevance. The hypothesis proposes that the nutritional efficiency of a worker is positively related to his consumption level at least up to a certain point. If there is a stable relationship between the consumption level of the worker and his wage income, then the worker's productivity is positively linked to the wage that he receives. However, an increase in wage affects men and women differently due to differences in their spending patterns. Women are more likely than men to spend a significantly higher proportion of their income on purchases of goods and services that promote the nutrition, health and general well-being of their families (Duncan 1997; Quisumbing et al. 1998; Kurz and Welch 2000). Men tend to spend most of their income on non-food items and their personal luxury articles like alcohol and cigarettes or reinvest it in their work or businesses (Guyer 1988; Hoddinott and Haddad 1995; Anderson and Baland 2002). Hence, an increase in the female wage is more likely than male wages to raise the nutritional standard and efficiency of both men and women in a family. Since liberalization policies affect labour allocation and wages of men and women, it in turn can have different impacts on their efficiencies, inducing further labour reallocation and change in wages.

In this chapter we analyse the effects of liberalized investment policies resulting in increased foreign capital inflow on the gender-based wage gap and welfare of an economy in a three-sector general equilibrium model appropriate particularly for the female labour-oriented export-led developing countries of South Asia like India, Pakistan and Bangladesh.[2] It is assumed that the efficiency functions of the male and female workers are different due to two reasons: firstly, gendered differences in spending patterns, leading to differential effects of male and female wages on their nutrition, and, secondly, social institutions and supply side constraints resulting in lesser availability of education and health facilities to women vis-à-vis men. Economic liberalization affects both male and female wages and their efficiencies, while change in the volume of public provision of social services directly affects the efficiencies of men and women, but in dissimilar ways. These, in turn, alter the number of male and female workers in efficiency units and result in reallocation of factors of production among sectors using them with different intensities (in accordance with the Rybczynski theorem) and changes in relative factor prices. The comparative static results show that liberalized investment policies leading to enhanced foreign capital inflow into both the export- and import-competing sectors may accentuate wage inequality but also raise the welfare of the economy. The result can explain the empirical evidences of widening gender wage inequality in

[2]The model in this chapter is based on Mukhopadhyay and Chaudhuri (2013).

different countries, particularly the female labour-intensive export-oriented ones. It also indicates that there exists a trade-off between reduction in gender wage gap and improvement in national welfare.

6.2 The Model

We consider a small open full-employment economy consisting of three sectors. Sector 1 produces an agricultural commodity, X_1, using male labour (M), female labour (F) and capital of type 1 (K_1). Sector 2 uses female labour and capital of type 1 to produce a manufacturing product, X_2. Sector 3 produces a manufacturing product, X_3, using male labour and capital of type 2 (K_2). It is assumed that sectors 1 and 2 are the export sectors; while sector 1 is the primary good exporting sector, sector 2 may be identified as the female labour-oriented export-processing zone.[3] Sector 3 is the tariff-protected import-competing sector. Male labour is mobile between sectors 1 and 3, while female labour is employed in sectors 1 and 2. Capital of type 1 is mobile between the two export sectors while capital of type 2 is specific[4] to sector 3. All the factors of production are fully utilized.[5] Due to the assumption of a small economy, all the product prices (P_i) are internationally given. Production functions exhibit constant returns to scale with diminishing marginal productivity to each factor. Commodity 1 is assumed to be the numeraire.

The general equilibrium is represented by the following set of equations:

$$W_{\mathrm{M}} a_{M1} + W_{\mathrm{F}} a_{F1} + R a_{K1} = 1 \tag{6.1}$$

$$W_{\mathrm{F}} a_{F2} + R a_{K2} = P_2 \tag{6.2}$$

$$W_{\mathrm{M}} a_{M3} + r a_{K3} = P_3 (1 + t) \tag{6.3}$$

[3]Some examples of industries intensive in female labour are garments, tea, tobacco and food processing.

[4]Here K_1 requires less skill than K_2 and, therefore, can fairly be assumed to be used simultaneously in the agricultural and export manufacturing sectors.

[5]In reality, a developing economy is plagued by the existence of involuntary unemployment of both male and female labour due to the presence of factor market distortions. Since our focus is on gender wage inequality and not on unemployment, we have ignored factor market distortions and unemployment of labour. The production structure of our economy is a three-sector analogue (or a 3×4 specific factor extension) of the classic 2×3 specific factor full-employment general equilibrium model as developed by Jones (1971). As the return to each mobile factor is the same in the two sectors in which it is employed, there occurs full employment of all the mobile factors in the different sectors of the economy.

Here, a_{K_i} is the capital–output ratio in the ith sector, $i = 1, 2, 3$; a_{M_i} denotes male labour–output ratio in the ith sector, $i = 1, 3$; and a_{F_i} is the female labour–output ratio in the ith sector, $i = 1, 2$. W_{M} and W_{F} are the male and female wage rates (per efficiency unit), respectively, with $W_{\mathrm{M}} > W_{\mathrm{F}}$, so that there exists a gap between male and female labour wages[6]; R and r denote returns to capital of type 1 and 2, respectively.

Equations (6.1), (6.2) and (6.3) are the competitive industry equilibrium conditions in the three sectors. Sectors 1 and 2 together can effectively be regarded as a *modified Heckscher–Ohlin subsystem (MHOSS)*. The modification is due to the fact that apart from two common inputs, capital of type 1 and female labour, sector 1 also uses male labour as an input. We now make some assumptions on the relative factor intensities that will be used throughout the analysis. Since sector 2 is the female labour-oriented export-processing zone, we assume that sector 2 is female labour-intensive vis-à-vis sector 1 with respect to capital (of type 1) in both value and physical sense. These, respectively, suggest that $\theta_{F2}\theta_{K1} > \theta_{F1}\theta_{K2}$ and $\lambda_{F2}\lambda_{K1} > \lambda_{F1}\lambda_{K2}$. It is also assumed that the male labour intensity in sector 1 is not less than the female labour intensity in sector 2 with respect to capital in value terms, which in turn implies that $(\theta_{M1}\theta_{K2} \geq \theta_{F2}\theta_{K1})$. Besides, for the sake of analytical simplicity, we also consider that the capital–output ratio in sector 1 (a_{K1}) is constant.[7]

Complete utilization of capital of types 1 and 2 can be expressed, respectively, as

$$a_{K1}X_1 + a_{K2}X_2 = K_{D1} + K_{F1} = K_1 \tag{6.4}$$

$$a_{K3}X_3 = K_{D2} + K_{F2} = K_2 \tag{6.5}$$

Capital of either type includes both domestic capital and foreign capital, which are perfect substitutes. Incomes from foreign capital are completely repatriated.

The efficiency of each type of worker (male and female) is assumed to depend positively on the wages and the workers' access to education and health facilities.[8]

[6]The male female wage gap exists in agriculture as well. For example, in India, the wage rates paid to women workers in the agricultural sector are at least 20–30 % lower than those paid to men for the same activity. In non-agricultural activities, the difference is even more pronounced, with women being paid less than half the wages given to their male counterparts (Ramachandran 2006).

[7]Although this is a simplifying assumption, it is not completely without any basis. Agriculture requires inputs like fertilizers, pesticides and weedicides, which are to be used in recommended doses. Now if capital of type 1 is used to purchase those inputs, the capital (of type 1)–output ratio, a_{K1}, becomes constant technologically. However, male labour and female labour are substitutes and the production function displays the property of constant returns to scale in these two inputs. However, even if the capital (of type 1)–output ratio is not given technologically, the results still hold under alternative sufficient conditions incorporating the partial elasticities of substitution between capital of type 1 and the two types of labour used in sector 1.

[8]It may be noted that in accordance with the 'consumption efficiency hypothesis' as outlined earlier, nutritional efficiencies of the workers actually depend on quantities of commodities consumed by them, which is represented by their wages. However, quantities of consumption must depend on commodity prices, which in turn suggest that commodity prices should figure in the

However, the efficiency functions of male and female labour are different. The efficiency function of a representative male worker is given by

$$H = H\left(E, (W_{\mathrm{M}} + W_{\mathrm{F}})\right); H_1, H_2 > 0 \tag{6.6}$$

Here E denotes the public spending on social sector like education and health, which is financed by a portion of the tariff revenue earned by the government from the import of commodity 3. It may include education subsidy and expenditure on provision and extension of health facilities. Since both higher education and better health are pivotal in raising the efficiency of a worker, an increase in E raises the efficiency of a worker.

The efficiency of a worker also depends on the family income depicted by $(W_{\mathrm{M}} + W_{\mathrm{F}})$, considering that each family consists of a working couple.[9] This is because higher income enhances women's decision-making power within households with substantial effects on what items are to be bought and how it is to be distributed among household members, with important implications for welfare of all the family members. In the countries for which information is available, women's income has beneficial effects on household calorie consumption (Von Braun and Kennedy 1994). Therefore, a hike in wages of women leads to higher consumption and efficiency of men as well.

Therefore, in Eq. (6.6), $H_1 = (\partial H/\partial E) > 0$ and $H_2 = (\partial H/\partial((W_{\mathrm{M}} + W_{\mathrm{F}})) > 0$ denote the responsiveness of the efficiency of male workers to changes in public spending on social sector and changes in family income, respectively.

On the other hand, apart from an increase in public provision of social services, the efficiency of women workers depend only on the female wage rate. Most of the evidences show that women working in export-oriented industries retain some control over their earnings (Kabeer 2000; Kusago and Barham 2001) and the effect of women's income is also beneficial to their own dietary intake (Bisgrove and Popkin 1996). Therefore, with an increase in their wages, their consumption and efficiency is likely to increase. However, male wages are not likely to have any significant impact since men tend to spend most of their income on non-food items and their personal luxury articles, so that any change in their wage does not affect the nutrition and efficiency of women in the particular household.[10]

efficiency functions. But since we consider a small open economy where the prices of all traded commodities are internationally given, the inclusion or exclusion of commodity prices into the efficiency functions does not, in fact, make any difference.

[9]The model implicitly considers both the cases of male/female households and extended households, which are quite common in developing countries. In case of the latter, empirical results show that household consumption is strongly correlated with their own income, even after extended households' pooled income is controlled for (Altonji et al. 1992; Park 2001). However, we do not consider the single-parent household case.

[10]It is empirically observed that men also contribute to the family although their contribution is far less than that of the women. There can be two extreme cases: (1) men do not contribute at all to family income, and (2) they contribute their whole income to family income. For the sake of

Hence, the efficiency of a representative female worker can be expressed as

$$h = h\,(E, W_{\mathrm{F}})\,; h_1, h_2 > 0 \tag{6.7}$$

In Eq. (6.7), $h_1 = (\partial h/\partial E) > 0$ and $h_2 = (\partial h/\partial W_{\mathrm{F}}) > 0$ are the responsiveness of the efficiency of female workers to changes in public spending on social sector and changes in the female wage, respectively.

However, due to social discrimination based on gender, women have access only to a portion of the public spending on social sector. Consequently, the effective impact of any change in public spending on social sector on the efficiency of a female worker is less than that of a male worker. Hence, we assume that $H_1 > h_1$.

The endowments of male and female labour in efficiency units are given by the following:

$$a_{M1}X_1 + a_{M3}X_3 = MH\,(E, W_{\mathrm{M}} + W_{\mathrm{F}}) \tag{6.8}$$

$$a_{\mathrm{F}1}X_1 + a_{\mathrm{F}2}X_2 = Fh\,(E, W_{\mathrm{F}}) \tag{6.9}$$

Here M and F denote the male and female population, respectively.

There are nine endogenous variables, $W_{\mathrm{M}}, W_{\mathrm{F}}, R, r, X_1, X_2X_3, H$ and h, that can be solved from Eqs. (6.1), (6.2), (6.3), (6.4), (6.5), (6.6), (6.7), (6.8) and (6.9). The policy parameters of the system are K_1, K_2 and E. This is an indecomposable system, where the factor prices cannot be solved from the price system alone. Therefore, any change in the factor endowments affect factor prices, which, in turn, affect the per unit input requirements, $a_{ij}s$ in each sector.

The demand side of the model is represented by a quasi-concave social utility function. Let U denote the social utility that depends on the consumption demands for the three commodities denoted by D_1, D_2 and D_3 and is depicted as

$$U = U\,(D_1, D_2, D_3)\,. \tag{6.10}$$

Now the aggregate demands for the three commodities are given by the following three equations.

$$\begin{array}{l} D_1 = D_1\,(P_1, P_2, P_3\,(1+t)\,, Y) \\ \qquad\qquad\;\; (-)(+) \quad\; (+) \quad\;\; (+) \end{array} \tag{6.11.1}$$

$$\begin{array}{l} D_2 = D_2\,(P_1, P_2, P_3\,(1+t)\,, Y) \\ \qquad\qquad\;\; (+)(-) \quad\; (+) \quad\;\; (+) \end{array} \tag{6.11.2}$$

analytical simplicity, we have considered the first extreme case. The algebra of the model becomes extremely complicated if we consider the intermediate case. It may, however, be checked intuitively that even if we assume that men do contribute to family income but at a significantly lower rate than women, the qualitative results of the model are retained.

and,

$$D_3 = \underset{}{D_3}\left(\underset{(+)}{P_1}, \underset{(+)}{P_2}, \underset{(-)}{P_3(1+t)}, \underset{(+)}{Y}\right) \tag{6.11.3}$$

where Y is the national income at domestic prices. All commodities are normal goods with negative and positive own price and income elasticities of demand, respectively. The cross-price elasticities are positive. So, we have $E^i_{Pi} = ((\partial D_i/\partial P_i)(P_i/D_i)) < 0$; $E^i_Y = ((\partial D_i/\partial Y)(Y/D_i)) > 0$ for $i = 1, 2, 3$ and $E^i_{Pk} = ((\partial D_i/\partial P_k)(P_k/D_i)) > 0$ for $i \neq k$.

The foreign capital income of both types is fully repatriated. The balance-of-trade equilibrium requires that

$$P_1 D_1 + P_2 D_2 + P_3 D_3 = P_1 X_1 + P_2 X_2 + P_3 X_3 - RK_{\mathrm{F1}} - rK_{\mathrm{F2}} - E \tag{6.12}$$

or, equivalently,[11]

$$P_1 D_1 + P_2 D_2 + P_3^* D_3 = P_1 X_1 + P_2 X_2 + P_3^* X_3 - RK_{\mathrm{F1}} - rK_{\mathrm{F2}} + (tP_3 I - E) \tag{6.12.1}$$

The volume of import is given by the following equation:

$$I = D_3\left(P_1, P_2, P_3(1+t), Y\right) - X_3 \tag{6.13}$$

The national income of the economy at domestic prices is given by

$$Y = P_1 X_1 + P_2 X_2 + P_3(1+t) X_3 + (tP_3 I - E) - RK_{\mathrm{F1}} - rK_{\mathrm{F2}} \tag{6.14}$$

or, equivalently,

$$Y = W_{\mathrm{M}} M H(.) + W_{\mathrm{F}} F h(.) + RK_{\mathrm{D1}} + rK_{\mathrm{D2}} + (tP_3 I - E) \tag{6.14.1}$$

In Eq. (6.14.1), $W_{\mathrm{M}}MH(.)$ and $W_{\mathrm{F}}Fh(.)$ are the total wage incomes earned by male and female workers, respectively. RK_{D1} and rK_{D2} are the domestic rental incomes from the two types of capital. E is the amount of government spending on health and education, which is financed by a portion of the tariff revenue, tP_3I, earned by the government from import of commodity 3. Finally, $(tP_3I - E)$ is the excess tariff revenue (net of the government spending), which is handed over to the consumers in a lump-sum manner.

[11] Here, $P_3^* = P_3(1+t)$ is the tariff-inclusive domestic price of X_3.

6.3 Effects of FDI and Government Policies on Gender Wage Inequality

In this section, we analyse the effects of (1) increased foreign capital inflow of both types and (2) government policies like higher public provision of social services on the gender wage inequality.[12]

It has been assumed that W_{M} and W_{F} represent the wage rates of male and female workers per efficiency units, respectively. Now, an increase in any of the parameters is likely to affect the efficiencies of both types of workers per capita. Since wage inequality generally refers to difference in per capita wage per unit of time, the appropriate measure of wage inequality between male and female workers is

$$W_{\mathrm{I}} = (W_{\mathrm{M}}H - W_{\mathrm{F}}h) \tag{6.15}$$

From (6.15) it is evident that the change in male–female wage inequality must depend on changes in their wages, W_{M} and W_{F}, and also on their efficiencies, H and h.[13]

6.3.1 *Effects of Foreign Capital Inflow*

Let us assume that due to policies inducing FDI, foreign capital of type 1 flows in. This implies that $\widehat{K}_1 > 0$ with all other parameters remaining unchanged. The effect on gender wage inequality is obtained as

$$\begin{aligned} W_{\mathrm{I}}\widehat{W}_{\mathrm{I}} = \underset{(-)}{\left(\frac{\widehat{K}_1}{\Delta\,|\theta|}\right)} \lambda_{M1}\lambda_{F2}\theta_{K3}\,[W_{\mathrm{M}}H_2W_{\mathrm{F}}\theta_{M1}\theta_{K2} - \underset{(+)}{W_{\mathrm{M}}\,(H_2W_{\mathrm{M}} + H)} \\ \underset{(-)}{(\theta_{F1}\theta_{K2} - \theta_{F2}\theta_{K1})} - \underset{(+)}{W_{\mathrm{F}}\,(h_2W_{\mathrm{F}} + h)\,\theta_{M1}\theta_{K2}}] \end{aligned} \tag{6.16}$$

It follows from (6.16) that $\widehat{W}_{\mathrm{I}} > 0$ when $\widehat{K}_1 > 0$ under the sufficient conditions:

$$\left.\begin{array}{l} \text{(i)}\ \ \Delta < 0 \ \ \text{and} \\ \text{(ii)}\ W_{\mathrm{M}}H_2 \geq (h_2W_{\mathrm{F}} + h) \end{array}\right\} \tag{6.17}$$

[12]The comparative static results have been derived in Appendix 6.1.

[13]Labour productivity improvements (via increased social spending) result only in declines in wages since the country is a price taker.

Now, let us consider the case when foreign capital of type 2 flows in. This implies that $\widehat{K}_2 > 0$ with other parameters remaining unaltered. The resulting wage inequality is given as

$$\begin{aligned} W_1\widehat{W}_1 = & \underset{(-)}{\left(\frac{\widehat{K}_2}{(\Delta\,|\theta|)}\right)} \lambda_{M3}\theta_{K3}\underset{(+)}{(\lambda_{K1}\lambda_{F2}-\lambda_{K2}\lambda_{F1})}\,[W_{\mathrm{M}}H_2W_{\mathrm{F}}\theta_{M1}\theta_{K2} \\ & - W_{\mathrm{M}}\underset{(+)}{(H_2W_{\mathrm{M}}+H)}\,\underset{(-)}{(\theta_{F1}\theta_{K2}-\theta_{F2}\theta_{K1})} - W_{\mathrm{F}}\,\underset{(+)}{(h_2W_{\mathrm{F}}+h)}\,\theta_{M1}\theta_{K2}] \end{aligned} \tag{6.18}$$

It follows from (6.18) that $\widehat{W}_{\mathrm{I}} > 0$ when $\widehat{K}_2 > 0$ if condition (6.17) holds.

These results lead to the following proposition.

Proposition 6.1 *Foreign capital* i*nflow of either type may aggravate gender-based wage differential.*

An inflow of foreign capital of type 1 lowers its return, R. For satisfying the zero-profit condition in sector 2, W_{F} must rise. Also a Rybczynski effect takes place in the MHOSS. Sector 1 expands while sector 2 contracts, since the former is more capital-intensive vis-à-vis the latter with respect to female labour. The input demands for both types of labour increase in sector 1 leading to increases in both W_{M} and W_{F}. The additional female labour in sector 1 comes from the contracting sector 2, while male labour must come from sector 3. Consequently, sector 3 contracts. Now, owing to increases in W_{M} and W_{F}, the efficiencies of both male and female workers augment but in different magnitudes due to differences in spending patterns. The increase in per capita wage for female workers is lower than that for the male workers, increasing the wage gap under the sufficient conditions (6.17).

On the other hand, an inflow of foreign capital of type 2 in the import-competing sector lowers the return to capital, r. Sector 3 must expand since the type of capital is specific to this sector. Accordingly, the demand for male labour rises, which in turn raises W_{M}. Additional male labour must come from sector 1 leading to its contraction. The contracting sector 1 releases both capital of type 1 and female labour to sector 2, which in turn expands. However, the increase in the demand for female labour in sector 2 is greater than the release of female labour by sector 1. This leads to an increase in the female wage, W_{F}. We may provide an alternative explanation as to why sector 1 (sector 2) contracts (expands) and W_{F} rises. As W_{M} rises, the effective price of commodity 1, net of cost on male labour, falls. This produces a Stolper–Samuelson type effect in the *MHOSS* resulting in a decrease in R and an increase in W_{F} as sector 1 (sector 2) is capital (female labour)-intensive. This then leads to a Rybczynski type effect.[14] As a result of increases in wages (per efficiency units), the efficiencies of both male and female labour (H and h)

[14] A Stolper–Samuelson effect is followed by a Rybczynski-type effect if the production functions are of variable-coefficient type.

rise. But the increase in H is greater than that in h because of the reasons discussed earlier. The per capita wage inequality rises under the given sufficient conditions.

6.3.2 *Effects of Increased Public Provision of Education and Health*

Now we examine the effects of an increase in the public spending on social services, i.e. $\widehat{E} > 0$. The gender wage inequality is obtained as

$$
\begin{aligned}
W_{\mathrm{I}}\widehat{W}_{\mathrm{I}} = \left(\frac{E\widehat{E}}{(\Delta\,|\theta|)}\right) & \theta_{K3}\,[\{H_1\,(\lambda_{K2}\lambda_{F1} - \lambda_{K1}\lambda_{F2}) - \lambda_{M1}\lambda_{K2}h_1\,(1+\alpha)\} \\
& \quad (-) \qquad\qquad\qquad (-) \qquad\qquad\qquad (+) \\
& [W_{\mathrm{M}}H_2W_{\mathrm{F}}\theta_{M1}\theta_{K2} - W_{\mathrm{M}}\,(H_2W_{\mathrm{M}} + H)\,(\theta_{F1}\theta_{K2} - \theta_{F2}\theta_{K1}) \\
& \qquad\qquad\qquad\qquad\qquad (+) \qquad\qquad (-) \\
& -W_{\mathrm{F}}\,(h_2W_{\mathrm{F}} + h)\,\theta_{M1}\theta_{K2}] \\
& \qquad\quad (+)
\end{aligned}
\tag{6.19}
$$

It follows from (6.19) that $\widehat{W}_{\mathrm{I}} < 0$ when $\widehat{E} > 0$ if condition (6.17) holds. These results lead to the following proposition.

Proposition 6.2 *An increase in the public spending on social services may improve the gender wage inequality.*

A boost in E augments the efficiencies and therefore endowments of both male and female labour (in efficiency units), the latter being lesser due to skewed access to social services ($H_1 > h_1$). Both W_{M} and W_{F} fall as the supply of both types of labour (in efficiency units) increase, given their demands. As W_{M} falls, the return to capital of type 2, i.e. r rises (see Eq. 6.3) urging the producers to substitute capital by male labour. This lowers the capital–output ratio in sector 3, i.e. a_{K3}. Since $X_2 = K_2/a_{K3}$ (see Eq. 6.5), sector 3 expands. Besides, fall in both W_{M} and W_{F} in turn generate a second round of effect, reducing the efficiencies of both male and female labour. The gap in per capita wages improves under the same sufficient conditions.

6.4 Effects of FDI and Government Policies on the Welfare of the Economy

The comparative static results on gender wage inequality show that government policies pertaining to enhanced provision of social services reduce the gender wage gap, while foreign capital inflow of either type enhances it. However, it is equally important to ascertain the effect of each policy change on the welfare of the economy. Therefore, we now analyse the implications of different policies on welfare, measured by the social welfare function as given by Eq. (6.10).[15]

6.4.1 Effects of Foreign Capital Inflow

An inflow of K_1, on one hand, leads to increases in both W_M and W_F (explained in Proposition 6.1), which in turn augment the efficiencies of both male and female workers and their endowments in efficiency units. Therefore, the total wage income of male and female labour rises. On the other hand, as sector 3 contracts (already explained in Proposition 6.1) the tariff revenue rises following a boost in import demand. This in turn raises the net transfer payments made to the consumers. Welfare of the economy improves as both aggregate wage income and net transfer payments increase.

Analogously, an inflow of foreign capital of type 2 results in hike in W_M and W_F (as explained in Proposition 6.1) so that the male and female labour in efficiency units rise and their total wage income rises, producing a favourable effect on social welfare. On the other hand, as sector 3 expands, import demand falls that lowers the tariff revenue and hence the net transfer payments to the consumers. This affects welfare adversely. Thus, there are two opposite effects on welfare. The net outcome would be an improvement of the society's welfare if the positive wage effect outweighs the negative tariff revenue effect. This leads to the following proposition.

Proposition 6.3 *An inflow of foreign capital of either type may be welfare improving.*[16]

6.4.2 Effects of Increased Public Provision of Education and Health

An increase in E raises the efficiencies of both male and female workers, so that given their wages, there is a favourable impact on welfare. However, the

[15] See Appendix 6.2 for mathematical derivations of welfare changes.

[16] The liberalized investment policy in the form of an FDI into the export sector(s) may be an instrument that can lead to export-led growth and raise the output of the export sector. On the other hand, contrary to the famous Brecher and Alejandro (1977) proposition that suggests an inflow of foreign capital into the import-competing sector under certain conditions might lead to import substitution and lower the country's welfare, there are works like Marjit and Beladi (1996), Marjit et al. (1997), Chaudhuri (2005, 2007) and Chaudhuri et al. (2006) which have shown that welfare may improve also in this case. In the present model, both export-promotion and import-substitution policies through FDI may improve social welfare.

wages do not remain the same. We have seen that the policy reduces W_{M} and W_{F}, leading to declines in the endowments of both male and female labour in efficiency units (explained in Proposition 6.2). The net outcomes on the male and female endowments in efficiency units and total wage income depend on the relative strengths of the two opposite effects. Besides, as the tariff-protected, import-competing sector (sector 3) expands, the demand for import falls. The consequence would be a decline in the tariff revenue. The net lump-sum transfer payments made to consumers also plummets. Social welfare worsens if the aggregate wage effect is either negative or not positive enough to dominate over the negative tariff revenue effect. So the following proposition can now be established.

Proposition 6.4 *Increased public provision of social services may have detrimental consequences on the welfare of the economy.*

6.5 Policy Implications of the Results

In the wake of liberalization and pursuit for inclusive growth, the gender perspective needs to be integrated into policy reforms in the developing countries, characterized by wide persistence of gender-based wage gap, so as to avoid unintended and even counterproductive effects on gender equality and welfare of the economy. Since an increasing number of countries have been embarking on the path of economic liberalization including freer flow of foreign capital, it becomes imperative to examine the effects of different liberalized policies on the wage gap. In this chapter, we develop a three-sector general equilibrium model to study the effects of FDI on the gender wage differential and welfare of the economy. It is assumed that the efficiency functions of male and female workers are different due to (1) skewed access to education and health and (2) differences in their spending patterns and effects of wages on nutrition. In this scenario, it is found that freer inflow of foreign capital into both export and import sectors may aggravate male–female wage inequality but may have favourable consequences on the welfare of the economy. However, although increased provision of social services leads to narrowing of wage inequality, it may have detrimental effects on welfare. The chapter shows that there exists a trade-off between gender wage inequality and welfare of the economy. It also provides theoretical explanations behind the empirical findings Vijaya and Kaltani (2007), cited earlier, that shows adverse impact on overall wages and gender wage gap as a result of FDI. Nonetheless, it may be mentioned that although investment in education and health has adverse static effects on welfare, if the dynamic effects are considered, then human capital formation and rise in productivity may be welfare enhancing in the long run.

Appendices

Appendix 6.1: Effects of Different Policies on Gender Wage Inequality

Total differentiation of (6.1), (6.2) and (6.3) and use of envelope conditions yields

$$\theta_{M1}\widehat{W}_{\mathrm{M}} + \theta_{F1}\widehat{W}_{\mathrm{F}} + \theta_{K1}\widehat{R} = 0 \tag{6.A.1}$$

$$\theta_{F2}\widehat{W}_{\mathrm{F}} + \theta_{K2}\widehat{R} = 0 \tag{6.A.2}$$

$$\theta_{M3}\widehat{W}_{\mathrm{M}} + \theta_{K3}\widehat{r} = 0 \tag{6.A.3}$$

It may be noted that producers in each industry choose techniques of production so as to minimize unit costs. This leads to the condition that the distributive-share weighted average of changes in input–output coefficients along the unit isoquant in each industry must vanish near the cost-minimization point. This states that an isocost line is tangent to the unit isoquant. In mathematical terms, cost-minimization conditions for the two industries may be written as $\theta_{L1}\widehat{a}_{L1} + \theta_{K1}\widehat{a}_{K1} = 0$ and $\theta_{L2}\widehat{a}_{L2} + \theta_{K2}\widehat{a}_{K2} = 0$. These are called the envelope conditions. See Caves et al. (1990) and/or Chaudhuri and Mukhopadhyay (2009).

Solving (6.A.1), (6.A.2) and (6.A.3) by Cramer's rule, we get

$$\widehat{W}_{\mathrm{M}} = -\left(\frac{1}{|\theta|}\right)\widehat{r}\theta_{K3}\left(\theta_{F1}\theta_{K2} - \theta_{K1}\theta_{F2}\right) \tag{6.A.4}$$

$$\widehat{W}_{\mathrm{F}} = \left(\frac{1}{|\theta|}\right)\widehat{r}\theta_{M1}\theta_{K2}\theta_{K3} \tag{6.A.5}$$

$$\widehat{R} = -\left(\frac{1}{|\theta|}\right)\widehat{r}\theta_{M1}\theta_{F2}\theta_{K3} \tag{6.A.6}$$

where $|\theta| = \theta_{M3}(\theta_{F1}\theta_{K2} - \theta_{K1}\theta_{F2}) < 0$ since it is assumed that sector 2 is more female labour-intensive than sector 1.

Total differentiation of (6.5), use of (6.A.4) and rearrangement give

$$\widehat{X}_3 = \widehat{K}_2 + \left(\frac{1}{|\theta|}\right)\widehat{r}\left\{S^3_{K\mathrm{M}}\left(\theta_{F1}\theta_{K2} - \theta_{K1}\theta_{F2}\right)\right\} \tag{6.A.7}$$

Here, S^i_{jk} is the degree of substitution between factors in the ith sector, $i = 1, 2, 3$, for example, in sector 1, $S^1_{FF} = (\partial a_{F1}/\partial W_{\mathrm{F}})(W_{\mathrm{F}}/a_{F1})$, $S^1_{FM} = (\partial a_{F1}/\partial W_{\mathrm{M}})(W_{\mathrm{M}}/a_{F1})$. $S^i_{jk} > 0$ for $j \neq k$ and $S^i_{jj} < 0$. It should be noted that as the production functions are homogeneous of degree one, the factor coefficients, $a_{ji}s$, are homogeneous of degree zero in the factor prices. Hence, the sum of elasticities for any factor of production in any sector with respect to factor prices must be zero. For example, in sector 1, with respect to female labour–output coefficient, we have $(S^1_{FF} + S^1_{FM} + S^1_{FK}) = 0$ and so on. For analytical simplicity, it is assumed that a_{K1} is constant, ruling out any substitution of capital with male and female labour in sector 1. Therefore, $S^1_{KM} = S^1_{KF} = 0$.

By totally differentiating (6.6) and (6.7), we get respectively

$$H\widehat{H} = H_1 E\widehat{E} + H_2\left(W_{\mathrm{M}}\widehat{W}_{\mathrm{M}} + W_{\mathrm{F}}\widehat{W}_{\mathrm{F}}\right) \tag{6.A.8}$$

$$h\widehat{h} = h_1 E\widehat{E} + h_2 W_{\mathrm{F}}\widehat{W}_{\mathrm{F}} \tag{6.A.9}$$

After substituting $(X_3 = K_2/a_{K3})$ from Eq. (6.5) in Eq. (6.8) and totally differentiating Eqs. (6.4), (6.8) and (6.9), one respectively gets

$$\lambda_{K1}\widehat{X}_1 + \lambda_{K2}\widehat{X}_2 + \left(\frac{1}{|\theta|}\right)A\theta_{K3}\widehat{r} = \widehat{K}_1 \tag{6.A.10}$$

$$\lambda_{M1}\widehat{X}_1 + \left(\frac{1}{|\theta|}\right)B\widehat{r} = H_1 E\widehat{E} \tag{6.A.11}$$

$$\lambda_{F1}\widehat{X}_1 + \lambda_{F2}\widehat{X}_2 + \left(\frac{1}{|\theta|}\right)\theta_{K3}C\widehat{r} = h_1 E\widehat{E} \tag{6.A.12}$$

Solving (6.A.10), (6.A.11) and (6.A.12) by Cramer's rule, we get

$$\begin{aligned}\widehat{r} = {} & \left(\frac{\widehat{K}_1}{\Delta}\right)\lambda_{M1}\lambda_{F2} + \left(\frac{\widehat{K}_2}{\Delta}\right)\lambda_{M3}\left(\lambda_{K1}\lambda_{F2} - \lambda_{K2}\lambda_{F1}\right) \\ & + \left(\frac{E\widehat{E}}{\Delta}\right)\left\{H_1\left(\lambda_{F1}\lambda_{K2} - \lambda_{K1}\lambda_{F2}\right) - h_1\alpha\lambda_{M1}\lambda_{K2}\right\}\end{aligned} \tag{6.A.13}$$

where

$$\left.\begin{aligned} A &= -\theta_{M1}\theta_{F2}\lambda_{K2}\underset{(-)}{S^2_{KK}} > 0 \\ B &= \Big[\underset{(-)}{(\theta_{F1}\theta_{K2} - \theta_{K1}\theta_{F2})}\left\{\lambda_{M3}\underset{(+)}{\left(S^3_{KM} + S^3_{MK}\right)} + \theta_{K3}\underset{(-)}{\left(H_2 W_{\mathrm{M}} - \lambda_{M1}S^1_{MM}\right)}\right\} \\ &\quad + \theta_{M1}\theta_{K2}\theta_{K3}\left(\underset{(+)}{\lambda_{M1}S^1_{MF}} - \underset{(+)}{H_2 W_{\mathrm{F}}}\right) \\ C &= \left[\lambda_{F1}S^1_{FM}\left(\theta_{F1}\theta_{K2} - \theta_{K1}\theta_{F2} + \theta_{M1}\theta_{K2}\right) + \theta_{M1}\theta_{K2}h_2 W_{\mathrm{F}} + \lambda_{F2}S^2_{FK}\theta_{M1}\right]\end{aligned}\right\} \tag{6.A.14}$$

and

$$\Delta = \underset{(-)}{\left(\frac{1}{|\theta|}\right)} \left[\begin{array}{l} \lambda_{M1}\theta_{K3}\{\lambda_{K2}\theta_{M1}\theta_{K2}h_2W_{\mathrm{F}} \\ +\lambda_{K2}\lambda_{F2}\theta_{M1}\underset{(+)}{\left(S_{FK}^2 + S_{KF}^2\right)} - (\theta_{F1}\theta_{K2} - \theta_{K1}\theta_{F2} + \theta_{M1}\theta_{K2})\lambda_{K2}\lambda_{F1}\underset{(-)}{S_{FF}^1}\} \\ + \underset{(-)}{(\lambda_{K2}\lambda_{F1} - \lambda_{K1}\lambda_{F2})}\left[\lambda_{M1}\theta_{K3}\theta_{M1}\underset{(-)}{S_{MM}^1}\theta_{F2} + \theta_{M1}\theta_{K3}\left(\lambda_{M1}S_{MF}^1 - H_2W_{\mathrm{F}}\theta_{K2}\right)\right. \\ + \underset{(-)}{(\theta_{F1}\theta_{K2} - \theta_{K1}\theta_{F2})}\{\lambda_{M3}\underset{(+)}{\left(S_{KM}^3 + S_{MK}^3\right)} + \theta_{K3}\underset{(-)}{\left(H_2W_{\mathrm{M}} - \lambda_{M1}S_{MM}^1\right)}\}]] \end{array} \right\} \tag{6.A.15}$$

Since it is assumed that the male labour intensity in sector 1 is not at least less than the female labour intensity in sector 2 with respect to capital, i.e. $\theta_{M1}\theta_{K2} \geq \theta_{K1}\theta_{F2}$, from (6.A.15), it follows that

$$\Delta < 0 \quad \text{if } \lambda_{M1}S_{MF}^1 \leq H_2W_{\mathrm{F}}\theta_{K2} \tag{6.A.15.1}$$

Now, if (6.A.15.1) holds, then from (6.A.14) we have $A > 0$, $B < 0$ and $C > 0$. Substituting (6.A.13) in (6.A.4) and (6.A.5) yields

$$\begin{aligned} \widehat{W}_{\mathrm{M}} = &-\left[\underset{(-)}{\left(\frac{\widehat{K}_1}{(|\theta|\,\Delta)}\right)}\theta_{K3}\lambda_{M1}\lambda_{F2}\underset{(-)}{(\theta_{F1}\theta_{K2} - \theta_{K1}\theta_{F2})}\right] \\ &-\left[\underset{(-)}{\left(\frac{\widehat{K}_2}{(|\theta|\,\Delta)}\right)}\theta_{K3}\lambda_{M3}\underset{(+)}{(\lambda_{K1}\lambda_{F2} - \lambda_{K2}\lambda_{F1})}\underset{(-)}{(\theta_{F1}\theta_{K2} - \theta_{K1}\theta_{F2})}\right] \\ &-\left[\underset{(-)}{\left(\frac{E\widehat{E}}{|\theta|\,\Delta}\right)}\theta_{K3}\underset{(-)}{\{H_1(\lambda_{F1}\lambda_{K2} - \lambda_{K1}\lambda_{F2}) - h_1\alpha\lambda_{M1}\lambda_{K2}\}}\underset{(-)}{(\theta_{F1}\theta_{K2} - \theta_{K1}\theta_{F2})}\right] \end{aligned} \tag{6.A.16}$$

and

$$\begin{aligned} \widehat{W}_{\mathrm{F}} = &\left[\underset{(-)}{\left(\frac{\widehat{K}_1}{(|\theta|\,\Delta)}\right)}\theta_{K3}\theta_{M1}\theta_{K2}\lambda_{M1}\lambda_{F2}\right] + \left[\underset{(-)}{\left(\frac{\widehat{K}_2}{(|\theta|\,\Delta)}\right)}\theta_{K3}\theta_{M1}\theta_{K2}\lambda_{M3}\underset{(+)}{(\lambda_{K1}\lambda_{F2} - \lambda_{K2}\lambda_{F1})}\right] \\ &+\left[\underset{(-)}{\left(\frac{E\widehat{E}}{(|\theta|\,\Delta)}\right)}\theta_{K3}\theta_{M1}\theta_{K2}\underset{(-)}{\{H_1(\lambda_{F1}\lambda_{K2} - \lambda_{K1}\lambda_{F2}) - h_1\alpha\lambda_{M1}\lambda_{K2}\}}\right] \end{aligned} \tag{6.A.17}$$

If (6.A.15.1) holds, the effects of changes in different parameters on male and female wages can be obtained as follows:

$$\left.\begin{array}{r}\text{(i)}\;\; \widehat{W}_{\mathrm{M}} > 0 \text{ and } \widehat{W}_{\mathrm{F}} > 0 \text{ when } \widehat{K}_1 > 0 \\ \text{(ii)}\;\; \widehat{W}_{\mathrm{M}} > 0 \text{ and } \widehat{W}_{\mathrm{F}} > 0 \text{ when } \widehat{K}_2 > 0 \\ \text{(iii)}\;\; \widehat{W}_{\mathrm{M}} < 0 \text{ and } \widehat{W}_{\mathrm{F}} < 0 \text{ when } \widehat{E} > 0\end{array}\right\} \tag{6.A.18}$$

Total differentiation of Eq. (6.15) yields

$$W_{\mathrm{I}}\widehat{W}_{\mathrm{I}} = W_{\mathrm{M}}H\left(\widehat{H} + \widehat{W}_{\mathrm{M}}\right) - W_{\mathrm{F}}h\left(\widehat{h} + \widehat{W}_{\mathrm{F}}\right)$$

Use of Eqs. (6.A.8) and (6.A.9) yields

$$\begin{aligned} W_{\mathrm{I}}\widehat{W}_{\mathrm{I}} = {} & W_{\mathrm{M}}\left\{H_1 E\widehat{E} + H_2\left(W_{\mathrm{M}}\widehat{W}_{\mathrm{M}} + W_{\mathrm{F}}\widehat{W}_{\mathrm{F}}\right)\right\} + W_{\mathrm{M}}H\widehat{W}_{\mathrm{M}} \\ & - W_{\mathrm{F}}\left(h_1 E\widehat{E} + h_2 W_{\mathrm{F}}\widehat{W}_{\mathrm{F}}\right) - W_{\mathrm{F}}h\widehat{W}_{\mathrm{F}} \\ = {} & E\widehat{E}\left(W_{\mathrm{M}}H_1 - W_{\mathrm{F}}h_1\right) + W_{\mathrm{M}}\widehat{W}_{\mathrm{M}}\left(H_2W_{\mathrm{M}} + H\right) + W_{\mathrm{F}}\widehat{W}_{\mathrm{F}}\left(H_2W_{\mathrm{M}} - h_2W_{\mathrm{F}} - h\right) \end{aligned} \tag{6.A.19}$$

Now the effects of $\widehat{K}_1 > 0$, $\widehat{K}_2 > 0$ and $\widehat{E} > 0$ on $\widehat{W}_{\mathrm{I}}$ are obtained by substitution of (6.A.4) and (6.A.5) in (6.A.19) and expressed in Eqs. (6.16), (6.18) and (6.19), respectively.

Appendix 6.2: Effects of Different Policies on Welfare

Differentiating (6.10) and (6.12.1), one gets

$$\begin{aligned}\left(\frac{dU}{U_1}\right) = {} & dD_1 + P_2dD_2 + P_3^* dD_3 = dX_1 + P_2dX_2 + P_3^* dX_3 \\ & - RdK_{\mathrm{F1}} - rdK_{\mathrm{F2}} - dE\end{aligned} \tag{6.A.20}$$

Differentiation of (6.14) gives

$$dY = dX_1 + P_2dX_2 + P_3^* dX_3 + tP_3dI + P_3Idt - RdK_{\mathrm{F1}} - rdK_{\mathrm{F2}} - dE \tag{6.A.21}$$

Note that the production functions in the two sectors are given by $X_1 = Q^1(M_1, F_1, K_1^1)$, $X_2 = Q^2(F_2, K_2^1)$ and $X_3 = Q^3(M_3, K_3^2)$. The full-employment conditions for the four factors are given by $M_1 + M_3 = W_{\mathrm{M}}H(.)$; $F_1 + F_2 = W_{\mathrm{F}}h(.)$; $K_1^1 + K_2^1 = K_{\mathrm{D1}} + K_{\mathrm{F1}} = K_1$ and $K_3^2 = K_{\mathrm{D2}} + K_{\mathrm{F2}} = K_2$ where K_j^i is the employment of capital of type i in the jth sector. Now, $dM_1 + dM_3 = W_{\mathrm{M}}\{H_1dE + H_2(dW_{\mathrm{M}} + dW_{\mathrm{F}})\}$; $dK_1^1 + dK_2^1 = dK_{F1}$; $dK_3^2 = dK_{F2}$ and $dF_1 + dF_2 = W_{\mathrm{F}}(h_1dE + h_2dW_{\mathrm{F}})$.

Also $P_iQ_j^i$ is the value of the marginal product of the jth factor in the ith sector, which is equal to the factor price.

Hence, by differentiating production functions, from Eq. (6.A.21), we get

$$\begin{aligned} dY &= Q_F^1 dF_1 + Q_K^1 dK_1^1 + Q_M^1 dM_1 + P_2\left(Q_F^2 dF_2 + Q_K^2 dK_2^1\right) \\ &\quad + P_3^*\left(Q_M^3 dM_3 + Q_K^3 dK_3^2\right) + tP_3 dI - RdK_{F1} - rdK_{F2} - dE \\ &= \left(W_{\mathrm{F}} dF_1 + RdK_1^1 + W_{\mathrm{M}} dM_1\right) + \left(W_{\mathrm{F}} dF_2 + RdK_2^1\right) \\ &\quad + \left(W_{\mathrm{M}} dM_3 + rdK_3^2\right) + tP_3 dI - RdK_{F1} - rdK_{F2} - dE \\ &= W_{\mathrm{F}} F\left(h_1 dE + h_2 dW_{\mathrm{F}}\right) + W_{\mathrm{M}} M\left\{H_1 dE + H_2\left(dW_{\mathrm{M}} + dW_{\mathrm{F}}\right)\right\} + rdK_{F2} \\ &\quad + RdK_{F1} + tP_3 dI - RdK_{F1} - rdK_{F2} - dE \\ &= dW_{\mathrm{F}}\left(W_{\mathrm{F}} F h_2 + W_{\mathrm{M}} M H_2\right) + dW_{\mathrm{M}} W_{\mathrm{M}} M H_2 + dE\left(W_{\mathrm{F}} F h_1\right. \\ &\quad \left. + W_{\mathrm{M}} M H_1 - 1\right) + tP_3 dI \end{aligned} \tag{6.A.22}$$

Differentiating (6.13) and using (6.A.22), we get

$$\begin{aligned} dI = \left(\frac{\partial D_3}{\partial P_3^*}\right) dP_3^* + \left(\frac{\partial D_3}{\partial Y}\right) &\left[dW_{\mathrm{F}}\left(W_{\mathrm{F}} F h_2 + W_{\mathrm{M}} M H_2\right) + dW_{\mathrm{M}} W_{\mathrm{M}} M H_2\right. \\ &\left. + dE\left(W_{\mathrm{F}} F h_1 + W_{\mathrm{M}} M H_1 - 1\right) + tP_3 dI\right] - dX_3 \end{aligned}$$

or

$$\begin{aligned} dI\left[1 - tP_3\left(\frac{\partial D_3}{\partial Y}\right)\right] = \left(\frac{\partial D_3}{\partial P_3^*}\right) dP_3^* + \left(\frac{m}{P_3^*}\right) &\left[dW_{\mathrm{F}}\left(W_{\mathrm{F}} F h_2 + W_{\mathrm{M}} M H_2\right)\right. \\ &+ dW_{\mathrm{M}} W_{\mathrm{M}} M H_2 + dE\left(W_{\mathrm{F}} F h_1 + W_{\mathrm{M}} M H_1 - 1\right) \\ &\left. + tP_3 dI\right] - dX_3 \end{aligned}$$

or

$$\begin{aligned} dI = V\Bigg[ZP_3 dt + \left(\frac{m}{P_3^*}\right) &\left\{dW_{\mathrm{F}}\left(W_{\mathrm{F}} F h_2 + W_{\mathrm{M}} M H_2\right) + dW_{\mathrm{M}} W_{\mathrm{M}} M H_2\right. \\ &\left. + dE\left(W_{\mathrm{F}} F h_1 + W_{\mathrm{M}} M H_1 - 1\right) + tP_3 dI\right\} - dX_3\Bigg] \end{aligned} \tag{6.A.23}$$

where $m = P_3^*(\partial D_3/\partial Y)$ is the marginal propensity to consume commodity 3; $V = [(1+t)/\{(1+t(1-m)\}] = \{1+(tmV/(1+t)\} > 0$; and $Z = [(\partial D_3/\partial P_3{*}) + D_3(\partial D_3/\partial Y)] < 0$ is the Slutsky's pure substitution term.

Using (6.A.20) and (6.A.23) and arranging terms, one gets

$$\begin{aligned} \left(\frac{dU}{U_1}\right) = V &\left[dW_{\mathrm{F}}\left(W_{\mathrm{F}} F h_2 + W_{\mathrm{M}} M H_2\right) + dW_{\mathrm{M}} W_{\mathrm{M}} M H_2\right. \\ &\left. + dE\left(W_{\mathrm{F}} F h_1 + W_{\mathrm{M}} M H_1 - 1\right)\right] - tP_3 V dX_3 \end{aligned} \tag{6.A.24}$$

Now substituting (6.A.13) in (6.A.7), one gets

$$
\begin{aligned}
\widehat{X}_3 = {} & \widehat{K}_1 \Bigg[\underset{(-)}{\left(\frac{S^3_{KM}}{\Delta\,|\theta|} \right)} \underset{(-)}{(\theta_{F1}\theta_{K2} - \theta_{K1}\theta_{F2})} \lambda_{M1}\lambda_{F2} \Bigg] \\
& + E\widehat{E} \Bigg[\underset{(-)}{\left(\frac{S^3_{KM}}{\Delta\,|\theta|} \right)} \underset{(-)}{(\theta_{F1}\theta_{K2} - \theta_{K1}\theta_{F2})} \{ \underset{(-)}{H_1 (\lambda_{F1}\lambda_{K2} - \lambda_{K1}\lambda_{F2}) - h_1\lambda_{M1}\lambda_{K2}} \} \Bigg] \\
& + \widehat{K}_2 \underset{(-)}{\left(\frac{1}{\Delta\,|\theta|} \right)} \big[\lambda_{M1}\theta_{K3} \{ \lambda_{K2}\theta_{M1}\theta_{K2}h_2W_{\mathrm{F}} + \lambda_{K2}\lambda_{F2}\theta_{M1} \underset{(+)}{\left(S^2_{FK} + S^2_{KF} \right)} \\
& - (\theta_{F1}\theta_{K2} - \theta_{K1}\theta_{F2} + \theta_{M1}\theta_{K2}) \lambda_{K2}\lambda_{F1} \underset{(-)}{S^1_{FF}} \} + \underset{(-)}{(\lambda_{K2}\lambda_{F1} - \lambda_{K1}\lambda_{F2})} \big[\lambda_{M1}\theta_{K3}\theta_{M1} \underset{(-)}{S^1_{MM}} \theta_{F2} \\
& + \theta_{M1}\theta_{K3} \left(\lambda_{M1}S^1_{MF} - H_2W_{\mathrm{F}}\theta_{K2} \right) + \underset{(-)}{(\theta_{F1}\theta_{K2} - \theta_{K1}\theta_{F2})} \{ \lambda_{M3}S^3_{KM} \\
& + \theta_{K3} \underset{(-)}{\left(H_2W_{\mathrm{M}} - \lambda_{M1}S^1_{MM} \right)} \} \big] \big]
\end{aligned}
\tag{6.A.25}
$$

Use of (6.A.15.1) and (6.A.25) yields the following:

$$
\left.
\begin{aligned}
&\text{(i)}\ \ \widehat{X}_3 < 0 \text{ when } \widehat{K}_1 > 0 \\
&\text{(ii)}\ \ \widehat{X}_3 > 0 \text{ when } \widehat{K}_2 > 0 \\
&\text{(iii)}\ \ \widehat{X}_3 > 0 \text{ when } \widehat{E} > 0
\end{aligned}
\right\}
\tag{6.A.26}
$$

Substituting (6.A.16), (6.A.17) and (6.A.25) in (6.A.24), one gets

$$
\frac{1}{U_1}\left(\frac{dU}{dK_1}\right) = V\left[\underset{(+)}{\left(\frac{dW_{\mathrm{F}}}{dK_1}\right)} \underset{(+)}{(W_{\mathrm{F}}Fh_2 + W_{\mathrm{M}}MH_2)} + \underset{(+)}{\left(\frac{dW_{\mathrm{M}}}{dK_1}\right)} W_{\mathrm{M}}MH_2\right] - tP_3V \underset{(-)}{\left(\frac{dX_3}{dK_1}\right)}
\tag{6.A.27}
$$

From (6.A.27) it follows that $dU/dK_1 > 0$, which means that an inflow of foreign capital of type 1 is welfare improving.

From (6.A.24) we have

$$
\frac{1}{U_1}\left(\frac{dU}{dK_2}\right) = V\left[\underset{(+)}{\left(\frac{dW_{\mathrm{F}}}{dK_2}\right)} (W_{\mathrm{F}}Fh_2 + W_{\mathrm{M}}MH_2) + \underset{(+)}{\left(\frac{dW_{\mathrm{M}}}{dK_2}\right)} W_{\mathrm{M}}MH_2\right] - tP_3V \underset{(+)}{\left(\frac{dX_3}{dK_2}\right)}
\tag{6.A.28}
$$

From (6.A.28) we find that $dU/dK_2 > 0$ and that welfare improves owing to an inflow of foreign capital of type 2 if the sum of the two positive terms within the square brackets is greater than the negative term within the parentheses. Why this can happen has been explained intuitively in Sect. 6.4.1.

From (6.A.24) we get

$$\frac{1}{U_1}\left(\frac{dU}{dE}\right) = V\left[\underset{(-)}{\left(\frac{dW_F}{dE}\right)}\underset{(+)}{(W_F F h_2 + W_M M H_2)} + \underset{(-)}{\left(\frac{dW_M}{dE}\right)} W_M M H_2\right.$$
$$\left. + (W_F F h_1 + W_M M H_1 - 1) - t P_3 V \underset{(+)}{\left(\frac{dX_3}{dE}\right)}\right] \tag{6.A.29}$$

From (6.A.29) it follows that $dU/dE < 0$ if $(W_F F h_1 + W_M M H_1) \leq 1$.

References

Altonji J, Hayashi F, Kotlikoff LJ (1992) Is the extended family altruistically linked? Direct tests using micro data. Am Econ Rev 82(5):1177–1198

Anderson S, Baland JM (2002) The economics of roscas and intra-household resource allocation. Q J Econ 117(3):963–995

Balakrishnan R (2002) The hidden assembly line: gender dynamics of subcontracted work in a global economy. Kumarian Press, Bloomfield

Berik G, Rodgers Y, Zveglich J (2004) International trade and gender wage discrimination: evidence from East Asia. Rev Dev Econ 8(2):237–254

Bisgrove EZ, Popkin BM (1996) Does women's work improve their nutrition: evidence from the urban Philippines. Soc Sci Med 43(10):1475–1488

Bliss CJ, Stern NH (1978) Productivity, wages, and nutrition, Parts I and II. J Dev Econ 5(4): 331–362

Braunstein E, Brenner M (2007) Foreign direct investment and gendered wages in urban China. Fem Econ 31(3–4):213–237

Brecher RA, Diaz Alejandro CF (1977) Tariffs, foreign capital and immiserizing growth. J Int Econ 7:317–322

Carr M, Chen M, Tate J (2000) Globalization and home-based workers. Fem Econ 6(3):123–142

Caves RE, Frankel JA, Jones RW (1990) World trade and payments, 5th edn. Scott/Foresman/Little/Brown Higher Education, London

Chaudhuri S (2005) Labour market distortion, technology transfer and gainful effects of foreign capital. Manch Sch 73(2):214–227

Chaudhuri S (2007) Foreign capital, welfare and unemployment in the presence of agricultural dualism. Jpn World Econ 19(2):149–165

Chaudhuri S, Mukhopadhyay U (2009) Revisiting the informal sector: a general equilibrium approach. Springer, New York

Chaudhuri S, Yabuuchi S, Mukhopadhyay U (2006) Inflow of foreign capital and trade liberalization in a model with an informal sector and urban unemployment. Pac Econ Rev 11:87–103

Corley M, Perardel Y, Popova K (2005) Wage inequality by gender and occupation: a cross-country analysis, Employment strategy papers no. 20. International Labour Office, Geneva

Duncan T (1997) Incomes, expenditures and health outcomes: evidence on intrahousehold resource allocation. In: Haddad L, Hoddinott J, Alderman H (eds) Intrahousehold resource allocation in developing countries: models, methods and policy. The Johns Hopkins University Press, Baltimore/London

Fiske ST (1998) Stereotyping, prejudice, and discrimination. In: Fiske ST, Gilbert DT, Lindsay G (eds) The handbook of social psychology, vol 2. McGraw Hill, New York, pp 357–414

Goldin C (2002) A pollution theory of discrimination: male and female differentials in occupations and earnings. NBER working paper No. 8985, Cambridge, MA

Guyer J (1988) Dynamic approaches to domestic budgeting: cases and methods from Africa. In: Dwyer D, Bruce J (eds) A home divided: women and income in the third world. Stanford University Press, Stanford

Herz B, Sperling GB (2004) What works in girls' education, Evidence and policies from the developing world. Council on Foreign Relations, New York

Hoddinott J, Haddad L (1995) Does female income share influence household expenditure? Evidence from Cote d'Ivoire'. Oxf Bull Econ Stat LVII:77–97

Jones RW (1971) A three-factor model in theory, trade and history. In: Bhagwati J et al (eds) Trade, balance of payments and growth. North-Holland, Amsterdam

Kabeer N (2000) The power to choose: Bangladeshi women and labour market decisions in London and Dhaka. Verso, London

Kao C, Polachek S, Wunnava P (1994) Male–female wage differentials in Taiwan: a human capital approach. Econ Dev Cult Change 42(2):351–374

Kurz KM, Welch CJ (2000) Enhancing nutrition results: the case for a women's resources approach. International Center for Research on Women, Washington, DC

Kusago T, Barham B (2001) Preference heterogeneity, power, and intrahousehold decision-making in rural Malaysia. World Dev 29(7):1237–1256

Leibenstein H (1957) Economic backwardness and economic growth. Wiley, New York

Marjit S, Beladi H (1996) Protection and gainful effects of foreign capital. Econ Lett 53:311–326

Marjit S, Broll U, Mitra S (1997) Targeting sectors for foreign capital inflow in a small developing economy. Rev Int Econ 5:101–106

Mukhopadhyay, Chaudhuri (2013) Economic liberalization, gender wage inequality and welfare. J Int Trade Econ Dev 22(8):1214–1239

Oostendorp R (2004) Globalization and the gender wage gap, World Bank policy research working paper 3256. World Bank, Washington, DC

Park C (2001) Is extended family in low-income countries altruistically linked? Evidences from Bangladesh. Working paper no. 0107. SCAPE, National University of Singapore, Singapore

Polachek SW (2004) How the human capital model explains why the gender wage gap narrowed. Discussion paper No. 1102, The Institute for the Study of Labor (IZA), Bonn

Quisumbing AR, Haddad L, Meinzen-Dick R, Brown LR (1998) Gender issues for food security in developing countries: implications for project design and implementation. Can J Dev Stud XIX(Special Issue):185–208

Ramachandran N (2006) Women and food security in South Asia: current issues and emerging concerns. UNU – WIDER research paper no. 131, Helsinki

Seguino S (2000) The effects of structural change and economic liberalization on gender wage differentials in South Korea and Taiwan. Camb J Econ 24(4):437–459

Seguino S (2002) Promoting gender equality through labor standards and living wages: an exploration of the issues. Paper prepared for presentation at global labor standards and living wages conference, PERI, Amherst, MA, 19–20 April 2002

Sen G, Östlin P (2007) Unequal, unfair, ineffective and inefficient gender inequity in health: why it exists and how we can change it, Final report to the WHO commission on social determinants of health. National Collaborating Centre for Determinants of Health, Antigonish

Sharma N (2007) Gender inequality and women's health: an empirical study of the factors affecting their health. Paper presented at the annual meeting of the Southern Political Science Association, New Orleans, LA, 03 Jan 2007. http://www.allacademic.com/meta/p143276_index.html

Siegmann KA (2006) Globalisation, gender and equity – effects of foreign direct investment on labour markets in rural Indonesia. J Econ 3(1):113–130

UNCTAD (1999) World investment report. United Nations, New York
UNICEF (2007) Women and children: The Double Dividend of Gender Equality, New York
Vijaya RM, Kaltani L (2007) Foreign direct investment and wages: a bargaining power approach. J World-Syst Res 13(1):83–95
Von Braun J, Kennedy E (1994) Agricultural commercialisation, economic development and nutrition. The Johns Hopkins University Press for IFPRI, Baltimore

Chapter 7
FDI and Unemployment

7.1 Introduction

The persistence of unemployment of labour is a disconcerting feature of the developing countries. The explanation of unemployment as a general equilibrium phenomenon depends on the type of labour, unskilled or skilled, under consideration. If a worker is choosy in selecting jobs and is therefore voluntarily unemployed, he must be having the privilege of a family support system. On the contrary, if a worker is unemployed even though he is willing to work at a lower wage, it is involuntary unemployment and is a matter of serious concern to the economists and policymakers.

The developing countries are characterized by the existence of economic dualism, whereby the labour market, like the other factor markets, is also dualistic. Harris and Todaro (1970) (HT) had explained the process of labour migration and unemployment in a dualistic framework and introduced the notion that intersectoral labour reallocation is affected not only by the intersectoral wage gap but also by the probability of obtaining an urban job.

During the last 50 years, there has been unprecedented growth of population and massive urbanization, the latter mainly due to rural-urban migration. Economic development has failed to generate adequate employment and income opportunities in the modern sector, so that the surplus urban labour force has been compelled to generate its own means of employment and survival. The HT model proposes that all potential rural migrants aim at urban modern sector employment but does not explain the movement of those targeting the urban subsistence sector employment. It was Fields (1975) who pointed out that there were three choices for migrants: a formal sector job, open urban unemployment, or a job in the urban informal sector.

S. Chaudhuri and U. Mukhopadhyay, *Foreign Direct Investment in Developing Countries: A Theoretical Evaluation*, DOI 10.1007/978-81-322-1898-2_7, © Springer India 2014

Hence, the informal sector can be viewed as a holding ground for workers awaiting entry into the modern sector, and it is motivated by the objective of employment generation rather than profit maximization.[1]

7.2 Some of the Theoretical Explanations of Unemployment

The persistence of involuntary unemployment in developing economies can be explained by labour market imperfection. Unemployment may arise in the urban sector if the wage rate is rigid downwards and does not fall even if there is excess supply of labour. There are a few alternative theories that explain wage rigidity and the existence of unemployment. First, in some models, wage rigidity arises from a variety of institutional forces that may include minimum wages, trade unions (Lin 1989; Park 1991; Yoo 1995), government pay policy (Gindling 1991), etc. Firms would prefer to pay lower wages and employ more labour if they could reduce wages, but here they are legally disallowed to do so. Employment is lower in the presence of wage rigidity than it would be with complete wage flexibility. Higher-than-market-clearing wages for institutional reasons in the formal sector is the core feature of many economic models like the Keynesian macroeconomic model, Lewis's classical development model (1954) and dualistic labour market model of HT.

The second kind of models (above-market-clearing wages set on the supply side) assumes that although there is no binding on wages to fall, it is the workers who do not bid wages down (Bardhan and Rudra 1981; Drèze and Mukherjee 1989; Solow 1990; Osmani 1991). This is known as the 'collusive theory of unemployment'. Suppose that wages in a labour market are above the market-clearing level for some reason – for example, because the wage was set in the peak season and the economy is now in the slack season. In case the demand for labour is inelastic, each of the unemployed knows that he will earn more on average over the course of many days if he does not undercut the established wage. Here, wages are kept above the market-clearing level by the behaviour of the unemployed, and unemployment persists as a result.

Another important type of model that explains inflexibility of wage and persistence of unemployment is the one where wage rate is determined through unionization of labour and collective bargaining. Collective bargaining is the process of negotiation whereby workers organize collectively and bargain with employers regarding the terms and conditions of employment of employees, such as wages, working conditions, hours of work, etc. Through the offers of negotiation, threat of strike, actual strike, etc., they exert pressure on the employers in order to secure higher wages, reduced hours of work, share in profits and other benefits. Assuming that each formal sector firm has a separate trade union, the unionized

[1]For a detailed discussion on the evolution, definition and role of the informal sector in the developing economies, see Chaudhuri and Mukhopadhyay (2009), chapter 1.

wage function may be derived as a solution to the Nash bargaining game between the representative firm and the representative union in the formal sector (Norback 2001; Chaudhuri 2003; Chaudhuri and Mukhopadhyay 2009, etc.). In this type of model, the firm's bargaining power depends on the right to lockout or fire, whereas the union's power depends on the right to organize and strike. Owing to the firm-specific human capital embodied in the workforce, firms do not always sack all workers the moment they strike. If there were a strike or lockout, both the parties would lose due to the loss of firm revenue from which to pay wages and obtain profit. Thus usually both parties have an incentive to negotiate and wages are settled above the market-clearing levels. In other words, wages are kept above the equilibrium level since both workers and employers agree to accept it through collective bargaining.

An alternative explanation is provided by the efficiency wage theory, which postulates that profit-maximizing firms will pay higher-than-market-clearing wages if and only if the gains in productivity from doing so outweigh the costs, so that profits are higher. This mechanism was conceptualized by Leibenstein (1957). He asserted that the nutritional efficiency of a worker depends positively on his consumption level at least up to a certain level of consumption. Therefore, an increase in the consumption level raises the nutritional efficiency, i.e. productivity of the worker. The 'consumption efficiency hypothesis' is the earliest version[2] of the efficiency wage theory and is applicable to the poor unskilled workers who are at or slightly above their subsistence consumption level.

The more recent versions of the efficiency wage theory have usefully analysed the mechanisms by which productivity gains are realized. These fall into two major categories. One set of explanations is that higher wages enable firms to hire better-quality workers from a heterogeneous pool of labour. They may, for example, hire workers who have more education and are expected to be more productive. Alternatively, they may administer tests of potential job performance and hire those workers who perform the best on these tests and thus avoid the adverse selection problem. The other set of explanation is that higher wages induce workers of a given skill level to perform in a more productive manner. The mechanisms analysed here include better nutrition, improved morale, reduced shirking (moral hazard), lower labour turnover, reduced absenteeism and greater discretionary effort. Hence in the efficiency wage models, wages remain above the market-clearing level because firms prefer to pay higher wages in their profit-maximizing interest. Put differently, a firm that is paying efficiency wages would hurt its profits if it lowered wages.

The HT type of model is yet another way to explain unemployment in a general equilibrium framework where the efficiency of each worker is considered to be exogenously given and equal to unity. However, in such a model, unemployment is specific to the urban sector and is suitable to explain unemployment of unskilled labour only. But it does not account for the unemployment of skilled labour, which is a disquieting problem in developing economies and aggravated particularly after the global economic slowdown.

[2]The hypothesis was later developed by Bliss and Stern (1978), Dasgupta and Ray (1986), etc.

It is important to note that in an economy the possibility of being unemployed also rises with increasing education and skills. In the case of India, NSSO surveys conducted over the years show that the unemployment rate among those educated above the secondary level was higher, in both rural and urban areas, than those with lesser educational attainments. The NSSO 61st round report, *Employment and Unemployment Situation in India 2004–05*, attributes this to the fact that 'the job seekers become gradually more and more choosers as their educational level increases'. Serneels (2007) has found that in Ethiopia, unemployment is concentrated among the relatively well-educated first-time jobseekers who come from the middle classes.

In order to theoretically explain the existence of unemployment of skilled labour, one has to recourse to the efficiency wage theories. One version of efficiency wage theory is based upon the work of Shapiro and Stiglitz (1984) where the work effort of a worker is positively related to both the wage rate and the unemployment rate. A more generalized version of efficiency wage theory is the 'fair wage hypothesis' (FWH). Akerlof and Yellen (1990), Feher (1991), Agell and Lundborg (1992, 1995), etc., have explained unemployment as a general equilibrium phenomenon using the FWH. According to the treatment of the FWH by Agell and Lundborg (1992, 1995), the efficiency of a worker is sensitive to the functional distribution of income. Consequently, the return on capital and wage rates of labour and the unemployment rate appear as arguments in the efficiency function.

Let us now discuss some of the attempts that can be made to examine the link between unemployment and the liberalized investment policy in a general equilibrium set-up.

7.3 FDI in 2-Sector Mobile Capital HT Model

We present the essence of the basic 2×2 mobile capital version of the HT model, which is also known as the Corden and Findlay (1975) model. A small open economy with two sectors, rural (sector 1) and urban (sector 2), is considered. Sector 1 produces an agricultural commodity using labour and capital, while sector 2 produces a manufacturing good using the same two inputs. Capital is perfectly mobile between the two sectors and its economy-wide return is r. Labour is also perfectly mobile intersectorally although the wage rates differ. Workers in the urban sector are unionized and receive a higher wage, $\overline{W}$, than their counterparts in the rural sector who receive a low competitive wage, W. So $\overline{W} > W$, and this intersectoral wage differential leads to rural-urban migration of labour. Markets are perfectly competitive except the urban labour market. It is assumed that production functions of the two sectors exhibit constant returns to scale with positive but diminishing marginal productivity to each factor. Finally, commodity 1 is taken to be the numeraire.

The usual zero-profit conditions for the two sectors are as follows:

$$Wa_{L1} + ra_{K1} = 1 \tag{7.1}$$

$$\overline{W}a_{L2} + ra_{K2} = P_2 \tag{7.2}$$

where a_{ji} is the amount of the jth factor required to produce 1 unit of commodity i, where $j = L, K$ and $i = 1, 2$.

The full-utilization condition for capital is given by

$$a_{K1}X_1 + a_{K2}X_2 = K \tag{7.3}$$

There is unemployment of labour in the urban sector which is denoted by L_{U}. So the labour endowment equation is as follows:

$$a_{L1}X_1 + a_{L2}X_2 + L_{\mathrm{U}} = L \tag{7.4}$$

Finally, the HT migration equilibrium condition is given by

$$\left(\frac{\overline{W}a_{L2}X_2}{a_{L2}X_2 + L_{\mathrm{U}}}\right) = W \tag{7.5}$$

Equation (7.5) states that in the migration equilibrium, the expected urban wage must be equal to the rural sector wage. Using (7.4), Eq. (7.5) may be rewritten as follows:

$$\left(\frac{\overline{W}}{W}\right) a_{L2}X_2 + a_{L1}X_1 = L \tag{7.5.1}$$

Sectors can be classified in terms of relative factor intensities. It is assumed that sector 1 (sector 2) is more labour (capital)-intensive than the other sector in value sense, i.e. $\left(Wa_{L1}/a_{K1} > \overline{W}a_{L2}/a_{K2}\right)$. This automatically implies that sector 1 is more labour-intensive vis-à-vis sector 2 in both value sense and physical sense.

The general equilibrium structure consists of Eqs. (7.1), (7.2), (7.3), (7.4) and (7.5.1) and five endogenous variables are W, r, X_1, X_2 and L_{U}. This is a decomposable production structure. So factor prices depend on commodity prices but not on factor endowments. Given $\overline{W}$, r is obtained from Eq. (7.2). Inserting the value of r in (7.1), W is obtained. Once factor prices are known, factor coefficients, a_{ji} s, are also known. The equilibrium values of X_1 and X_2 are determined from Eqs. (7.3) and (7.5.1). Finally, L_{U} is obtained from (7.4).

From (7.5.1), one can write

$$\left(\frac{\overline{W}a_{L2}X_2 + Wa_{L1}X_1}{L}\right) = W \tag{7.5.2}$$

Equation (7.5.2) states that the average wage of all workers in an HT economy is always equal to the rural sector wage.

The HT equilibrium is Pareto-suboptimal for two reasons. First, the wages across sectors are not equalized and an urban-rural wage differential persists, and secondly, there exists urban unemployment in the migration equilibrium.

The basic HT model has been reexamined and extended by different authors in different directions. However, most of the authors have come to the same broad conclusion that in the presence of rural-urban wage differential, the urban development policies cannot mitigate the problem of unemployment in the urban sector and therefore indicate to a rural development programme as a possible solution to the problem. For example, an urban sector development policy like that of a liberalized investment policy raises the urban unemployment of labour in the new migration equilibrium. This can be easily seen using the general equilibrium set-up we have just outlined.

In order to analyse the effect of an inflow of foreign capital on the urban unemployment level, we rewrite the capital endowment Eq. (7.3) as follows:

$$a_{K1}X_1 + a_{K2}X_2 = K_{\mathrm{D}} + K_{\mathrm{F}} = K \tag{7.3.1}$$

where K_{D} and K_{F} denote domestic and foreign capital stocks in the economy, respectively, and they are perfect substitutes. The earnings from foreign capital are completely repatriated.

Owing to a liberalized investment policy, the stock of foreign capital and hence the aggregate capital stock would increase. This produces a Rybczynski effect which expands sector 2 and contracts sector 1 since sector 2 (urban sector) is more capital-intensive than sector 1 (rural sector) in value sense. New jobs are created in the urban sector which paves the way for a fresh migration of labour from sector 1 to sector 2. But the number of new migrants is greater than the number of new jobs created in the urban sector. Consequently, the level of unemployment in the urban sector rises.

So the following proposition is now imminent.

Proposition 7.1 *In a two-sector mobile capital HT model, an inflow of foreign capital increases the urban unemployment level.*

This result is surprising because capital scarcity is held responsible for the existence of unemployment in the capital-scarce developing economies. But, an inflow of capital from outside or even domestic capital formation raises the level of unemployment. On the other hand, population growth lowers urban unemployment. This damaging property of the two-sector mobile capital HT model can be rectified at least partially if each of the two sectors uses a specific capital.[3]

[3]Beladi and Naqvi (1988) have also found this result by inclusion of a scarce factor (a specific input, say, land) in the rural sector.

7.4 FDI in a 3-Sector Job Search Model

Job search is an integral part of the labour market in all economies whether developed or developing. It is often held that the search process is most efficient when the worker is unemployed. Search unemployment exists because both jobs and workers are heterogeneous, and a mismatch can result between the characteristics of supply and demand. Such a mismatch can be related to skills, payment, work time, location, seasonal industries, attitude, taste and several other factors. New entrants and re-entrants can also suffer a spell of search unemployment. Workers as well as employers accept a certain level of imperfection, risk or compromise, but usually not right away; they will invest some time and effort to find a better match. This is in fact beneficial to the economy since it results in a more efficient allocation of economic resources.

Originally, the search theory was formulated to analyse unemployment, and later, it was extended to highlight many things like unemployment duration, job matching and on-the-job search. The idea of job search has been incorporated in many theoretical models, the most important of which are McCall (1970), Majumder (1975), Fields (1975, 1989), Stark (1982), Adam and Cletus (1995), Postel-Vinay and Robin (2002), Hussey (2005), Sheng and Xu (2007), Flinn and Mabli (2008), Dolado et al. (2009), Arseneau and Chugh (2009), Macit (2010), etc.

McCall (1970) first used the job search theory to analyse the decision-making process of a jobseeker. Fields (1975) introduced on-the-job search from the agricultural sector into a two-sector HT-type model with constant rural wage. In this model, he showed that the urban unemployment rate would be lower than what was predicted by the HT (1970) model. Fields (1989) distinguished between ex ante and ex post allocation of labour. This is justified when people searching jobs stay at a sector and get jobs in the other sector. Such distinction is the unique feature of Fields' (1989) model. On the other hand, Majumder (1975) shows that the 'graduation theory'[4] fails if the urban formal sector directly recruits from the rural sector.

Sheng and Xu (2007) develop a simple two-sector search model to examine the impact of the terms-of-trade (TOT) shocks on unemployment and show that an improvement of TOT reduces unemployment. Flinn and Mabli (2008) analyse the impact of binding minimum wage on labour market outcomes and welfare in a partial equilibrium model of matching and bargaining in the presence of on-the-job search. Arseneau and Chugh (2009) introduce general equilibrium efficiency in the standard labour search and matching framework. Macit (2010) develops a New Keynesian model in search and matching structure with firing costs and shows how labour market institutions affect the wage and inflation dynamics.

[4]According to the 'graduation theory', it is beneficial to remain in the urban informal sector and search part time for a highly paid job in the urban formal sector.

It is worth noting that the theoretical literature on search unemployment has not been adequately analysed in a multi-sector general equilibrium setting where capital, apart from labour, is an input of production and there is international trade. A notable exception is Bandopadhyay and Chaudhuri (2011) that has examined the effects of foreign capital inflows on unemployment and welfare in a developing economy by extending the search unemployment model of Fields (1989) to include international trade and capital as a separate input of production. But this is a two-sector general equilibrium model that includes only a rural sector and an urban formal sector.

However, it is beyond any doubt that the informal sector plays a very significant role in employment in developing countries constituting at least 70 % of total employment of the working population (Agenor 1996), and that in most cases the informal sector mainly produces non-traded intermediate goods for the formal sector on a subcontract basis.[5] The ongoing process of economic reforms has increased significantly the role played by the informal sector in determining the pattern of employment in the developing countries. Reformatory policies contract the formal manufacturing sector and drive workers out to the informal segment of the labour market. Empirical studies like Dev (2000), Bhalotra (2002), ILO (2006) and Leite et al. (2006) have reported that the size of the informal sector in the developing countries has increased considerably in the post-reform period. But the expanding informal sector has not been able to absorb the huge number of retrenched workers from the formal sector. The consequence has been a steep rise in the level of open unemployment in many of the developing economies.

Keeping in view the importance of the urban informal sector, in this section, we develop a three-sector general equilibrium model with an urban informal sector in the line of Fields' (1989) analysis of search unemployment.[6] In the line of Fields (1989), we have distinguished between ex ante and ex post allocation of the labour force. However, the present analysis is an improvement over Fields' (1989) work in a number of ways. First, while in Fields (1989), the rural sector wage is fixed; in the present case, the wage rate is flexible and market determined. Second, Fields (1989) considers a closed economy, while here there is international trade. Third, we have introduced capital as an input, but Fields (1989) has considered labour as the only input of production. The inclusion of capital in the production structure has made Fields' model in the ex post case to work very nearly like an HT model of rural-urban migration. Fourth, unlike Fields (1989), we have considered a non-traded intermediate good in our model. Finally, owing to the presence of international trade and capital as an input, the present model is quite handy for analysing the consequences of external shocks and nature of intersectoral capital mobility on unemployment and other endogenous variables.

[5]See Bose (1978), Papola (1981), Romatet (1983) and Chaudhuri and Mukhopadhyay (2009), among others.

[6]This is based on excerpts of Chaudhuri and Bandopadhyay (2013).

In the present model, the rural sector (sector 1) and the urban informal sector (sector 2) use capital of type 1, while the urban formal sector (sector 3) uses capital of type 2. So, capital of type 1 is perfectly mobile between the first two sectors of the economy, while capital of type 2 is specific to sector 3. Besides, sector 2 produces a non-traded input for sector 3. We also assume two concepts of factor intensities – ex ante and ex post. We examine the impact of an inflow of foreign capital on unemployment and social welfare. Our analysis finds that inflows of foreign capital may lower urban unemployment but worsen social welfare when the urban informal sector is more capital-intensive relative to the rural sector. Quite interestingly, in the case when the rural sector is capital-intensive, we may obtain exactly the opposite results. The present analysis, therefore, suggests the possibility of a trade-off between the government's twin objectives of growth with foreign capital and mitigation of the urban unemployment problem. These results are extremely crucial from the viewpoint of policy-making in an unemployment-plagued, low-income developing economy.

7.4.1 The Model

Let us consider a three-sector job search model for a small open economy. The three sectors are the rural sector (sector 1), the urban informal sector (sector 2) and the urban formal sector (sector 3). X_1 is the export good which is produced in sector 1. X_2 is the non-traded good which is produced in sector 2 and is used as input in Sector 3. Both sectors 1 and 2 use labour and capital of type 1 as their inputs. Finally, sector 3 is the tariff-protected import-competing sector that produces its output X_3 by means of labour, capital of type 2 and the non-traded input produced by sector 2. The assumption of small open economy gives constant product prices for the two internationally traded goods, whereas the price of the non-traded good is determined in the domestic market.

We make a simplifying assumption that capital of type 2 is entirely owned by foreign capitalists.[7] The production functions exhibit constant returns to scale with positive but diminishing marginal productivity to each factor of production. All the markets except the urban formal labour market are competitive, and in the long-run equilibrium, product price is matched exactly by the unit cost of production in each sector. So according to our assumption, foreign capital is specific to the formal sector. However, capital of type 1 is perfectly mobile between the rural sector and the urban informal sector. So, we have different rentals on the two types of capital

[7]This simplifying assumption can be relaxed to include both domestic capital and foreign capital if these are perfect substitutes. This would not affect the qualitative results of the model. Besides, it may be mentioned that Khan (1982), Chandra and Khan (1993), Gupta (1994, 1997), Chaudhuri (2003, 2005), Chaudhuri et al. (2006), Chaudhuri and Mukhopadhyay (2009), etc., have also made this assumption for different purposes.

in the economy. As both sector 1 and sector 2 use the same two inputs, they together form a Heckscher–Ohlin subsystem (HOSS) and can therefore be classified in terms of factor intensities in value sense.[8] However, at this stage, we do not want to make any specific-factor intensity classification. We would rather consider both the cases one by one and see how our results change depending on different factor intensity conditions.

The wage rate in the urban formal sector is institutionally given. Urban unemployment exists in our stylized economy as urban jobseekers devote full time for searching urban jobs, and all of them do not get high-paid urban jobs. The unsuccessful urban jobseekers either get absorbed in the urban informal sector at a low wage or remain unemployed.

Many of the notations that would be used in the formal presentation of the model have been defined earlier. The other notations are as follows:

L^k = ex ante number of people searching for urban formal sector jobs from the kth sector, $k = 1, 2, 3$; L_i = ex post level of employment in ith sector, $i = 1, 2\ 3$; W_1 = rural wage rate; W_2 = urban informal sector wage rate; $W_3{*}$ = the exogenously given wage in the unionized sector 3; R_1 = rate of return to capital of type 1; R_2 = return to capital of type 2; ρ = probability of getting urban jobs; φ_1 = job search efficiency in the rural sector; φ_2 = job search efficiency in the urban informal sector; U = level of urban unemployment; σ_i = elasticity of factor substitution in the ith sector.

The general equilibrium structure of the model is as follows:

The competitive profit conditions are given by the following three price-unit cost equalities:

$$W_1 a_{L1} + R_1 a_{K1} = 1 \tag{7.6}$$

$$W_2 a_{L2} + R_1 a_{K2} = P_2 \tag{7.7}$$

$$W_3^* a_{L2} + R_2 a_{K2} + P_2 a_{23} = (1 + t)\, P_3 = P_3^* \tag{7.8}$$

The probability of getting urban formal sector job is

$$\rho = \frac{a_{L3} X_3}{(\varphi_1 L^1 + \varphi_2 L^2 + L^3\,)} \tag{7.9}$$

where $(\varphi_1 L^1 + \varphi_2 L^2 + L^3)$ is the total number of jobseeker equivalence.[9]

---

[8]This is due to the fact that the wage rates in the rural sector and the urban informal sector differ. This implies the same intensity rankings in physical sense as well. We subsequently introduce the concepts of factor intensities in ex ante value sense and ex post value sense.

[9]See Fields (1989) in this context.

There is a specific expected income corresponding to each search strategy. In equilibrium, the expected incomes from the three strategies must be equal. Thus, the allocation of labour force among the three strategies is given by[10]

$$\rho W_3^* = \varphi_1 \rho W_3^* + (1 - \varphi_1 \rho)\, W_1 = \varphi_2 \rho W_3^* + (1 - \varphi_2 \rho)\, W_2 \qquad \text{(7.10 and 7.11)}$$

The number of people searching for urban formal sector jobs from the rural sector is L^1. Out of L^1, $\varphi_1 \rho L^1$ people get employment in the urban formal sector. Thus, the ex post number of workers in the rural sector is

$$a_{L1} X_1 = L^1 (1 - \varphi_1 \rho) \tag{7.12}$$

The ex post number of workers in the urban informal sector (non-traded sector) is

$$a_{L2} X_2 = L^2 (1 - \varphi_2 \rho) \tag{7.13}$$

Labour is not fully employed. The ex ante and the ex post endowments of labour are given by the following equations:

$$L^1 + L^2 + L^3 = L \tag{7.14}$$

$$a_{L1} X_1 + a_{L2} X_2 + a_{L3} X_3 + U = L \tag{7.15}$$

Capital of either type is fully employed. The capital endowment equations are as follows:

$$a_{K3} X_3 = K_2 \tag{7.16}$$

$$a_{K1} X_1 + a_{K2} X_2 = K_1 \tag{7.17}$$

As capital of type 2 is fully owned by foreign capitalists, we have $K_2 = K_F$.

The output of the informal sector, X_2, is entirely used up in sector 3 as input. The per-unit requirement of the intermediate input, a_{23}, is assumed to be technologically fixed in sector 3.[11,12] The supply of X_2 is circumscribed by its total demand by sector 3. The demand-supply equality condition is given by

$$X_2 = a_{23} X_3 \tag{7.18}$$

---

[10] Following Fields (1975, 1989), it is assumed that the rural jobseekers are less efficient compared to those in the informal sector. This means that $\varphi_1 < \varphi_2$.

[11] See footnote 29, Chap. 5 in this context.

[12] Although a_{23} is fixed, the other two inputs, labour and capital of type 2, together continue to display the constant returns to scale. In other words, if the usages of labour and capital are increased (decreased) by a constant proportion, the level of production also increases (decreases) by the same proportion provided the usage of the non-traded input is adjusted appropriately.

The country exports commodity 1 and imports commodity 3. The trade balance condition requires that

$$X_1 - D_1 = P_3\,(D_3 - X_3) + R_2 K_{\mathrm{F}}$$

or

$$D_1 + P_3^* D_3 = X_1 + P_3^* X_3 + tP_3 M - R_2 K_2 \tag{7.19}$$

where $P_3^* = (1+t)P_3$ is the tariff-inclusive domestic price of commodity 3; $M = (D_3 - X_3)$ is the volume of import of good 3; and $R_2 K_{\mathrm{F}}$ is the repatriated income on foreign capital.

The welfare of this small open economy is measured by national income at domestic prices, Y.[13] As foreign capital income is completely repatriated, the expression for national income at domestic prices is given by

$$Y = X_1 + P_3^* X_3 + tP_3 M - R_2 K_2 \tag{7.20}$$

It may be noted that tP_3M is the amount of tariff revenue of the government from the import of commodity 3 which is completely transferred to the consumers as lump-sum payments.

The aggregate demand for commodity 3 is written as follows:

$$D_3 = D_3\underset{(-)\,(+)}{\left(P_3^*, Y\right)} \tag{7.21}$$

Finally, the volume of import of commodity 3 is given by

$$M = D_3\left(P_3^*, Y\right) - X_3 \tag{7.22}$$

Using Eqs. (7.9) and (7.12), (7.13) and (7.14), we get

$$W_1 a_{L1} X_1 + W_2 a_{L2} X_2 = \rho W_3^* L - W_3^* a_{L3} X_3 \tag{7.9.1}$$

Now from Eqs. (7.9.1) and (7.10, 7.11), (7.12), (7.13) and 7.14), it follows that

$$W_1 \lambda_{L1} + W_2 \lambda_{L2} + W_3^* \lambda_{L3} = \rho W_3^* \tag{7.9.2}$$

Equation (7.9.2) of this model bears a resemblance to the migration equilibrium condition in the three-sector HT model with an urban informal sector. The inclusion

[13]In the present model, we have considered national income at domestic prices as the measure of national welfare since final commodity prices are given internationally. See Sect. 2.6 for its justification in detail.

of capital has made Fields'(1989) model in the ex post situation to behave more or less like a three-sector HT model with an urban informal sector. Furthermore, the rural sector and the informal sector together would work like a Heckscher–Ohlin subsystem (HOSS).

This is an indecomposable system. We can determine W_1, W_2, R_1 and ρ from Eqs. (7.6), (7.7), (7.10 and 7.11) in terms of P_2. Equation (7.8) determines R_2. The factor coefficients, a_{ji} s, are thus obtained in terms of P_2. Then, Eq. (7.16) yields X_3. Solving Eqs. (7.9.1) and (7.17), we get X_1 and X_2. Then, L^1, L^2 and L^3 are obtained from Eqs. (7.12), (7.13) and (7.14), respectively. U is found from Eq. (7.15). Next, Y, D_3 and M are obtained from Eqs. (7.20), (7.21) and (7.22). Thus, all endogenous variables are obtained in terms of P_2. Finally, P_2 is solved from Eq. (7.18). Once P_2 is obtained, the values of all other endogenous variables are determined.

7.4.2 FDI, Unemployment and Social Welfare

We now examine the effects of foreign capital inflows on urban unemployment and national welfare in our small open economy.

Totally differentiating Eqs. (7.6), (7.7), (7.8), (7.9.1), (7.10 and 7.11), (7.15), (7.17) and (7.18), using the static stability condition in the market for commodity 2 and simplifying, we can establish the following proposition:

Proposition 7.2 *In the case when the urban informal sector is more capital-intensive relative to the rural sector in both ex ante and ex post value senses, an inflow of foreign capital lowers urban unemployment if the vertically integrated urban sector is sufficiently labour-intensive vis-à-vis the rural sector with respect to capital of type 1 (in physical sense). However, when the rural sector is capital-intensive, the urban unemployment problem is likely to aggravate under reasonable conditions.*[14]

We may explain Proposition 7.2 as follows. Let us first consider the case where the urban informal sector is more capital-intensive relative to the rural sector in ex ante and ex post value senses. An inflow of foreign capital in the formal sector (sector 3) affects both the factor prices and the output composition of the economy. This immediately lowers the return to capital of type 2, R_2. Sector 3 expands both in terms of output and employment since capital of type 2 is specific to this sector.[15] The expansion of sector 3 leads to higher demand for the non-traded input which is

---

[14]For classifications of sectors in terms of factor intensities in ex ante and ex post value senses and mathematical proof of Proposition 7.2, see Appendices (7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7 and 7.8).

[15]Given the unionized wage, W_3^*, the producers in sector 3 substitute labour by capital since R_2 has fallen. This lowers the demand for labour in this sector. On the other hand, the demand for labour rises as this sector has expanded. If the elasticity of substitution between factors in sector 3, σ_3, is low, the second effect on employment dominates over the former. Consequently, employment in sector 3, $a_{L3}X_3$, rises.

produced by sector 2 (urban informal sector). Consequently, the price of the non-traded input P_2 rises. Besides, sector 2 also expands as its output is used in fixed proportion in sector 3. Sector 1 has to contract as it has to release capital of type 1 to the expanding sector 2. Since P_2 has increased and sector 2 is intensive in the use of capital of type 1, the return to this type of capital, R_1, rises and the wage rates in sectors 1 and 2, W_1 and W_2, fall (see Eqs. (7.6) and (7.7)). Since the wage–rental ratios in the first two sectors have fallen, producers would substitute capital of type 1 by labour. Employment in sector 2 definitely rises, but that in sector 1 is likely to fall as sector 1 has contracted. So, we find that the levels of employment increase in both sectors 2 and 3, while that in sector 1 is likely to fall. It can be shown that the net effect of all these three effects would be an increase in aggregate employment (and correspondingly a decrease in urban unemployment) in the economy if the vertically integrated urban sector is sufficiently labour-intensive vis-à-vis the rural sector with respect to capital of type 1 (in physical sense).[16] On the contrary, when sector 2 is more labour-intensive relative to sector 1 with respect to capital of type 1, R_1 decreases and the two wage rates, W_1 and W_2, increase with an increase in P_2. Producers in these two sectors now substitute labour by capital leading to reductions in both a_{L1} and a_{L2}. Employment in sector 1 unambiguously falls while that in sector 2 may fall subject to a few sufficient conditions. The level of employment in sector 3 rises provided σ_3 is low. The net outcome of all these effects would be a decrease in aggregate employment and an equivalent increase in urban unemployment under the sufficient conditions as stated in Appendix the proposition.

For examining the welfare consequence of FDI after totally differentiating Eqs. (7.20), (7.21), (7.22), (7.9.1), (7.10 and 7.11) and (7.18) and simplifying, we can prove[17] the following proposition.

Proposition 7.3 *An inflow of foreign capital unambiguously lowers social welfare if the informal sector is capital-intensive vis-à-vis the rural sector in both ex ante and ex post value senses. However, in the opposite case, social welfare definitely improves in the absence of any tariff. Even in the presence of tariff, welfare may improve.*

Proposition 7.3 can be intuitively explained in the following fashion. An inflow of foreign capital in the presence of a tariff and with full repatriation of income on foreign capital affects national income in two ways. First, following a change in the output composition there occurs a reallocation of labour between the different sectors of the economy, offering different wages with $W_3^* > W_1 > W_2$. This we call the labour reallocation effect (LRE) which produces either positive or negative effect on national income depending on the factor intensity conditions between sectors 1 and 2. Second, as the tariff-protected import-competing sector expands, the volume of import falls. This lowers the tariff revenue which is transferred to the consumers in a lump-sum fashion. This may be called the tariff revenue effect (TRE) which

[16] This has been proved in Appendices (7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7 and 7.8).

[17] See Appendices 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7 and 7.9 for detailed derivations.

unambiguously produces unfavourable effect on social welfare. We have already found that FDI leads to contraction of sector 1 and expansion of both sectors 2 and 3. Our analysis shows that the change in aggregate wage income is unambiguously negative in the situation where the urban informal sector is more capital-intensive vis-à-vis the rural sector.[18] This is the negative LRE which also exerts a downward pressure on national welfare. Therefore, social welfare measured in terms of national income at domestic prices worsens unequivocally. On the contrary, in the case where the rural sector is capital-intensive, the LRE is positive.[19] So there are two opposite effects on welfare. In the absence of any tariff, i.e. $t = 0$, there does not exist any negative TRE and welfare definitely improves owing to the positive LRE. Despite the presence of a tariff, social welfare may still improve if the positive LRE dominates over the negative TRE.

It is, however, important to note that in the presence of multiple distortions, the effect(s) of any parametric changes on social welfare (or any other objective(s)) might change enormously compared to the one distortion case. This is because the effects of different distortions might move in the two opposite directions nullifying each other's effects. Hence, the net effect depends on the relative magnitudes of different effects. This is a well-known result in the theory of international trade. This is true for the present case also. So, the existence of a trade-off between government's dual objectives of improvement in social welfare (national income) and mitigation of unemployment problem may break down if apart from labour market distortion there is trade distortion in the form of a tariff on the import-competing sector.

7.4.3 Policy Implications of Results

The analysis of this section shows that the results of an inflow of foreign capital on urban unemployment and social welfare hinge crucially on the factor intensity rankings of the rural and the urban informal sector. If the urban informal sector is capital-intensive relative to the rural sector, an inflow of foreign capital may reduce unemployment but unambiguously lowers social welfare. On the contrary, when the rural sector is more capital-intensive vis-à-vis the informal sector, we may obtain exactly the opposite results. Foreign capital inflow may raise urban unemployment but improve social welfare. We have already pointed out that in the

[18]See Eq. (7.A.57.1) in Appendix 7.9.

[19]See Eq. (7.A.57.2) in Appendix 7.9.

ex post situation, this job search model would roughly behave like a three-sector HT migration model with an urban informal sector. This is why the factor intensity differential between the rural sector and the urban informal sector plays a pivotal role in predicting the outcomes of FDI on unemployment. However, the results on welfare would depend on the relative magnitudes of labour market distortion and tariff distortion. Thus, in both the cases, it is obvious that there exists a trade-off between reduction of unemployment and achieving growth with foreign capital[20] which deserves the attention of the policymakers to design appropriate development policies for a developing economy. When unemployment situation improves at the cost of economic growth, the government may think in terms of imposing a tax on foreign capital income thereby increasing its revenue in order to improve social welfare. Alternatively, the tariff rate may be increased or decreased depending on the elasticity of the import demand function so that the tariff revenue increases. On the contrary, when the problem of unemployment aggravates but national income rises, the government may think in terms of providing a wage subsidy and/or a price subsidy to sector 3 so as to create more employment in that sector. The policy would indirectly increase employment in sector 2 also. The increase in aggregate employment might exceed the possible decrease in employment in sector 1. If this happens, urban unemployment situation improves. Now what policies to undertake depends on whether mitigation of unemployment problem or achieving a high rate of economic growth lies at the top of the agenda list of the government of the country in question.

7.5 Consequences of FDI on Skilled and Unskilled Unemployment

In this section, we develop a three-sector, specific-factor HT-type general equilibrium model where the FWH is valid.[21] The validity of the standard immiserizing result of foreign capital inflows using this set-up is examined, and the consequences of capital inflows on the unemployment of both types of labour are studied. We find that although an inflow of foreign capital in the primary export sector unambiguously improves social welfare, FDI in the secondary sectors may be welfare-worsening. The unemployment situation of both types of labour unequivocally

[20]This result is not new in the literature on trade and development. The main contribution of the analysis in this section is to show that the same results go through despite the presence of search unemployment mechanism as developed by Fields (1989) and our inclusion of international trade and capital as an input of production.

[21]This section is based on Chaudhuri and Banerjee (2010a). See also Chaudhuri and Banerjee (2010b) for similar simple general equilibrium structure.

improves in both the cases.[22] Although many of the developing economies[23] are yet to go far in allowing the entry of foreign capital in agriculture, our analysis justifies the desirability of FDI flow in agriculture from the perspective of both unemployment and social welfare.

7.5.1 The Model

We consider a small open dual economy with three sectors: one rural and two urban. There are four factors of production: land, capital, unskilled labour and skilled labour. The rural sector produces an agricultural commodity using land, capital and unskilled labour. The production technology in agriculture is of the fixed-coefficient type.[24] a_{N1} units of land (N), a_{K1} units of capital (K) and a_{L1} units of unskilled labour (L) together produce one unit of the agricultural output (X_1). Sector 2 is an urban sector that produces a low-skill manufacturing commodity (X_2) by means of capital and unskilled labour. Finally, sector 3, another urban sector, uses capital and skilled labour (S) to produce a high-skill commodity (X_3).

Skilled labour is specific to sector 3. Unskilled labour is perfectly mobile between sectors 1 and 2, while capital is completely mobile among all the three sectors of the economy. On the other hand, as sectors 2 and 3 produce non-agricultural commodities, land is specific to the rural sector (sector 1). Although the amount of agricultural land of the economy is given, it can be increased by allowing the entry of foreign capital in agriculture.[25] Foreign investments may be sought to

---

[22]The result of an inflow of foreign capital in the urban sectors on the unskilled unemployment is counterintuitive because it is contrary to the standard HT result that an urban development policy accentuates the unemployment problem in the urban area. See Chaudhuri (2000) and Chaudhuri et al. (2006) in this context.

[23]For example, in India, FDI in agriculture is only permitted in certain sectors like floriculture, horticulture, development of seeds, animal husbandry, pisciculture and cultivation of vegetables. Besides, FDI is permitted in tea plantations subject to the Foreign Investment Promotion Board (FIPB) approval. Details are available at http://business.mapsofindia.com/fdi-india/sectors/agriculture-services.html.

[24]Although this is a simplifying assumption, it is not completely without any basis. After the advent of the HYV (high-yielding variety) technology in many of the developing economies including India, agriculture requires inputs which are to be used in recommended doses. The inherent complementarity among the different inputs may justify the use of the fixed-coefficient production technology in agriculture. There are several works including those of Ensminger (2002) and FAO (2003) that have documented the critical role played by the use of various complementary agricultural inputs including land, fertilizer, hybrid seeds and agricultural labour in enhancing agricultural output in many developing countries. However, even if the inputs are substitutes, the qualitative results of this section still hold under additional sufficient conditions incorporating the partial elasticities of substitution between the three inputs.

[25]It may be mentioned that some of the developing countries, especially those in the sub-Saharan Africa are now allowing FDI in agriculture. The amount of FDI in agriculture in these countries has increased considerably over the last few years. The inflow of FDI in agriculture amounted to

exploit 'surplus' land currently unused or underutilized.[26] One reason of why land may not be used to its full potential is that the infrastructural investments needed to bring it into production are significant and beyond the budgetary resources of the country. International investments might bring much needed infrastructural investments which in turn could relax the land constraint of the economy. Hence, the aggregate land endowment of the economy (N) consists of both domestically owned land (N_D) and foreign-owned land (N_F) and is an increasing function of the amount of FDI in agriculture (C).

Sector 2 faces an imperfect unskilled labour market in the form of a unionized labour market where unskilled workers receive a contractual wage, W^*, while the unskilled wage rate in the rural sector, W, is market determined. The two unskilled wage rates are related by the HT migration equilibrium condition where the expected urban wage equals the rural wage rate with $W^* > W$. Therefore, there is urban unemployment of unskilled labour. On the other hand, we use the FWH to explain unemployment of skilled labour, and the efficiency function of skilled labour is similar to that of Agell and Lundborg (1992, 1995). This function can be derived from the effort norm of the skilled workers, which is sensitive to the functional distribution of income and the skilled unemployment rate. This is the optimal effort function of the utility maximizing skilled workers. The aggregate capital stock of the economy (K) includes both domestic capital (K_D) and foreign capital (K_F) and these are perfect substitutes. Incomes from foreign capital and foreign-owned land are completely repatriated. Sectors 1 and 3 are the two export sectors, while sector 2 is the import-competing sector and is protected by an import tariff. Sector 2 uses capital more intensively with respect to unskilled labour vis-à-vis sector 1. Production functions in the two nonagricultural sectors are of the variable-coefficient type and exhibit constant returns to scale with positive and diminishing marginal productivity to each factor. Finally, commodity 3 is chosen as the numeraire.

Given the perfectly competitive commodity markets, the three price-unit cost equality conditions relating to the three industries are as follows:

$$Wa_{L1} + ra_{K1} + Ra_{N1} = P_1 \tag{7.23}$$

$$W^*a_{L2} + ra_{K2} = P_2(1 + t) \tag{7.24}$$

$$\frac{W_S}{E}a_{S3} + ra_{K3} = 1 \tag{7.25}$$

more than USD 3 billion per year by 2007, compared to USD 1 billion in 2000. The main form of recent investments is purchase or long-term leasing of agricultural land for food production. The area of land acquired in Africa by foreign capitalists between 2005 and 2008 is estimated at up to 20 million hectares. For details, see FAO (2009).

[26] See FAO (2009).

Here, r and R denote the returns to capital and land, respectively (both domestic and foreign); t is the ad valorem rate of import tariff on the import of commodity 2; E is the efficiency of each skilled worker; and W_S/E is the wage rate per efficiency unit of skilled labour.

Following Agell and Lundborg (1992, 1995), we assume that the effort norms of the skilled labour depend positively on (1) skilled wage relative to average unskilled wage, (2) skilled wage relative to returns on capital and land and (3) the unemployment rate of skilled labour. It may be mentioned that the average unskilled wage in the economy is the rural sector wage that follows from the 'envelope property' of the HT framework.[27] Therefore, we write

$$E = E\left(\frac{W_S}{W}, \frac{W_S}{r}, \frac{W_S}{R}, v\right) \tag{7.26}$$

The efficiency function satisfies the following mathematical restrictions[28]:

$$E_1, E_2, E_3, E_4 > 0; \quad E_{11}, E_{22}, E_{33} < 0; \quad E_{12} = E_{13} = E_{14} = E_{23} = E_{24} = E_{34} = 0.$$

The unit cost of skilled labour in sector 3, denoted ϖ, is given by

$$\varpi = \left(\frac{W_S}{E(.)}\right) \tag{7.27}$$

Each firm in sector 3 minimizes its unit cost of skilled labour as given by (7.27). The first-order condition of minimization is

$$E = \frac{W_S}{W}E_1 + \frac{W_S}{r}E_2 + \frac{W_S}{R}E_3 \tag{7.28}$$

where E_i s (for $i = 1, 2, 3$) are the partial derivatives of the efficiency function with respect to W_S/W, W_S/r and W_S/R, respectively. Equation (7.28) can be rewritten as

$$\varepsilon_1 + \varepsilon_2 + \varepsilon_3 = 1 \tag{7.28.1}$$

where ε_i is the elasticity of the $E(.)$ function with respect to its ith argument. This is the modified Solow condition as obtained in Agell and Lundborg (1992, 1995).

---

[27]Unskilled workers are employed in the rural and low-skill urban manufacturing sectors where they earn W and W^* wages, respectively. Some of the unskilled workers remain unemployed in the urban sector earning nothing. The average wage income of all unskilled workers in the economy is the rural sector wage. This can be easily shown from Eqs. (7.32) and (7.33). So, the efficiency function, given by Eq. (7.26), indirectly takes into account the unionized wage and the urban unemployment of unskilled labour as determinants.

[28]Mathematical derivations of the efficiency function from the rational behaviour of a representative skilled worker and explanations of the mathematical restrictions on the partial derivatives are available in Agell and Lundborg (1992, 1995).

The amount of foreign-owned land (N_F) is considered to be an increasing function of the amount of FDI in agriculture (C), i.e.

$$N_F = N_F(C); N_F' > 0.$$

Full utilization of land[29] and capital, respectively, entails

$$a_{N1}X_1 = N_D + N_F(C) = N \tag{7.29}$$

$$a_{K1}X_1 + a_{K2}X_2 + a_{K3}X_3 = K \tag{7.30}$$

There is unemployment of skilled labour in the economy, and the rate of unemployment is v. The skilled labour endowment equation is, therefore, given by

$$a_{S3}X_3 = E\,(1 - v)\,S \tag{7.31}$$

where S is the endowment of skilled labour (in physical unit).

In the migration equilibrium, there exists urban unemployment of unskilled labour (L_U). The unskilled labour endowment equation is given by

$$a_{L1}X_1 + a_{L2}X_2 + L_U = L \tag{7.32}$$

where L denotes the endowment of unskilled labour (in physical unit).

In an HT framework, the unskilled labour allocation mechanism is such that in the labour market equilibrium, the rural wage rate, W, equals the expected wage income in the urban sector. Therefore, the rural-urban migration equilibrium condition of unskilled labour is expressed as

$$\left(\frac{W^*}{W}\right)a_{L2}X_2 + a_{L1}X_1 = L \tag{7.33}$$

Using (7.29), Eq. (7.33) can be rewritten as follows:

$$\left(\frac{W^*}{W}\right)a_{L2}X_2 + \frac{a_{L1}}{a_{N1}}N = L \tag{7.33.1}$$

Similarly, the use of (7.31) in Eq. (7.30) yields

$$\left[\left(\frac{a_{K1}}{a_{N1}}N\right) + a_{K2}X_2 + \left\{\frac{a_{K3}E\,(1 - v)\,S}{a_{S3}}\right\}\right] = K \tag{7.30.1}$$

[29]It may be noted that the amount of foreign-owned land (N_F) may rise with FDI without affecting the amount of domestically owned land (N_D). So, the aggregate land endowment of the economy (N) also is an increasing function of the amount of FDI in agriculture (C). See footnote 30 in this context.

In this general equilibrium model, there are ten endogenous variables, namely, $W, r, R, W_S, E, v, L_U, X_1, X_2$ and X_3, and the same number of independent equations, namely, (7.23), (7.24), (7.25), (7.26), (7.28), (7.29), (7.30.1), (7.31), (7.32) and (7.33.1). The endogenous variables are determined as follows. The system does not possess the decomposition property. r is found from (7.24) as W^* is given exogenously. W, R, W_S, v and X_2 are simultaneously solved from Eqs. (7.23), (7.26), (7.28), (7.30.1) and (7.33.1). E is then found from (7.25). X_1 and X_3 are solved from Eqs. (7.29) and (7.31), respectively. Finally, L_U is obtained from (7.32).

A close look at the price system reveals that given the value of R, sectors 1 and 2 can be conceived to form a modified subsystem (MSS) since they use two common inputs: unskilled labour and capital. It is sensible to assume that sector 2 is more capital-intensive than sector 1 in value sense with respect to unskilled labour. This implies that $(a_{K2}/W^*a_{L2}) > (a_{K1}/Wa_{L1})$.

We measure welfare of the economy by national income at world prices, Y, and is given by

$$Y = WL + RN_D + rK_D + W_S(1-v)S - tP_2X_2 \tag{7.34}$$

It is assumed that incomes from foreign capital and foreign-owned land are completely repatriated. In Eq. (7.34), WL and $W_S(1-v)S$ give the aggregate wage incomes of the unskilled and skilled workers, respectively. RN_D is the rental income from domestically owned land endowment,[30] while rK_D denotes rental income from domestic capital. Finally, tP_2X_2 measures the cost of tariff protection of the production side.

7.5.2 FDI in Agricultural Land and Unemployment of Skilled Labour

We now analyse the consequences of FDI on national welfare and unemployment of skilled labour. An inflow of foreign capital in the primary export sector is captured by an increase in C which in turn raises the aggregate endowment of land of the economy. On the other hand, FDI in the secondary sectors including the tariff-protected import-competing sector of the economy is demonstrated through an increase in the endowment of capital, K.

[30] If a part of the FDI in agriculture takes the form of long-term rental contracts of existing land by foreign capitalists, the amount of domestically owned land (N_D) falls, but the aggregate rental income (including that from leased-out land) does not fall if the leasing out of land takes place at the market-determined rental rate, R. On the contrary, N_D does not change if the FDI is made to exploit 'surplus' land currently unused or underutilized.

Differentiating Eqs. (7.23), (7.26) (7.28), (7.33.1) and (7.30.1), the following expressions are derived, respectively[31]:

$$\theta_{L1}\widehat{W} + \theta_{N1}\widehat{R} = 0 \tag{7.35}$$

$$\varepsilon_1\widehat{W} + \varepsilon_3\widehat{R} - \varepsilon_4\widehat{v} = 0 \tag{7.36}$$

$$B_1\widehat{W} + B_2\widehat{R} - B_3\widehat{W}_S + \varepsilon_4\widehat{v} = 0 \tag{7.37}$$

$$-\lambda^*_{L2}\widehat{W} + \lambda^*_{L2}\widehat{X}_2 = -M_1\widehat{C} \tag{7.38}$$

$$\lambda_{K2}\widehat{X}_2 + \lambda_{K3}\widehat{W}_S - B_4\widehat{v} = \widehat{K} - M_2\widehat{C} \tag{7.39}$$

where,

$$\left.\begin{array}{l}
B_1 = \frac{E_{11}}{E}\left(\frac{W_S}{W}\right)^2 < 0; B_2 = \frac{E_{33}}{E}\left(\frac{W_S}{R}\right)^2 < 0; \\
B_3 = \left[\left(\frac{W_S}{W}\right)^2 \frac{E_{11}}{E} + \left(\frac{W_S}{r}\right)^2 \frac{E_{22}}{E} + \left(\frac{W_S}{R}\right)^2 \frac{E_{33}}{E}\right] < 0; B_4 = \left(\frac{\lambda_{K3}v}{1-v}\right) > 0; \\
e = \left(\left(\frac{dN_F}{dC}\right)\left(\frac{C}{N_F}\right)\right) > 0; \lambda^*_{L2} = \left(\frac{W^*}{W}\right)\lambda_{L2} > 0; \lambda_{N_F} = \left(\frac{N_F}{N}\right) > 0; \\
M_1 = \lambda_{L1}\lambda_{N_F}e > 0; M_2 = \lambda_{K1}\lambda_{N_F}e > 0.
\end{array}\right\} \tag{7.40}$$

Arranging (7.35), (7.36), (7.37), (7.38) and (7.39) in a matrix notation, one obtains

$$\begin{bmatrix} \theta_{L1} & \theta_{N1} & 0 & 0 & 0 \\ \varepsilon_1 & \varepsilon_3 & 0 & -\varepsilon_4 & 0 \\ B_1 & B_2 & -B_3 & \varepsilon_4 & 0 \\ -\lambda^*_{L2} & 0 & 0 & 0 & \lambda^*_{L2} \\ 0 & 0 & \lambda_{K3} & -B_4 & \lambda_{K2} \end{bmatrix} \begin{bmatrix} \widehat{W} \\ \widehat{R} \\ \widehat{W}_S \\ \widehat{v} \\ \widehat{X}_2 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ -M_1\widehat{C} \\ \widehat{K} - M_2\widehat{C} \end{bmatrix} \tag{7.41}$$

The determinant to the coefficient matrix is

$$\begin{array}{l} |D| = \lambda^*_{L2}\,[-\varepsilon_4 B_3\theta_{N1}\lambda_{K2} + (\varepsilon_4\lambda_{K3}J - B_3B_4H)] \\ \qquad\qquad (+)\,(-) \qquad\qquad\qquad (+) \qquad\quad (-)\,(+) \end{array} \tag{7.42}$$

where

$$\left.\begin{array}{l} J = \{\theta_{L1}(B_2 + \varepsilon_3) - \theta_{N1}(B_1 + \varepsilon_1)\} \\ H = (\theta_{L1}\varepsilon_3 - \theta_{N1}\varepsilon_1). \end{array}\right\} \tag{7.43}$$

[31]Note that a_{L1}, a_{N1} and a_{K1} are technologically given. See footnote 24 in this context.

Since the production structure is indecomposable, an increase in the land endowment of the economy that results from an increase in foreign investments in agriculture (C) must lower its rate of return, R, i.e. $\left(\widehat{R}/\widehat{N}\right) < 0$. Thus, solving (7.41) by Cramer's rule, it can be easily proved[32] that

$$|D| > 0 \tag{7.44}$$

For determining the signs of J and H, we need to impose some restrictions on the relative responsiveness of the $E(.)$, $E_1(.)$ and $E_3(.)$ functions with respect to their two arguments: (W_S/W) and (W_S/R). The efficiency function, given by Eq. (7.26), is assumed to satisfy the following two special properties.

Property A The responsiveness of $E(.)$ with respect to W_S/R is greater than that with respect to W_S/W such that $(\varepsilon_3/\theta_{N1}) > (\varepsilon_1/\theta_{L1})$.

Property B The algebraic value of the elasticity of $E_3(.)$ with respect to W_S/R is not less than that of $E_1(.)$ with respect to W_S/W, i.e. $(E_{33}W_S/E_3R) \geq (E_{11}W_S/E_1W)$.

The implications of the above two properties are as follows. Although the efficiency of skilled workers depends on the relative income distribution, they are expected to have different attitudes towards the earnings of different factors of production. So changes in incomes of different factors should affect the efficiency of skilled labour in different degrees. It is reasonable to assume that the average unskilled wage is substantially lower than the skilled wage so that the skilled workers are expected to be compassionate towards their unskilled counterparts. On the contrary, they are likely to feel significantly deprived if the returns on land and capital increase relative to the skilled wage, adversely affecting their work morale. Therefore, it may be logical to assume that increases in incomes of the capitalists engender a more negative response among the skilled workers and lower their efficiency than that resulting from an increase in the average unskilled wage.

Properties (A) and (B) of the efficiency function together imply that[33]

$$\left.\begin{array}{l}\left(\frac{\theta_{L1}}{\theta_{N1}}\right) > \left(\frac{\varepsilon_1}{\varepsilon_3}\right) \geq \left(\frac{\varepsilon_1+B_1}{\varepsilon_3+B_2}\right); \text{ and,} \\ J = \{\theta_{L1}(B_2+\varepsilon_3) - \theta_{N1}(B_1+\varepsilon_1)\} > 0; H = (\theta_{L1}\varepsilon_3 - \theta_{N1}\varepsilon_1) > 0\end{array}\right\} \tag{7.45}$$

Differentiating Eqs. (7.24) and (7.25), it is easy to show that

$$\widehat{E} = \widehat{W}_S \tag{7.46}$$

This leads to the following corollary.

---

[32]This has been shown in Appendix 7.10.

[33]This has been proved in Appendix 7.11.

Corollary 1 *The efficiency of skilled labour, E, and the skilled wage rate,* W_S*, always change in the same direction and in the same proportion.*

From (7.35), we can write

$$\widehat{W} = -\left(\frac{\theta_{N1}}{\theta_{L1}}\right)\widehat{R} \tag{7.47}$$

This establishes the following corollary.

Corollary 2 *W and R are negatively correlated.*

Using (7.47), Eq. (7.36) can be rewritten as follows:

$$\widehat{v} = \frac{(\varepsilon_3\theta_{L1} - \varepsilon_1\theta_{N1})\,\widehat{R}}{\varepsilon_4\theta_{L1}} \tag{7.48}$$

Using (7.45) from (7.48), the following corollary is imminent.

Corollary 3 *R and v are positively related.*[34]

Adding (7.36) and (7.37) and substituting for $\widehat{W}$ from (7.35), we get

$$\widehat{W}_S = \underset{(-)}{\left[\frac{\theta_{L1}(\varepsilon_3 + B_2) - \theta_{N1}(\varepsilon_1 + B_1)}{\theta_{L1}B_3}\right]}\widehat{R} \tag{7.49}$$

With the help of (7.45) from (7.49), the following corollary immediately follows.

Corollary 4 *R and* W_S *are negatively related.*

Solving (7.41) by Cramer's rule, the following proposition can be easily established.[35]

Proposition 7.4 *Under assumptions A and B, an inflow of foreign capital to either of the two broad sectors of the economy leads to (i) an increase in the rural unskilled wage, W; (ii) a decrease in the return to land, R; (iii) an increase in the skilled wage,* W_S*; (iv) a fall in the unemployment rate of skilled labour, v; and (v) an expansion of sector 3. Furthermore, (vi) sector 1 expands (remains unaffected) while sector 2 contracts (expands) owing to FDI in the primary (secondary) sector(s) of the economy.*

An inflow of foreign capital in agriculture (C) raises the effective land endowment of the economy thereby lowering its return (R). This raises the rural unskilled wage, W in order to satisfy the zero-profit condition in sector 1 (see Eq. (7.23)). A fall in R lowers the skilled unemployment rate, v (corollary 3), and

[34] As the rural sector unskilled wage and the return to land are negatively related (corollary 2), there is a negative relationship between the average unskilled (rural) wage and skilled unemployment rate.

[35] See Appendix 7.12 for mathematical derivations of the results.

raises the skilled wage, W_S (corollary 4), and hence their efficiency, E (corollary 1). As employment of skilled labour rises in efficiency unit (also in physical unit), sector 3 expands. Sector 1 also expands since the endowment of the sector-specific input, land, has increased. Both sectors 1 and 3 draw capital from sector 2, leading to a contraction of the latter.

On the other hand, an inflow of foreign capital in the non-agricultural sectors does not affect its return, r, since it is determined from Eq. (7.24). Both sectors 2 and 3 expand as they use capital. The output and the employment in sector 1 do not change because the endowment of the sector-specific input, land, does not change and the production technology is of the fixed-coefficient type. As sector 2 expands, the expected urban unskilled wage for a prospective rural unskilled worker rises. This lures the rural workers to move to the urban sector. But as the output and the employment in agriculture do not change, the workers can be kept in the rural sector only if the rural sector unskilled wage (W) rises sufficiently. An increase in W lowers the return to land (R) which in turn raises W_S (corollary 4) and hence E (corollary 1) and lowers the skilled unemployment rate, v (corollary 3). As the employment of skilled labour rises in both efficiency and physical units, sector 3 expands.

We now intend to examine the welfare consequences of inflows of foreign capital in the different sectors of the economy. Differentiating the national income expression (Eq. 7.34), the following proposition can be proved.[36]

Proposition 7.5 *An inflow of foreign capital in agriculture is unambiguously welfare-improving*[37] *while inflows of foreign capital in the secondary sectors may fail to boost social welfare.*

We explain Proposition 7.5 in the following fashion. In Proposition 7.4, we find that FDI in either of the two broad sectors of the economy raises the aggregate unskilled wage, skilled wage rate, aggregate skilled employment and hence the aggregate skilled wage but lowers the domestic rental income on land. The domestic capital income, however, remains unchanged. It is easy to show that the increase in the aggregate unskilled wage income outweighs the fall in the domestic rental income on land.[38] Hence in both the cases, the aggregate factor income unambiguously rises. Besides, an inflow of capital in agriculture leads to a contraction of the tariff-protected import-competing sector. Hence, the cost of protection of the import-competing sector falls. Social welfare unequivocally improves in this case. But in the case of FDI to the non-agricultural sectors, the protected sector expands. Hence, there is no guarantee that it improves social welfare unless the positive effect of increased aggregate factor income is strong enough to dominate over the negative distortionary effect of tariff protection of the import-competing sector.

---

[36]This has been proved in Appendix 7.13.

[37]Here, foreign capital inflow takes place in the economy's primary export sector. There are other works in the literature like Beladi and Marjit (1992a) that have examined the welfare consequence of foreign capital in the export sector of a small open economy. However, they have found the inflow of foreign capital to be immiserizing. See Chap. 3 in this context.

[38]This has been shown in Appendix 7.13.

7.6 FDI and Unemployment of Unskilled Labour

Our next task is to analyse the outcomes of foreign capital inflows in different sectors on the unemployment of unskilled labour in the urban area. Subtraction of Eq. (7.32) from Eq. (7.33) yields

$$L_{\mathrm{U}} = a_{L2}X_2\left(\frac{W^* - W}{W}\right) \tag{7.50}$$

Totally differentiating Eq. (7.50), one can establish the following proposition.[39]

Proposition 7.6 *An inflow of foreign capital to either of the two broad sectors of the economy unambiguously improves the urban unemployment problem of unskilled labour.*

We explain Proposition 7.6 as follows. In the migration equilibrium, the expected urban wage for a prospective unskilled rural migrant equals the actual unskilled rural wage. An inflow of foreign capital of either type affects the migration equilibrium in two ways. First, the low-skill urban manufacturing sector expands or contracts. This leads to a change in the number of jobs available in this sector. The expected urban wage for a prospective rural migrant, $[W^*/\{1 + (L_{\mathrm{U}}/a_{L2}X_2)\}]$, changes as the probability of getting a job in this sector changes for every unskilled worker. This is *the centrifugal force*. If the expected urban wage rises (falls), *the centrifugal force* is positive (negative). This paves the way for fresh migration (reverse migration) from the rural (urban) to the urban (rural) sector. On the other hand, an inflow of foreign capital of either type raises the rural unskilled wage (see Proposition 7.4). This is *the centripetal force* that prevents rural workers from migrating to the urban sector. Thus, there are two opposite effects that determine the size of the unemployed urban unskilled workforce. In the case of an inflow of foreign capital in agriculture, the low-skill urban manufacturing sector contracts in terms of both output and employment. The expected urban unskilled wage falls. So the centrifugal force is negative and drives some of the unemployed urban workers to return to the rural sector. Thus, both the centripetal and the centrifugal forces work in the same direction and cause the urban unemployment of unskilled labour to decline. On the contrary, in the case of an inflow of foreign capital in the secondary sectors, the low-skill urban sector expands and raises the expected urban unskilled wage. This lures the rural workers to move to the urban sector. But as the rural sector output and employment do not change, the workers remain in the rural sector because the rural sector unskilled wage has increased. Given that the employment of unskilled labour in agriculture does not change and that the employment in the low-skill urban sector (sector 2) has increased, the aggregate employment of unskilled labour in the economy increases thereby improving the urban unemployment situation.

[39]See Appendix 7.14 for mathematical proof of this proposition.

7.7 Policy Implications of the Results

In the previous two sections, we have developed a three-sector general equilibrium model that can explain the unemployment phenomenon of both skilled and unskilled labour. The unemployment of unskilled labour is explained in terms of the HT-type rural-urban migration mechanism, while that of skilled labour is explicated by using the FWH. There are four factors of production: land, capital, unskilled labour and skilled labour. The effective land endowment of the economy can be increased by allowing the entry of foreign capital in agriculture. Inflows of foreign capital may take place also in the secondary sectors of the economy. Consequences of foreign capital inflows in the different sectors of the economy have been studied on national welfare and unemployment of either type of labour. We have found that FDI in agriculture unambiguously improves social welfare. On the contrary, an inflow of foreign capital in the secondary sectors may fail to improve social welfare. The unemployment problem of either type of labour unequivocally improves in both the cases. The theoretical analysis, therefore, justifies the desirability of FDI flow in the primary export sector from the perspective of both unemployment and social welfare. These results shed some new light on a long-standing policy debate as to whether priority should be given to agriculture or to secondary and/or services sector for achieving a decent economic growth and eradicating poverty in a developing economy.[40] Montalvo and Ravallion (2009) have discussed this issue in detail by citing both the Chinese and the Indian experiences. Although India could achieve a high rate of economic growth during the liberalized regime giving high priority to the tertiary sector, it has not performed well in the poverty front.[41] On the contrary, China has been amply successful in both economic growth and poverty fronts by giving top priority to agriculture. After witnessing China's exemplary success on the agricultural front, the developing economies like India are of late toying with the idea of permitting FDI in agriculture.[42] The analysis in the previous sections provides a theoretical foundation of such a move by the developing nations.

---

[40]The unskilled workers earning low wages usually constitute the poorer section of the working population. In terms of this model, if the average unskilled wage falls and/or the unemployment situation of unskilled labour deteriorates, the incidence of poverty rises. Interestingly, in the present case, we have found that due to FDI in either of the two broad sectors of the economy, the average unskilled wage (rural sector wage) rises and the unemployment level decreases. Therefore, the magnitude of poverty is expected to have decreased. However, it may be noted that there are three different groups of unskilled workers earning different wages. Their sectoral allocation has also changed. Besides, there are also skilled workers in the model and their wages and unemployment situation have changed. So, the conclusion that poverty has decreased might be quite different if one brings in income inequality in the measurement of poverty based on the entire workforce.

[41]The World Bank (2008) estimates that 456 million Indians (42 % of the total Indian population) in 2005 lived under the global poverty line of $1.25 per day (purchasing power parity). This means that a third of the global poor in 2005 lived in India. Besides, the number of poor people living under $1.25 a day has increased from 421 million in 1981 to 456 million in 2005. Further details are available at http://go.worldbank.org/DQKD6WV4T0.

[42]See Deshpande (2007) for details.

Appendices

Appendix 7.1: Derivations of Certain Useful Expressions

Total differentials of Eqs. (7.6), (7.7), (7.11) and (7.12) yield

$$\theta_{L1}\widehat{W}_1 + \theta_{K1}\widehat{R}_1 = 0 \tag{7.A.1}$$

$$\theta_{L2}\widehat{W}_2 + \theta_{K2}\widehat{R}_1 = \widehat{P}_2 \tag{7.A.2}$$

$$(1-\varphi_1\rho)\,\widehat{W}_1 - \widehat{\rho} = 0 \tag{7.A.3}$$

$$(1-\varphi_2\rho)\,\widehat{W}_2 - \widehat{\rho} = 0 \tag{7.A.4}$$

Arranging Eqs. (7.A.1), (7.A.2), (7.A.3) and (7.A.4) in a matrix notation, we write

$$\begin{bmatrix} \theta_{L1} & 0 & \theta_{K1} & 0 \\ 0 & \theta_{L2} & \theta_{K2} & 0 \\ (1-\varphi_1\rho) & 0 & 0 & -1 \\ 0 & (1-\varphi_2\rho) & 0 & -1 \end{bmatrix} \begin{bmatrix} \widehat{W}_1 \\ \widehat{W}_2 \\ \widehat{R}_1 \\ \widehat{\rho} \end{bmatrix} = \begin{bmatrix} 0 \\ \widehat{P}_2 \\ 0 \\ 0 \end{bmatrix} \tag{7.A.5}$$

Appendix 7.2: Effects of a Change in $\mathbf{P}_2$ *on Factor Prices and* $\boldsymbol{\rho}$

Using Cramer's rule from (7.A.5), we get

$$\left.\begin{aligned} \widehat{W}_1 &= \frac{\theta_{K1}}{\Delta}(1-\varphi_2\rho)\,\widehat{P}_2 \\ \widehat{W}_2 &= \frac{\theta_{K1}}{\Delta}(1-\varphi_1\rho)\,\widehat{P}_2 \\ \widehat{R}_1 &= -\frac{\theta_{L1}}{\Delta}(1-\varphi_2\rho)\,\widehat{P}_2 \\ \widehat{\rho} &= \frac{\theta_{K1}}{\Delta}(1-\varphi_1\rho)(1-\varphi_2\rho)\,\widehat{P}_2 \\ &\text{where } \Delta = \theta_{K1}\theta_{L2}(1-\varphi_1\rho) - \theta_{L1}\theta_{K2}(1-\varphi_2\rho) \end{aligned}\right\} \tag{7.A.6}$$

Using Eqs. (7.12) and (7.13), Δ can alternatively be expressed as follows:

$$\begin{aligned}\Delta &= \frac{a_{L1}X_1}{L^1}\theta_{K1}\theta_{L2} - \frac{a_{L2}X_2}{L^2}\theta_{L1}\theta_{K2}\\ &= \theta_{L1}\theta_{L2}\left[\frac{\theta_{K1}a_{L1}X_1}{\theta_{L1}L^1} - \frac{\theta_{K2}a_{L2}X_2}{\theta_{L2}L^2}\right]\\ &= \theta_{L1}\theta_{L2}\left[\frac{\theta_{K1}}{\left(\frac{W_1L^1}{P_1X_1}\right)} - \frac{\theta_{K2}}{\left(\frac{W_2L^2}{P_2X_2}\right)}\right]\end{aligned}$$

So,

$$\Delta = \theta_{L1}\theta_{L2}\left[\frac{\theta_{K1}}{\theta^*_{L1}} - \frac{\theta_{K2}}{\theta^*_{L2}}\right] \tag{7.A.7}$$

where $\theta_{K1} = (R_1a_{K1}/P_1)$, $\theta_{K2} = (R_1a_{K2}/P_2)$, $\theta^*_{L1} = (W_1L^1/P_1X_1)$ and $\theta^*_{L2} = (W_2L^2/P_2X_2)$.

Now, total differentials of Eq. (7.8) yield

$$\widehat{R}_2 = -\frac{\theta_{23}}{\theta_{K3}}\widehat{P}_2 \tag{7.A.8}$$

Appendix 7.3: Effects of a Change in $\mathbf{K}_2$ *on the Price of the Non-traded Good*

Totally differentiating Eq. (7.9.1) and using Eqs. (7.16), (7.A.6), (7.A.7) and (7.A.8), we get

$$W_1\lambda_{L1}\widehat{X}_1 + W_2\lambda_{L2}\widehat{X}_2 = \left(W_3^*B_1 - W_1\lambda_{L1}B_2 - W_2\lambda_{L2}B_3\right)\widehat{P}_2 - W_3^*\lambda_{L3}\widehat{K}_2 \tag{7.A.9}$$

Total differentials of Eq. (7.17) and the use of Eqs. (7.A.6), (7.A.7) and (7.A.8) yield

$$\lambda_{K1}\widehat{X}_1 + \lambda_{K2}\widehat{X}_2 = -\left(\lambda_{K1}B_4 + \lambda_{K2}B_5\right)\widehat{P}_2 \tag{7.A.10}$$

where

$$\left.\begin{aligned}
B_1 &= \frac{\rho}{\Delta}\theta_{K1}(1-\varphi_1\rho)(1-\varphi_2\rho) - \lambda_{L3}\sigma_3\frac{\theta_{23}}{\theta_{K3}}(\theta_{K3}-\theta_{L3})\\
B_2 &= \frac{1}{\Delta}\theta_{K1}(1-\sigma_1)(1-\varphi_2\rho)\\
B_3 &= \frac{1}{\Delta}\left[\theta_{K1}(1-\varphi_1\rho) - \sigma_2\theta_{K2}(1-\varphi_1\rho\theta_{K1}-\varphi_2\rho\theta_{L1})\right]\\
B_4 &= \frac{1}{\Delta}\theta_{L1}\sigma_1(1-\varphi_2\rho)\\
B_5 &= \frac{\sigma_2\theta_{L2}}{\Delta}\left[\theta_{K1}(1-\varphi_1\rho) + \theta_{L1}(1-\varphi_2\rho)\right]
\end{aligned}\right\} \tag{7.A.11}$$

and σ_i is the elasticity of factor substitution in the ith sector.

Differentiating Eq. (7.18) and solving (7.A.9) and (7.A.10) by Cramer's rule, we get

$$\left.\begin{aligned}
\widehat{X}_1 &= \frac{1}{|\lambda|}\left(B_1^*\widehat{P}_2 - W_3^*\lambda_{K2}\lambda_{L3}\widehat{K}_2\right);\\
\widehat{X}_2 &= \frac{1}{|\lambda|}\left(W_3^*\lambda_{K1}\lambda_{L3}\widehat{K}_2 - B_2^*\widehat{P}_2\right);\text{and,}\\
\widehat{X}_2 &= \widehat{X}_3 \ \ \text{(note that } a_{23} \text{ is constant.)}
\end{aligned}\right\} \tag{7.A.12}$$

where

$$\left.\begin{aligned}
B_1^* &= \{W_3^*\lambda_{K2}B_1 - W_1\lambda_{L1}\lambda_{K2}B_2 - W_2\lambda_{L2}\lambda_{K2}B_3 + W_2\lambda_{L2}(\lambda_{K1}B_4 + \lambda_{K2}B_5)\}\\
B_2^* &= \{W_3^*\lambda_{K1}B_1 - W_1\lambda_{L1}\lambda_{K1}B_2 - W_2\lambda_{L2}\lambda_{K1}B_3 + W_1\lambda_{L1}(\lambda_{K1}B_4 + \lambda_{K2}B_5)\}
\end{aligned}\right\} \tag{7.A.13}$$

and

$$|\lambda| = (W_1\lambda_{L1}\lambda_{K2} - W_2\lambda_{K1}\lambda_{L2}) = \left[\left(\frac{X_1X_2}{LK_D}\right)(a_{L1}W_1a_{K2} - a_{L2}W_2a_{K1})\right]$$

or

$$|\lambda| = \left(\frac{P_1X_1P_2X_2}{R_1LK_D}\right)|\theta| \tag{7.A.14}$$

where

$$|\theta| = (\theta_{L1}\theta_{K2} - \theta_{L2}\theta_{K1}) \tag{7.A.14.1}$$

Differentiating Eq. (7.16), we get

$$\widehat{X}_3 = \widehat{K}_2 - B_6\widehat{P}_2 \tag{7.A.15}$$

where

$$B_6 = \frac{\sigma_3\theta_{L3}\theta_{23}}{\theta_{K3}} \tag{7.A.16}$$

Differentiating Eq. (7.18) and using Eqs. (7.A.12) and (7.A.15) and simplifying, we obtain

$$\begin{aligned}\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right) &= \frac{1}{\Delta'}\left(W_3^*\lambda_{L3}\lambda_{K1} - |\lambda|\right)\\ &= \frac{1}{\Delta'}W_1\lambda_{L1}\left(W_3^*\lambda_{L3} + W_2\lambda_{L2}\right).\left[\frac{\lambda_{K1}}{W_1\lambda_{L1}} - \frac{\lambda_{K2}}{\left(W_3^*\lambda_{L3} + W_2\lambda_{L2}\right)}\right]\end{aligned} \tag{7.A.17}$$

where

$$\Delta' = B_2^* - |\lambda|\, B_6 = B_2^* - |\lambda|\left(\frac{\sigma_3\theta_{L3}\theta_{23}}{\theta_{K3}}\right) \tag{7.A.18}$$

From Eq. (7.A.8), we write

$$\left(\frac{\widehat{R}_2}{\widehat{K}_2}\right) = -\left(\frac{\theta_{23}}{\theta_{K3}}\right)\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right)$$

or

$$\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right) = -\left(\frac{\theta_{K3}}{\theta_{23}}\right)\left(\frac{\widehat{R}_2}{\widehat{K}_2}\right) \tag{7.A.19}$$

Now, it is sensible to assume that an inflow of foreign capital (of type 2) lowers the return to capital of that type, i.e. R_2. In an indecomposable production structure like this where all factor prices depend on every factor endowment, R_2 should fall since the supply of capital of type 2 has increased given the demand. This implies, $\left(\widehat{R}_2/\widehat{K}_2\right) < 0$.

From Eq. (7.A.19), we, therefore, find that

$$\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right) = -\left(\frac{\theta_{K3}}{\theta_{23}}\right)\underset{(-)}{\left(\frac{\widehat{R}_2}{\widehat{K}_2}\right)} > 0 \tag{7.A.19.1}$$

This means that an inflow of foreign capital of type 2 always raises the price of the non-traded input. The reason is quite simple. An increase in the endowment of capital of type 2 leads to an expansion of sector 3 since capital of type 2 is specific to sector 3. As sector 3 expands, the demand for the non-traded input, X_2, rises which, in turn, raises its price, P_2.

Now from (7.A.17), it follows that

$$\left(\frac{1}{\Delta'}\right)\left(W_3^*\lambda_{L3}\lambda_{K1} - |\lambda|\right) > 0 \tag{7.A.20.1}$$

$$\left(\frac{1}{\Delta'}\right)\left[\frac{\lambda_{K1}}{W_1\lambda_{L1}} - \frac{\lambda_{K2}}{\left(W_3^*\lambda_{L3} + W_2\lambda_{L2}\right)}\right] > 0 \tag{7.A.20.2}$$

Appendix 7.4: Derivations of Static Stability Condition in the Market for Good 2

As commodity 2, produced in the sector 2, is internationally non-traded, its market must clear domestically through adjustment in its price, P_2. The stability condition in the market for commodity 2 requires that

$$\frac{\widehat{X}_3}{\widehat{P}_2} - \frac{\widehat{X}_2}{\widehat{P}_2} < 0 \tag{7.A.21}$$

Using (7.A.12), one can find

$$\left(\frac{\widehat{X}_2}{\widehat{P}_2}\right) = -\left(\frac{B_2^*}{|\lambda|}\right) \tag{7.A.22}$$

On the other hand, from Eqs. (7.A.15) and (7.A.16), it follows that

$$\frac{\widehat{X}_3}{\widehat{P}_2} = -B_6 = -\left(\frac{\sigma_3\theta_{L3}\theta_{23}}{\theta_{K3}}\right) < 0 \tag{7.A.23}$$

Using Eqs. (7.A.22) and (7.A.23), the stability condition (7.A.21) becomes

$$\left(\frac{B_2^*}{|\lambda|}\right) < \left(\frac{\sigma_3\theta_{L3}\theta_{23}}{\theta_{K3}}\right) \tag{7.A.24}$$

Appendix 7.5: Simplifying Assumptions on Production Technologies

For simplifying matters and deriving comparative static results under meaningful sufficient conditions, let us now assume that the production functions of sectors 1 and 2 are of Cobb–Douglas types and the elasticity of substitution between factors in sector 3 is sufficiently low. All these imply that

$$\left.\begin{array}{l}\sigma_1 = \sigma_2 = 1; \quad \text{and} \\ \sigma_3 \cong 0\end{array}\right\} \tag{7.A.25}$$

Appendix 7.6: Factor Intensity Conditions and Algebraic Signs of Certain Useful Expressions

We consider the following two cases depending on the relative factor intensities between the rural sector and the urban informal sector.

Case I *The urban informal sector is more capital-intensive than the rural sector in both ex post and ex ante value senses.*

That the informal sector is capital-intensive relative to the rural sector in an ex post value sense implies that

$$|\theta| = \theta_{L1}\theta_{K2} - \theta_{L2}\theta_{K1} > 0 \tag{7.A.26}$$

This also implies from (7.A.14) that

$$|\lambda| = \left(\frac{P_1 X_1 P_2 X_2}{R_1 L K_{\mathrm{D}}}\right) |\theta| > 0 \tag{7.A.27}$$

Now that the urban informal sector is more capital-intensive relative to the rural sector in an ex ante value sense implies that

$$\frac{\theta_{K1}}{\theta_{L1}^{*}} < \frac{\theta_{K2}}{\theta_{L2}^{*}} \tag{7.A.28}$$

Using (7.A.28) from (7.A.7), we find that

$$\Delta = \theta_{L1}\theta_{L2}\left[\frac{\theta_{K1}}{\theta_{L1}^{*}} - \frac{\theta_{K2}}{\theta_{L2}^{*}}\right] < 0 \tag{7.A.29}$$

Now using expressions (7.A.25), (7.A.26) and (7.A.27) and (7.A.29) from (7.A.11), (7.A.13), (7.A.18) and (7.A.24), we have

$$\left.\begin{array}{l}|\theta| > 0;\ |\lambda| > 0;\ \Delta < 0;\ \ \Delta' < 0; \\ B_1 < 0;\ B_2 = 0;\ B_3 = 1;\ B_4 < 0;\ B_5 < 0; \\ B_1^* < 0;\ B_2^* < 0.\end{array}\right\} \tag{7.A.30}$$

So, if the urban informal sector is more capital-intensive than the rural sector in both ex post and ex ante value senses, we have the algebraic signs of certain useful expressions as given by (7.A.30).

From (7.A.20.1), we now find that

$$\left(W_3^* \lambda_{L3} \lambda_{K1} - |\lambda|\right) < 0 \tag{7.A.30.1}$$

Besides, from (7.A.20.2), it now follows that

$$\tfrac{\lambda_{K1}}{W_1 \lambda_{L1}} < \tfrac{\lambda_{K2}}{\left(W_3^* \lambda_{L3} + W_2 \lambda_{L2}\right)} \tag{7.A.30.2}$$

After a little manipulation from (7.A.30.2), we obtain

$$\left(\frac{\theta_{K1}}{\theta_{L1}}\right) < \left(\frac{\theta_{K2}\theta_{23}}{\theta_{L3} + \theta_{L2}\theta_{23}}\right) \tag{7.A.31}$$

The interpretations of the condition as presented in (7.A.31) are as follows. Sector 3 does not use capital 1 directly. However, it uses capital of type 1 indirectly through use of the non-traded input produced in sector 2 that uses capital of type 1 directly. So the condition implies that the vertically integrated urban formal sector (sector 3) is more capital-intensive vis-à-vis the rural sector in the ex post value sense.

Case II *The rural sector is more capital-intensive relative to the urban informal sector in ex post value sense.*

That the rural sector is more capital-intensive than the urban informal sector in the ex post value sense implies that

$$|\theta| = \theta_{L1}\theta_{K2} - \theta_{L2}\theta_{K1} < 0 \tag{7.A.32}$$

This also implies from (7.A.14) that

$$|\lambda| = \left(\frac{P_1 X_1 P_2 X_2}{R_1 L K_{\mathrm{D}}}\right) |\theta| < 0 \tag{7.A.33}$$

Now that the rural sector is more capital-intensive vis-à-vis the urban informal sector in an ex ante value sense implies that

$$\frac{\theta_{K1}}{\theta^*_{L1}} > \frac{\theta_{K2}}{\theta^*_{L2}} \tag{7.A.34}$$

Using (7.A.34) from (7.A.7), we find that

$$\Delta = \theta_{L1}\theta_{L2}\left[\frac{\theta_{K1}}{\theta^*_{L1}} - \frac{\theta_{K2}}{\theta^*_{L2}}\right] > 0 \tag{7.A.35}$$

Now using expressions (7.A.25), (7.A.32), (7.A.33) and (7.A.35) from (7.A.11), (7.A.13), (7.A.18) and (7.A.24), we have

$$\left.\begin{array}{l} |\theta| < 0;\ |\lambda| < 0;\ \Delta > 0;\ \ \Delta' > 0; \\ B_1 > 0;\ B_2 = 0;\ B_3 = 1;\ B_4 > 0;\ B_5 > 0; \\ B^*_1 > 0;\ B^*_2 > 0. \end{array}\right\} \tag{7.A.36}$$

So, if the rural sector is more capital-intensive than the urban informal sector in both ex post and ex ante value senses, we have the algebraic signs of different useful expressions as given by (7.A.36).

Besides, from expressions (7.A.20.1) and (7.A.20.2), we find that

$$\left.\begin{array}{c} \underset{(-)}{\left(W^*_3\lambda_{L3}\lambda_{K1} - |\lambda|\right)} > 0; \\ \left[\frac{\lambda_{K1}}{W_1\lambda_{L1}} - \frac{\lambda_{K2}}{(W^*_3\lambda_{L3}+W_2\lambda_{L2})}\right] > 0 \end{array}\right\} \tag{7.A.37}$$

Appendix 7.7: Effects of a Change in $\mathbf{K_2}$ *on Factor Prices,* $\boldsymbol{\rho}$ *and Output Composition*

Case I *The urban informal sector is more capital-intensive than the rural sector in both ex post and ex ante value senses.*

Using (7.A.19.1) and the algebraic signs of the expressions presented in (7.A.30) from (7.A.6), the following results are obtained:

$$\left.\begin{array}{l} \left(\frac{\widehat{W}_1}{\widehat{K}_2}\right) = \left[\underset{(-)}{\left(\frac{\theta_{K1}}{\Delta}\right)}(1-\varphi_2\rho)\underset{(+)}{\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right)}\right] < 0;\ \left(\frac{\widehat{W}_2}{\widehat{K}_2}\right) = \left[\underset{(-)}{\left(\frac{\theta_{K1}}{\Delta}\right)}(1-\varphi_1\rho)\underset{(+)}{\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right)}\right] < 0; \\ \left(\frac{\widehat{R}_1}{\widehat{K}_2}\right) = -\left[\underset{(-)}{\left(\frac{\theta_{L1}}{\Delta}\right)}(1-\varphi_2\rho)\underset{(+)}{\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right)}\right] > 0; \\ \left(\frac{\widehat{\rho}}{\widehat{K}_2}\right) = \underset{(-)}{\left(\frac{\theta_{K1}}{\Delta}\right)}\left[(1-\varphi_1\rho)(1-\varphi_2\rho)\underset{(+)}{\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right)}\right] < 0. \end{array}\right\} \tag{7.A.38}$$

Using (7.A.19.1), (7.A.25) and (7.A.30) once more from (7.A.12) and (7.A.15), the following results can also be obtained:

$$\left.\begin{array}{l}\left(\frac{\widehat{X}_1}{\widehat{K}_2}\right) = \left[\underset{(+)}{\left(\frac{1}{|\lambda|}\right)}\left(\underset{(-)}{B_1^*}\underset{(+)}{\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right)} - W_3^*\lambda_{K2}\lambda_{L3}\right)\right] < 0; \\ \left(\frac{\widehat{X}_2}{\widehat{K}_2}\right) \cong 1 > 0; \left(\frac{\widehat{X}_3}{\widehat{K}_2}\right) \cong 1 > 0.\end{array}\right\} \quad (7.A.39)$$

Case II *The rural sector is more capital-intensive relative to the urban informal sector in an ex post value sense.*

Using (7.A.19.1) and the algebraic signs of the expressions presented in (7.A.36) from (7.A.6), the following results are obtained:

$$\left.\begin{array}{l}\left(\frac{\widehat{W}_1}{\widehat{K}_2}\right) = \left[\underset{(+)}{\left(\frac{\theta_{K1}}{\Delta}\right)}(1-\varphi_2\rho)\underset{(+)}{\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right)}\right] > 0; \left(\frac{\widehat{W}_2}{\widehat{K}_2}\right) = \left[\underset{(+)}{\left(\frac{\theta_{K1}}{\Delta}\right)}(1-\varphi_1\rho)\underset{(+)}{\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right)}\right] > 0; \\ \left(\frac{\widehat{R}_1}{\widehat{K}_2}\right) = -\left[\underset{(+)}{\left(\frac{\theta_{L1}}{\Delta}\right)}(1-\varphi_2\rho)\underset{(+)}{\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right)}\right] < 0; \\ \left(\frac{\widehat{\rho}}{\widehat{K}_2}\right) = \underset{(+)}{\left(\frac{\theta_{K1}}{\Delta}\right)}\left[(1-\varphi_1\rho)(1-\varphi_2\rho)\underset{(+)}{\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right)}\right] > 0.\end{array}\right\} \quad (7.A.40)$$

Using (7.A.11), (7.A.18), (7.A.19.1), (7.A.25), (7.A.36) and (7.A.37) and simplifying from (7.A.12) and (7.A.15), the following results also can be obtained:

$$\left.\begin{array}{l}\frac{\widehat{X}_1}{\widehat{K}_2} = \frac{1}{|\lambda|}\left(\underset{(-)}{B_1^*}\underset{(+)(+)}{\frac{\widehat{P}_2}{\widehat{K}_2}} - W_3^*\lambda_{K2}\lambda_{L3}\right) < 0 \quad \text{if} \quad \left(\frac{\lambda_{K1}}{\lambda_{K2}}\right) > \left(\frac{\lambda_{L1}}{\lambda_{L2}+\lambda_{L3}}\right) \geq \left(\frac{B_2*}{B_1*}\right) \\ \frac{\widehat{X}_2}{\widehat{K}_2} \cong 1 > 0; \frac{\widehat{X}_3}{\widehat{K}_2} \cong 1 > 0.\end{array}\right\} \quad (7.A.41)$$

Appendix 7.8: Effects of a Change in K$_2$ *on Urban Unemployment*

Taking total differentials of Eq. (7.15) with respect to K_2 and using $\sigma_1 = \sigma_2 = 1$ and simplifying, we get

$$\frac{\widehat{U}}{\widehat{K}_2} = -\left(\frac{L}{U}\right)$$
$$\left[\begin{array}{c} \left\{\begin{array}{l} -\lambda_{L1}\theta_{K1}\left(\frac{\widehat{W}_1}{\widehat{P}_2}\right) - \lambda_{L2}\theta_{K2}\left(\frac{\widehat{W}_2}{\widehat{P}_2}\right) + (\lambda_{L1}\theta_{K1} + \lambda_{L2}\theta_{K2})\left(\frac{\widehat{R}_1}{\widehat{P}_2}\right) \\ + \lambda_{L3}\sigma_3\theta_{K3}\left(\frac{\widehat{R}_2}{\widehat{P}_2}\right) \end{array}\right\}\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right) + \\ \lambda_{L1}\left(\frac{\widehat{X}_1}{\widehat{K}_2}\right) + \lambda_{L2}\left(\frac{\widehat{X}_2}{\widehat{K}_2}\right) + \lambda_{L3}\left(\frac{\widehat{X}_3}{\widehat{K}_2}\right) \end{array}\right] \tag{7.A.42}$$

Now, using Eqs. (7.18), (7.A.6), (7.A.7), (7.A.8), (7.A.11), (7.A.12), (7.A.15), (7.A.16) and (7.A.25), we may rewrite Eq. (7.A.42) as follows:

$$\frac{\widehat{U}}{\widehat{K}_2} = -\left(\frac{L}{U}\right)\left[\begin{array}{c} \left\{\begin{array}{l} -\lambda_{L1}\frac{(\theta_{K1})^2}{\Delta}(1-\varphi_2\rho) - \lambda_{L2}\theta_{K2}\frac{\theta_{K1}}{\Delta}(1-\varphi_1\rho) \\ -(\lambda_{L1}\theta_{K1} + \lambda_{L2}\theta_{K2})\frac{\theta_{L1}}{\Delta}(1-\varphi_2\rho) \end{array}\right\}\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right) \\ + \frac{\lambda_{L1}}{|\lambda|}\left(B_1^*\frac{\widehat{P}_2}{\widehat{K}_2} - W_3^*\lambda_{L3}\lambda_{K2}\right) + (\lambda_{L2} + \lambda_{L3}) \end{array}\right] \tag{7.A.43}$$

Case I *The urban informal sector is more capital-intensive than the rural sector in both ex ante and ex post value senses.*

Using Eqs. (7.A.13), (7.A.14), (7.A.18), (7.A.30) and (7.A.30.1) and after simplification, Eq. (7.A.43) may be rewritten as follows:

$$\frac{\widehat{U}}{\widehat{K}_2} = -\left(\frac{L}{U}\right)$$
$$\left[\begin{array}{l} -\left\{\begin{array}{l} \lambda_{L1}(\theta_{K1})^2(1-\varphi_2\rho) + \lambda_{L2}\theta_{K2}\theta_{K1}(1-\varphi_1\rho) + \\ (\lambda_{L1}\theta_{K1} + \lambda_{L2}\theta_{K2})\underset{(+)}{\theta_{L1}}(1-\varphi_2\rho) \end{array}\right\}\left(\frac{\overset{(-)}{W_3^*\lambda_{L3}\lambda_{K1} - |\lambda|}}{\underset{(-)\ (-)}{\Delta B_2^*}}\right) \\ + \left(\frac{1}{\underset{(+)\ (-)}{|\lambda| B_2^*}}\right)\left[W_3^*\lambda_{L3}\lambda_{L1}\underset{(-)}{\left(\lambda_{K1}B_1^* - \lambda_{K2}B_2^*\right)} + \underset{(+)}{|\lambda|}\left\{(\lambda_{L2} + \lambda_{L3})\underset{(-)}{B_2^*} - \lambda_{L1}\underset{(-)}{B_1^*}\right\}\right] \end{array}\right] \tag{7.A.44}$$

Then, from Eq. (7.A.44), it follows that

$$\left(\frac{\widehat{U}}{\widehat{K}_2}\right) < 0 \quad \text{if} \quad \left(\frac{\lambda_{K1}}{\lambda_{K2}}\right) \geq \frac{B_2^*}{B_1^*} \geq \left(\frac{\lambda_{L1}}{\lambda_{L2} + \lambda_{L3}}\right) \tag{7.A.45}$$

From (7.A.45), it follows that if the urban sector as a whole is sufficiently labour-intensive relative to the rural sector with respect to capital of type 1 (in physical sense), urban unemployment falls due to inflows of foreign capital.

Case II *The rural sector is more capital-intensive relative to the urban informal sector in both ex ante and ex post value senses.*

Using Eqs. (7.A.13), (7.A.14), (7.A.17), (7.A.18), (7.A.36) and (7.A.37) and after simplification, Eq. (7.A.43) may be alternatively rewritten as follows:

$$\frac{\widehat{U}}{\widehat{K}_2} = -\left(\frac{L}{U}\right)$$

$$\left[\begin{array}{l} -\left\{\begin{array}{l}\lambda_{L1}(\theta_{K1})^2(1-\varphi_2\rho) + \lambda_{L2}\theta_{K2}\theta_{K1}(1-\varphi_1\rho) + \\ (\lambda_{L1}\theta_{K1} + \lambda_{L2}\theta_{K2})\,\theta_{L1}(1-\varphi_2\rho)\end{array}\right\}\underset{(+)(+)}{\overset{(+)}{\left(\frac{W_3^*\lambda_{L3}\lambda_{K1}-|\lambda|}{\Delta B_2^*}\right)}} \\ \quad\ \ (+) \\ +\underset{(-)\,(+)}{\left(\frac{1}{|\lambda|B_2^*}\right)}\left[W_3^*\lambda_{L3}\lambda_{L1}\left(\lambda_{K1}\underset{(+)}{B_1^*} - \lambda_{K2}\underset{(+)}{B_2^*}\right) + |\lambda|\underset{(-)}{\left\{(\lambda_{L2}+\lambda_{L3})\,\underset{(+)}{B_2^*} - \lambda_{L1}\underset{(+)}{B_1^*}\right\}}\right]\end{array}\right] \tag{7.A.46}$$

From Eq. (7.A.46), it is evident that

$$\left(\frac{\widehat{U}}{\widehat{K}_2}\right) > 0 \quad \text{if} \quad \left(\frac{\lambda_{K1}}{\lambda_{K2}}\right), \left(\frac{\lambda_{L1}}{\lambda_{L2}+\lambda_{L3}}\right) \geq \left(\frac{B_2^*}{B_1^*}\right) \tag{7.A.47}$$

Appendix 7.9: Effects of a Change in $\mathbf{K}_2$ *on Social Welfare*

Total differential of Eq. (7.20) yields

$$dY = dX_1 + P_3^* dX_3 - R_2 dK_2 + tP_3 dM \quad \text{(assuming the initial stock of foreign capital to be zero)} \tag{7.A.48}$$

Here, the three production functions are as follows:

$$\left.\begin{array}{c} X_1 = F^1(L_1, K_{11}); \\ X_2 = F^2(L_2, K_{12}); \text{ and,} \\ X_3 = F^3(L_3, K_2). \end{array}\right\} \tag{7.A.49}$$

Differentiating the production functions, we may rewrite Eq. (7.A.48) as follows:
$dY = (F_L^1 dL_1 + F_K^1 dK_{11}) + P_3^*(F_L^3 dL_3 + F_K^3 dK_2) + P_2 dX_2 - R_2 dK_2 + tP_3 dM$

(Note that from Eq. (7.18), we can write $a_{23}dX_3 = dX_2$.)

$$= (W_1 dL_1 + R_1 dK_{11}) + \left(W_3{}^* dL_3 + R_2 dK_2\right) + (W_2 dL_2 + R_1 dK_{12}) - R_2 dK_2 + tP_3 dM$$

(Note that $P^k F_j^k$ is the value of marginal product of the jth factor in the kth sector, which is equal to the factor price.)

$$= \left(W_1 dL_1 + W_2 dL_2 + W_3{}^* dL_3\right) + R_1 (dK_{11} + dK_{12}) + tP_3 dM$$

$$dY = \left(W_1 dL_1 + W_2 dL_2 + W_3{}^* dL_3\right) + tP_3 dM \quad (\text{since}, dK_{11} + dK_{12} = dK_1 = 0) \tag{7.A.50}$$

Differentiating Eq. (7.22), we obtain

$$dM = \left(\frac{\partial D_3}{\partial Y}\right) dY - dX_3$$

Using (7.A.50), we have

$$\begin{aligned} dM &= \left(\frac{\partial D_3}{\partial Y}\right) \left[\left(W_1 dL_1 + W_2 dL_2 + W_3^* dL_3\right) + tP_3 dM\right] - dX_3 \\ &= \left(\frac{m}{P_3^*}\right) \left[\left(W_1 dL_1 + W_2 dL_2 + W_3^* dL_3\right) + tP_3 dM\right] - dX_3 \end{aligned} \tag{7.A.51}$$

where m stands for the marginal propensity to consume the import good (commodity 3) and $m = P_3^*(\partial D_3/\partial Y)$ with $0 < m < 1$.

So, from (7.A.51)

$$dM \left[1 - \frac{tm}{1+t}\right] = \left(\frac{m}{P_3^*}\right) \left[\left(W_1 dL_1 + W_2 dL_2 + W_3^* dL_3\right)\right] - dX_3$$

or

$$dM = V \left[\left(\frac{m}{P_3^*}\right) \left(W_1 dL_1 + W_2 dL_2 + W_3^* dL_3\right) - dX_3\right] \tag{7.A.52}$$

where

$$V = \left[\frac{(1+t)}{1 + t(1-m)}\right] > 1.$$

Substituting (7.A.52) in (7.A.50) and simplifying, we obtain

$$dY = V\left[\left(W_1 dL_1 + W_2 dL_2 + W_3^* dL_3\right) - tP_3 dX_3\right]$$

or

$$\widehat{Y} = \left(\frac{V}{Y}\right)\left[\left(W_1 dL_1 + W_2 dL_2 + W_3^* dL_3\right) - tP_3 X_3 \widehat{X}_3\right] \tag{7.A.53}$$

Differentiating Eq. (7.9.1) with respect to K_2, we get

$$\begin{aligned} W_1\frac{dL_1}{dK_2} + W_2\frac{dL_2}{dK_2} + W_3^*\frac{dL_3}{dK_2} &= W_3^* L\frac{d\rho}{dK_2} - \left(L_1\frac{dW_1}{dK_2} + L_2\frac{dW_2}{dK_2}\right)\\ &= \frac{\rho W_3^* L}{K_2}\frac{\widehat{\rho}}{\widehat{K}_2} - \left(\frac{W_1 L_1}{K_2}\frac{\widehat{W}_1}{\widehat{K}_2} + \frac{W_2 L_2}{K_2}\frac{\widehat{W}_2}{\widehat{K}_2}\right) \end{aligned} \tag{7.A.54}$$

Using (7.A.6) in (7.A.54), we may write

$$\begin{aligned} \left[W_1\frac{dL_1}{dK_2} + W_2\frac{dL_2}{dK_2} + W_3^*\frac{dL_3}{dK_2}\right] &= -\left[\left\{\left(\frac{W_1 L_1}{K_2}\frac{\theta_{K1}}{\Delta}\right)(1-\varphi_2\rho) - \left(\frac{W_2 L_2}{K_2}\frac{\theta_{K1}}{\Delta}\right)\right.\right.\\ &\qquad \left.\left.(1-\varphi_1\rho) + \left(\frac{\rho W_3^* L}{K_2}\frac{\theta_{K1}}{\Delta}\right)(1-\varphi_1\rho)(1-\varphi_2\rho)\right\}\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right)\right]\\ &= \left(\frac{\theta_{K1}}{\Delta K_2}\right)\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right)\left[\begin{array}{c} -W_1 L_1 (1-\varphi_2\rho) - W_2 L_2 (1-\varphi_1\rho) \\ +\rho W_3^* L (1-\varphi_1\rho)(1-\varphi_2\rho) \end{array}\right]\\ &= \left(\frac{\theta_{K1}}{\Delta K_2}\right)\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right)\left[-W_1\frac{L_1 L_2}{L^2} - W_2\frac{L_2 L_1}{L^1} + \rho W_3^* L\left(\frac{a_{L1}X_1}{L^1}\right)\left(\frac{a_{L2}X_2}{L^2}\right)\right]\\ &= \left(\left(\frac{\theta_{K1}}{\Delta K_2}\right)\left(\frac{L_1 L_2}{L^1 L^2}\right)\right)\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right)\left[-W_1 L^1 - W_2 L^2 + \rho W_3^* L\right]\\ &= \left(\left(\frac{\theta_{K1}}{\Delta K_2}\right)\left(\frac{L_1 L_2}{L^1 L^2}\right)\right)\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right)\left[W_1 L_1 + W_2 L_2 + W_3^* L_3 - W_1 L^1 - W_2 L^2\right]\\ &= \left(\left(\frac{\theta_{K1}}{\Delta K_2}\right)\left(\frac{L_1 L_2}{L^1 L^2}\right)\right)\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right)\left[W_1\left(L_1 - L^1\right) + W_2\left(L_2 - L^2\right) + W_3^* L_3\right] \end{aligned} \tag{7.A.55}$$

Now, from Eq. (7.12), we can write

$$\frac{a_{L1}X_1}{L^1} = (1 - \varphi_1\rho) \Rightarrow \left(L_1 - L^1\right) = -\varphi_1\rho L^1 < 0 \tag{7.A.55.1}$$

Similarly, from Eq. (7.13), it follows that

$$\left(L_2 - L^2\right) = -\varphi_2\rho L^2 < 0 \tag{7.A.55.2}$$

Subtraction of Eq. (7.14) from Eq. (7.15) yields

$$\left(L_1 - L^1\right) + \left(L_2 - L^2\right) + \left(L_3 - L^3\right) + U = 0 \tag{7.A.55.3}$$

Using Eqs. (7.A.55.1) and (7.A.55.2) from Eq. (7.A.55.3), one can write

$$\begin{aligned} L_3 > \varphi_1\rho L^1 + \varphi_2\rho L^2 &\Rightarrow W_3^* L_3 > W_1\varphi_1\rho L^1 + W_2\varphi_2\rho L^2 \quad \left[\because W_1, W_2 < W_3^*\right] \\ &\Rightarrow \left(W_3^* L_3 + W_2\varphi_2\rho L^2\right) > W_1\varphi_1\rho L^1 \\ &\Rightarrow \left[-W_1\rho\varphi_1 L^1 + W_2\rho\varphi_2 L^2 + W_3^* L_3\right] > 0 \end{aligned} \tag{7.A.55.4}$$

So, from (7.A.55), it entails

$$\left[W_1\frac{dL_1}{dK_2} + W_2\frac{dL_2}{dK_2} + W_3^*\frac{dL_3}{dK_2}\right] = \left(\left(\frac{\theta_{K1}}{\Delta K_2}\right)\left(\frac{L_1L_2}{L^1L^2}\right)\right)\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right) \underset{(+)}{\left[-W_1\rho\varphi_1 L^1 + W_2\rho\varphi_2 L^2 + W_3^* L_3\right]} \tag{7.A.56}$$

Using Eqs. (7.A.53) and (7.A.56), we get

$$\frac{\widehat{Y}}{\widehat{K}_2} = \frac{V}{Y} \left[\left(\left(\frac{\theta_{K1}}{\Delta K_2}\right)\left(\frac{L_1L_2}{L^1L^2}\right)\right)\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right)\underset{(+)}{\left(-W_1\rho\varphi_1 L^1 + W_2\rho\varphi_2 L^2 + W_3^* L_3\right)} - tP_3X_3\left(\frac{\widehat{X}_3}{\widehat{K}_2}\right)\right] \tag{7.A.57}$$

Case I *The urban informal sector is more capital-intensive than the rural sector in both ex ante and ex post value senses.*

In this case, we have

$$\left(\frac{\theta^*_{K1}}{\theta^*_{L1}}\right) < \left(\frac{\theta^*_{K2}}{\theta^*_{L2}}\right) \Rightarrow \Delta = \theta_{L1}\theta_{L2}\left[\frac{\theta^*_{K1}}{\theta^*_{L1}} - \frac{\theta^*_{K2}}{\theta^*_{L2}}\right] < 0 \tag{7.A.29}$$

Using (7.A.29), (7.A.19.1) and (7.A.39) from (7.A.57), we find that

$$\frac{\widehat{Y}}{\widehat{K}_2} = \frac{V}{Y}$$
$$\left[\left\{\left(\underset{(-)}{\left(\frac{\theta_{K1}}{\Delta K_2}\right)\left(\frac{L_1L_2}{L^1L^2}\right)}\right)\underset{(+)}{\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right)}\underset{(+)}{\left(-W_1\rho\varphi_1L^1 + W_2\rho\varphi_2L^2 + W_3^*L_3\right)}\right\} - tP_3X_3\underset{(+)}{\left(\frac{\widehat{X}_3}{\widehat{K}_2}\right)}\right] < 0 \tag{7.A.57.1}$$

In Eq. (7.A.57.1), the term $\left\{\underset{(+)}{(V/Y)}\left(\underset{(-)}{(\theta_{K1}/\Delta K_2)}\left(L_1L_2/L^1L^2\right)\right)\underset{(+)}{\left(\widehat{P}_2/\widehat{K}_2\right)}\right.$ $\left.\underset{(+)}{\left(-W_1\rho\varphi_1L^1 + W_2\rho\varphi_2L^2 + W_3^*L_3\right)}\right\}$ denotes the magnitude of the LRE which is clearly negative. On the other hand, the term $-tP_3X_3\underset{(+)}{(V/Y)}\underset{(+)}{\left(\widehat{X}_3/\widehat{K}_2\right)}$ shows the magnitude of the negative TRE. So, national income at domestic prices unambiguously declines owing to FDI since both the effects are negative.

Case II *The rural sector is more capital-intensive relative to the urban informal sector in both ex ante and ex post value senses.*

In this case, we have

$$\left(\frac{\theta^*_{K1}}{\theta^*_{L1}}\right) > \left(\frac{\theta^*_{K2}}{\theta^*_{L2}}\right) \Rightarrow \Delta = \theta_{L1}\theta_{L2}\left[\frac{\theta^*_{K1}}{\theta^*_{L1}} - \frac{\theta^*_{K2}}{\theta^*_{L2}}\right] > 0 \tag{7.A.35}$$

Using (7.A.19.1), (7.A.35) and (7.A.41) from (7.A.57), we find that

$$\frac{\widehat{Y}}{\widehat{K}_2} = \frac{V}{Y}$$
$$\left[\left\{\left(\underset{(+)}{\left(\frac{\theta_{K1}}{\Delta K_2}\right)\left(\frac{L_1L_2}{L^1L^2}\right)}\right)\underset{(+)}{\left(\frac{\widehat{P}_2}{\widehat{K}_2}\right)}\underset{(+)}{\left(-W_1\rho\varphi_1L^1 + W_2\rho\varphi_2L^2 + W_3^*L_3\right)}\right\} - tP_3X_3\underset{(+)}{\left(\frac{\widehat{X}_3}{\widehat{K}_2}\right)}\right] \tag{7.A.57.2}$$

From (7.A.57.2), it is evident that in the absence of any tariff on sector 3, i.e. when $t = 0$, social welfare improves following an inflow of foreign capital. Even in the presence of a tariff, foreign capital inflows may be welfare improving if the positive LRE is stronger than the negative TRE.

Appendix 7.10: Proof of |D| > 0

Solving (7.41) by Cramer's rule, the following result is obtained:

$$\frac{\widehat{R}}{\widehat{C}} = \frac{|\lambda^*|}{|D|}\underset{(+)\,(-)}{(\theta_{L1}\varepsilon_4 B_3 \lambda_{N_{\mathrm{F}}} e)} \tag{7.A.58}$$

where

$$|D| = \lambda^*_{L2}\,[\underset{(+)\,(-)}{-\varepsilon_4 B_3 \theta_{N1}\lambda_{K2}} + (\underset{(+)}{\varepsilon_4 \lambda_{K3} J} - \underset{(-)\,(+)}{B_3 B_4 H})] \tag{7.42}$$

$$\left.\begin{aligned} J &= \{\theta_{L1}\,(B_2+\varepsilon_3) - \theta_{N1}\,(B_1+\varepsilon_1)\}\,; \\ H &= (\theta_{L1}\varepsilon_3 - \theta_{N1}\varepsilon_1)\,; \quad \text{and,} \\ |\lambda^*| &= \left(\lambda_{L1}\lambda_{K2} - \frac{W^*}{W}\lambda_{L2}\lambda_{K1}\right) > 0 \end{aligned}\right\} \tag{7.A.59}$$

(Note that $|\lambda^*| > 0$ as sector 1 is more unskilled labour-intensive vis-à-vis sector 2 in value sense.)

In an indecomposable production structure like this, it is sensible to assume that R falls if C (hence, N) rises, i.e. $\left(\widehat{R}/\widehat{C}\right) < 0$. From (7.A.58), it then follows that

$$|D| > 0. \tag{7.44}$$

From (7.42), (7.A.59) and (7.44), it follows that two sufficient conditions for $|D| > 0$ are

$J, H > 0$. See also Appendix 7.A.11 in this context.

Appendix 7.11: Implications of Properties (A) and (B) of E(.) Function

Since $E_1 = (\partial E/\partial(W_S/W)); E_3 = (\partial E/\partial(W_S/R)) > 0$ and $E_{11}, E_{33} < 0$, we must have

$[\varepsilon_1 E + E_{11}(W_S/W)^2] > 0$ and

$[\varepsilon_3 E + E_{33}(W_S/R)^2] > 0$. Using (7.40), one can, therefore, write

$$\left.\begin{aligned} (\varepsilon_1 + B_1) > 0 \quad \text{and} \\ (\varepsilon_3 + B_2) > 0. \quad \end{aligned}\right\} \tag{7.A.60}$$

From Property A, it follows that

$$\left(\frac{\theta_{L1}}{\theta_{N1}}\right) > \left(\frac{\varepsilon_1}{\varepsilon_3}\right) \tag{7.A.61}$$

That $H > 0$ is a direct consequence of Assumption A. We are going to prove that $J > 0$ if Property B holds.

From (7.45),

$$J > 0 \Rightarrow \left(\frac{\theta_{L1}}{\theta_{N1}}\right) > \left(\frac{\varepsilon_1 + B_1}{\varepsilon_3 + B_2}\right) \tag{7.A.62}$$

Now,

$$\left[\frac{\varepsilon_1}{\varepsilon_3} - \frac{(B_1 + \varepsilon_1)}{(B_2 + \varepsilon_3)}\right] = \left(\frac{(\varepsilon_1 B_2 - \varepsilon_3 B_1)}{\varepsilon_3 (B_2 + \varepsilon_3)}\right) = \left(\frac{\varepsilon_1}{B_2 + \varepsilon_3}\right)\left[\frac{B_2}{\varepsilon_3} - \frac{B_1}{\varepsilon_1}\right]$$

Substituting the values of B_1 and B_2 from (7.40) and simplifying, we can obtain the following expression:

$$\left[\frac{\varepsilon_1}{\varepsilon_3} - \frac{(B_1 + \varepsilon_1)}{(B_2 + \varepsilon_3)}\right] = \left(\frac{\varepsilon_1}{\varepsilon_3 + B_2}\right)\left[\frac{E_{33} W_S}{E_3 R} - \frac{E_{11} W_S}{E_1 W}\right] \tag{7.A.63}$$

Now, if $(E_{33} W_S / E_3 R) \geq (E_{11} W_S / E_1 W)$, i.e. if Assumption B holds from (7.A.60) and (7.A.63), it follows that

$$\frac{\varepsilon_1}{\varepsilon_3} \geq \frac{(B_1 + \varepsilon_1)}{(B_2 + \varepsilon_3)} \tag{7.A.64}$$

From (7.A.61) and (7.A.64), we can write

$$\left(\frac{\theta_{L1}}{\theta_{N1}}\right) > \left(\frac{\varepsilon_1 + B_1}{\varepsilon_3 + B_2}\right) \Rightarrow J > 0$$

Combining (7.A.61) and (7.A.64) and using (7.43), one can write

$$\left(\frac{\theta_{L1}}{\theta_{N1}}\right) > \left(\frac{\varepsilon_1}{\varepsilon_3}\right) \geq \left(\frac{\varepsilon_1 + B_1}{\varepsilon_3 + B_2}\right) \Rightarrow J, H > 0 \tag{7.45}$$

Appendix 7.12: Proof of Proposition 7.4

Solving (7.41) by Cramer's rule, using (7.40), (7.44) and (7.45) and simplifying, the following results can be obtained:

$$
\left.
\begin{aligned}
&\frac{\widehat{W}}{\widehat{C}} = -\left(\frac{\varepsilon_4\theta_{N1}B_3\lambda_{N_{\mathrm{F}}}e\,|\lambda^*|}{|D|}\right) > 0; \quad \frac{\widehat{W}}{\widehat{K}} = -\frac{\varepsilon_4\theta_{N1}B_3\lambda^*_{L2}}{|D|} > 0;\\
&\frac{\widehat{R}}{\widehat{C}} = \frac{|\lambda^*|}{|D|}\left(\theta_{L1}\varepsilon_4 B_3\lambda_{N_{\mathrm{F}}}e\right) < 0; \quad \frac{\widehat{R}}{\widehat{K}} = \frac{\lambda^*_{L2}\left(\theta_{L1}\varepsilon_4 B_3\right)}{|D|} < 0\\
&\frac{\widehat{W}_{\mathrm{S}}}{\widehat{C}} = \frac{|\lambda^*|}{|D|}\varepsilon_4 J\lambda_{N_{\mathrm{F}}}e > 0; \quad \frac{\widehat{W}_S}{\widehat{K}} = \frac{\lambda^*_{L2}}{|D|}\varepsilon_4 J > 0\\
&\frac{\widehat{v}}{\widehat{C}} = \frac{|\lambda^*|}{|D|}B_3 H\lambda_{N_{\mathrm{F}}}e < 0; \quad \frac{\widehat{v}}{\widehat{K}} = \frac{\lambda^*_{L2}}{|D|}B_3 H < 0\\
&\frac{\widehat{X}_1}{\widehat{C}} = \mathrm{e}\lambda_{N_{\mathrm{F}}} > 0; \quad \frac{\widehat{X}_2}{\widehat{C}} = \frac{1}{|D|}\left[-M_1\left(\varepsilon_4\lambda_{K3}J - B_3B_4H\right) + M_2\varepsilon_4 B_3\theta_{N1}\lambda^*_{L2}\right] < 0\\
&\frac{\widehat{X}_1}{\widehat{K}} = 0; \quad \frac{\widehat{X}_2}{\widehat{K}} = -\left(\frac{B_3\varepsilon_4\theta_{N1}\lambda^*_{L2}}{|D|}\right) > 0
\end{aligned}
\right\}
\tag{7.A.65}
$$

Results presented in (7.A.65) have been verbally stated in Proposition 7.4.

Appendix 7.13: Proof of Proposition 7.5

Totally differentiating (7.34), using (7.A.65), (7.40), (7.44) and (7.45) and simplifying, the following two expressions can be derived:

$$
\begin{aligned}
Y\left(\frac{\widehat{Y}}{\widehat{C}}\right) = {} & -\underset{(+)}{\frac{\varepsilon_4 B_3\lambda_{N_{\mathrm{F}}}e|\lambda^*|}{|D|}}\left(\theta_{N1}WL - \theta_{L1}RN_{\mathrm{D}}\right) + \underset{(+)}{\frac{W_S S\lambda_{N_{\mathrm{F}}}e|\lambda^*|}{|D|}}\left\{\underset{(+)}{(1-v)}\,\varepsilon_4 J \underset{(-)}{-}\underset{(+)}{vB_3H}\right\}\\
& -\underset{(+)}{\frac{tP_2X_2}{|D|}}\left[\underset{(+)}{M_1}\,\underset{(-)}{\left(\underset{(+)}{B_3B_4H} - \underset{(+)}{\varepsilon_4\lambda_{K3}J}\right)} + \underset{(+)}{M_2}\,\underset{(+)}{\varepsilon_4 B_3}\,\underset{(+)}{\theta_{N1}}\,\underset{(-)}{\lambda^*_{L2}}\right]
\end{aligned}
\tag{7.A.66}
$$

and

$$
\begin{aligned}
Y\left(\frac{\widehat{Y}}{\widehat{K}}\right) = {} & -\underset{(+)}{\frac{\varepsilon_4 B_3}{|D|}}\overset{(+)(-)}{\vphantom{x}}\left(\theta_{N1}WL - \theta_{L1}RN_{\mathrm{D}}\right)\lambda^*_{L2} + \underset{(+)}{\frac{W_S S\lambda^*_{L2}}{|D|}}\left\{\underset{(+)(+)}{(1-v)\,\varepsilon_4 J} - \underset{(-)(+)}{vB_3H}\right\}\\
& + \overset{(+)(-)}{\underset{(+)}{\left(\frac{\varepsilon_4 B_3}{|D|}\right)}}tP_2X_2\theta_{N1}\lambda^*_{L2}
\end{aligned}
\tag{7.A.67}
$$

Now,

$$(\theta_{N1}WL - \theta_{L1}RN_{\mathrm{D}}) = W\theta_{N1}\left(L - a_{L1}\frac{N_{\mathrm{D}}}{a_{N1}}\right) > 0 \tag{7.A.68}$$

(since from (7.29) $N_{\mathrm{D}}/a_{N1} \leq X_1$ and $N_{\mathrm{D}} \leq N$).

From (7.A.68), we find that the increase in the aggregate unskilled wage income outweighs the fall in the domestic rental income on land.

Using (7.A.68) from (7.A.66), we can conclude that

$$\left(\frac{\widehat{Y}}{\widehat{C}}\right) > 0$$

However, the sign of $\left(\widehat{Y}/\widehat{K}\right)$ is ambiguous which is clear from (7.A.67).

Appendix 7.14: Proof of Proposition 7.6

Total differentials of Eq. (7.50) yield

$$\lambda_{\mathrm{LU}}\widehat{L}_{\mathrm{U}} = \lambda_{L2}\left[\left(\frac{W^* - W}{W}\right)\widehat{X}_2 - \left(\frac{W^*}{W}\right)\widehat{W}\right] \tag{7.A.69}$$

where

$$\lambda_{\mathrm{LU}} = \left(\frac{L_{\mathrm{U}}}{L}\right)$$

Using (7.A.65) and simplifying from (7.A.69), the following expressions can be derived:

$$\begin{aligned}\left(\frac{\widehat{L}_U}{\widehat{C}}\right) = \underset{(+)}{\left(\frac{\lambda_{L2}}{\lambda_{\mathrm{LU}}|D|}\right)}\Bigg[\Bigg[\underset{(+)}{\left(\frac{W^*-W}{W}\right)}\Big[\underset{(+)}{M_1}\,(\underset{(-)(+)(+)}{B_3B_4H} - \underset{(+)(+)}{\lambda_{K3}\varepsilon_4J}) + \underset{(+)(+)(-)}{M_2\varepsilon_4B_3\theta_{N1}\lambda^*_{L2}}\Big] \\ + \left(\frac{W^*}{W}\right)(\underset{(+)(-)}{\theta_{N1}\varepsilon_4}\underset{(+)(+)}{B_3\lambda_{N_{\mathrm{F}}}e})\,|\lambda^*|\Bigg]\Bigg] < 0\end{aligned} \tag{7.A.70}$$

and

$$\left(\frac{\widehat{L}_{\mathrm{U}}}{\widehat{K}}\right) = \left(\frac{\lambda_{L2}}{\lambda_{\mathrm{LU}}}\right)\left[\frac{\overset{(-)(+)}{B_3\varepsilon_4\theta_{N1}\lambda^*_{L2}}}{\underset{(+)}{|D|}}\right] < 0 \tag{7.A.71}$$

References

Adam MZ, Cletus CC (1995) An introduction to the theory and estimation of a job-search model. Review (January/February):53–65

Agell J, Lundborg P (1992) Fair wages, involuntary unemployment and tax policy in the simple general equilibrium model. J Public Econ 47:299–320

Agell J, Lundborg P (1995) Fair wages in the open economy. Economica 62:325–351

Agenor PR (1996) The labour market and economic adjustment. IMF Staff Pap 32:261–355

Akerlof G, Yellen J (1990) The fair wage effort hypothesis and unemployment. Q J Econ 105:255–284

Arseneau DM, Chugh SK (2009) Labor force participation and general equilibrium efficiency in search and matching models. J Monet Econ 55:1401–1414

Bandopadhyay TK, Chaudhuri S (2011) Job-search and foreign capital inflow – a two sector general equilibrium analysis. Econ Model 28:2494–2501

Bardhan P, Rudra A (1981) Terms and conditions of labour contracts in agriculture: results of a survey in West Bengal 1979. Oxf Bull Econ Stat 43(1):89–111

Beladi H, Marjit S (1992a) Foreign capital and protectionism. Can J Econ 25:233–238

Beladi H, Naqvi N (1988) Urban unemployment and non-immiserizing growth. J Dev Econ 28:365–376

Bhalotra S (2002) The impact of economic liberalization on employment and wages in India. ILO, Geneva

Bliss CJ, Stern NH (1978) Productivity, wages, and nutrition, Parts I and II. J Dev Econ 5(4):331–362

Bose AN (1978) Calcutta and rural Bengal: small sector symbiosis. Minerva Publications, New Delhi

Chandra V, Khan MA (1993) Foreign investment in the presence of an informal sector. Economica 60:79–103

Chaudhuri S (2000) Rural–urban migration, informal sector, urban unemployment and development policies – a theoretical analysis. Rev Dev Econ 4:353–364

Chaudhuri S (2003) How and how far to liberalize a developing country with informal sector and factor market distortions. J Int Trade Econ Dev 12(4):403–428

Chaudhuri S (2005) Labour market distortion, technology transfer and gainful effects of foreign capital. Manch Sch 73(2):214–227

Chaudhuri S, Bandopadhyay TK (2013) Job-search and foreign capital inflow – a three sector general equilibrium analysis. Econ Model 35:159–169

Chaudhuri S, Banerjee D (2010a) FDI in agricultural land, welfare and unemployment in a developing economy. Res Econ 64(4):229–239

Chaudhuri S, Banerjee D (2010b) Foreign capital inflow, skilled–unskilled wage inequality and unemployment of unskilled labour in a fair wage model. Econ Model 7(1):477–486

Chaudhuri S, Mukhopadhyay U (2009) Revisiting the informal sector: a general equilibrium approach. Springer, New York

Chaudhuri S, Yabuuchi S, Mukhopadhyay U (2006) Inflow of foreign capital and trade liberalization in a model with an informal sector and urban unemployment. Pac Econ Rev 11:87–103

Corden WE, Findlay R (1975) Urban unemployment, intersectoral capital mobility and development policy in a dual economy. Economica 42:59–78

Dasgupta PS, Ray D (1986) Inequality as a determinant of malnutrition and unemployment: theory. Econ J 96:1011–1034

Deshpande RS (2007) Our approach must be guarded and cautious. The Financial Express, 16 July 2007. Also available at http://www.financialexpress.com/news

Dev M (2000) Economic liberalisation and employment in South Asia. Econ Pol Wkly 35:40–51

Dolado JJ, Marcel J, Juan FJ (2009) On-the-job search in a matching model with heterogeneous jobs and workers. Econ J 119(534):200–228

Drèze J, Mukherjee A (1989) Labour contracts in rural India. In: Chakravarty S (ed) The balance between industry and agriculture in economic development. Macmillan, London

Ensminger J (ed) (2002) Theory in economic anthropology. Alta Mira Press, Oxford

FAO (2003).FAO Tajikistan, United Nations Food and Agriculture Organization. Also available at http://www.untj.org/files/news/FAO%20News%201.pdf

FAO (2009) Foreign direct investment – win-win or land grab?' World summit on food security, Rome, Italy, 16–18 Nov 2009. Also available at http://farmlandgrab.org/8833

Feher E (1991) Fair wages and unemployment. Department of Economics, University of Technology, Vienna

Fields G (1975) Rural-urban migration, urban unemployment and underemployment and job search activity in LDCs. J Dev Econ 2(2):165–187

Fields G (1989) On-the–job search in a labour market model, ex-ante choices and ex-post outcomes. J Dev Econ 30:159–178

Flinn C, Mabli J (2008) On-the-job search, minimum wages and labor market outcomes in an equilibrium bargaining framework, Working paper no. 91, Collegio Carlo Alberto. www.carloalberto.org

Gindling TH (1991) Labor market segmentation and the determination of wages in the public, private-formal, and informal sectors in San Jose, Costa Rica. Econ Dev Cult Change 39(3):584–605. University of Chicago Press, Chicago

Gupta MR (1994) Duty- free zone, unemployment and welfare: a note. J Econ 59(2):217–236

Gupta MR (1997) Foreign capital and informal sector: comments on Chandra and Khan. Economica 64:353–363

Harris JR, Todaro MP (1970) Migration, unemployment and development: a two-sector analysis. Am Econ Rev 60:126–142

Hussey RM (2005) On-the-job search and wage rigidity in a general equilibrium model, Computing in economics and finance, 393. Society for Computational Economics

ILO (2006) Global employment trends brief. International Labour Office, Geneva

Khan MA (1982) Tariffs, foreign capital and immiserizing growth with urban unemployment and specific factors of production. J Dev Econ 10:245–256

Leibenstein H (1957) Economic backwardness and economic growth. Wiley, New York

Leite PG, McKinley T, Osorio RG (2006) The post-apartheid evolution of earnings inequality in South Africa, 1995–2004, Working paper no. 32. International Poverty Centre, UNDP, Brazil

Lin CC (1989) The basic labor standards law and operation of labor market: theory and partial empirical results, Academia Sinica

Macit F (2010) Labor market institutions and wage and inflation dynamics. Econ Anal Policy 40(3):393–410

Majumder D (1975) The urban informal sector, IBRD staff working paper, 211, Washington, DC

McCall JJ (1970) Economics of information and job search. Q J Econ 84:113–126

Montalvo JG, Ravallion M (2009) The pattern of growth and poverty reduction in China. Development Research Group, Director's Office, The World Bank, Washington, DC

Norback PJ (2001) Cumulative effects of labor market distortions in a developing country. J Dev Econ 65:135–152

Osmani SR (1991) Wage determination in rural labour markets: the theory of implicit co-operation. J Dev Econ 34:3–23

Park Y-B (1991) Union/non-union wage differentials in the Korean manufacturing sector. Int Econ J 5(4):79–91

Papola TS (1981) Urban informal sector in a developing economy. Vikash Publishing House, New Delhi

Postel-Vinay F, Robin JM (2002) The distribution of earnings in an equilibrium search model with state–dependent offers and counteroffers. Int Econ Rev 43(4):989–1016

Romatet E (1983) Calcutta's Informal sector: theory and reality. Econ Pol Wkly 18(50):2115–2128

Shapiro C, Stiglitz JE (1984) Equilibrium unemployment as a worker discipline device. Am Econ Rev 74:433–444

Serneels PM (2007) The nature of unemployment among young men in urban Ethiopia. Rev Dev Econ 11(1):170–186

Sheng,Y, Xu X (2007) Terms of trade shocks and endogenous search unemployment: a two sector model of non traded goods, DEGIT conference papers no. c012_025

Solow RM (1990) The labor market as a social institution. Blackwell publication, Cambridge, MA

Stark O (1982) On modeling the informal sector. World Dev 10(5):413–416

World Bank (2008) The World Bank estimates of poverty, Washington, DC

Xu Xinpeng, Sheng Y (2014) Terms of trade shocks and endogenous search unemployment: a two-sector model with non-traded goods. Pac Econ Rev (forthcoming)

Yoo G (1995) An analysis and decomposition of changing labor income distribution in Korea. Unpublished doctoral dissertation, Cornell University, Ithaca, USA

Chapter 8
FDI and Child Labour

8.1 Introduction

The root cause behind the emergence and prevalence of child labour in developing countries is supposed to be abject poverty. The impoverished are compelled to have large families and send their children out to the job market to earn their own means of livelihood. For extenuating the incidence of this evil in the society, it is, therefore, strongly suggested that policies should focus on economic development and income growth. A distinctive paper in this regard is that of Basu and Van (1998). They have shown that if child labour and adult labour are substitutes (*Substitution Axiom*) and if child leisure is a luxury commodity to the poor households (*Luxury Axiom*), unfavourable adult labour markets, responsible for low adult wage rate, is the driving force behind the incidence of child labour. The World Development Report (1995) has also recognized poverty as the greatest single force, which creates the flow of children into the workplace.[1]

With the last two decades witnessing radical changes due to liberalizing trade and investment policies across the globe, many of the developing countries have chosen free trade as their development strategy and resorted to attract huge amounts of foreign direct investment.[2] It was believed that inflow of foreign capital would lead to overall expansion of the economy, with formal sectors expanding at the cost of the informal sectors and more and more workers would be engaged in the higher wage-paying formal sectors. The number of poor working families from which children

[1] Bonnet (1993), Basu (1999), Basu (2000), Chaudhuri and Gupta (2004) and Chaudhuri and Dwibedi (2006, 2007) also support the view.

[2] According to UNCTAD (2008), the average yearly FDI inflows to developing countries increased from nearly \$20.6 billion during 1980s to \$118 billion during 1990s and then \$292 billion during the first eight years of the new millennium. As per UNCTAD (2013), FDI flows to developing countries increased from 637 billions of dollars in 2010 to \$703 billion in 2012. See Sects. 1.4 and 3.3 for more details.

S. Chaudhuri and U. Mukhopadhyay, *Foreign Direct Investment in Developing Countries: A Theoretical Evaluation*, DOI 10.1007/978-81-322-1898-2_8, © Springer India 2014

are sent out to work would decline, resulting in a shrink in the overall supply of child labour in the economy.

The overall predominance of child labour in developing countries has, in fact, dwindled with economic growth. Empirical studies like Cigno et al. (2002) and Neumayer and Soysa (2005) confirm that trade and investment reforms did have a favourable impact on child labour. Nonetheless, there are cases where the incidence has been on the rise. In this context, it is worthwhile to mention the empirical study by Swaminathan (1998) in the city of Bhavnagar in Gujarat, India, where he finds that the incidence of child labour has increased significantly after globalization despite the high economic growth rate of Gujarat mainly due to large inflow of foreign investment in the post reform period.

Therefore, a pertinent question that arises is why growth led by foreign capital has failed to lessen the gravity of the problem of child labour in some cases, while in general the incidence has declined in the developing countries in the liberalized regime. The theoretical literature on how economic reforms can impinge on the incidence of child labour is yet to emerge.

This chapter aims at filling up these gaps in the existing literature and identifying the different channels through which economic liberalization like increased FDI inflow can affect the child labour problem by constructing three general equilibrium models with child labour. The first one considers a three-sector full-employment model with two informal sectors where child labour is used along with adult labour. One of the two informal sectors produces a non-traded input for the formal sector. In this set-up we show how a liberalized investment policy is likely to exert a downward pressure on the incidence of child labour in the society. The second model is purported to explore why economic growth with foreign capital might, in some cases, produce a perverse effect on the child labour problem. It considers a three-sector general equilibrium framework with two informal sectors, one of them producing a non-traded final commodity; apart from agriculture, child labour is used to produce a final luxury commodity for the richer section of the population. Finally, a three-sector HT type general equilibrium model with endogenous skill formation has been developed to show that reduction in poverty is not a necessary condition for improvement of the problem of child labour in a developing economy. The supply function of child labour by each working family is derived from its intertemporal utility maximizing behaviour. In this case, economic reforms like an inflow of foreign capital can mitigate the incidence of child labour by raising the return to education and lowering the earning opportunities of children.

8.2 Inflow of Foreign Capital and Reduction in the Incidence of Child Labour

Let us begin our theoretical analysis with a three-sector full-employment model where there are two informal sectors and one formal sector. Both adult labour (L) and child labour (L_C) are used in the two informal sectors. One of the informal sectors (sector 1) produces an agricultural exportable product, X_1, with the help of adult labour, child labour and capital (K). The other informal sector (sector 2) uses the same three inputs to produce an internationally non-traded input,[3] X_2, for the formal manufacturing sector. Finally, the formal sector (sector 3), which is the import-competing sector of the economy, produces a manufacturing commodity, X_3, with adult labour, capital and the non-traded input produced by sector 2. The per-unit requirement of the intermediate input is assumed to be technologically fixed[4] in sector 3. We assume that the *Substitution Axiom*[5] of Basu and Van (1998) holds, so that adult and child labour are substitutes in the two informal sectors. Owing to effective wage legislation and unionization of labour, the adult wage rate in the formal sector is fixed at W^*, which is higher than the competitive informal sector adult wage rate, W. The adult labour allocation mechanism is of the following type. Adult workers initially try to get employment in the formal manufacturing sector but those who are unable to find employment in the sector are automatically absorbed in the two informal sectors, since there is complete wage flexibility in the latter sectors. Capital is perfectly mobile among the three sectors of the economy. It is reasonable to assume that the formal manufacturing sector is more capital-intensive vis-à-vis the two informal sectors with respect to adult labour. In other words, this implies that $(\lambda_{K1}/\lambda_{L1}), (\lambda_{K2}/\lambda_{L2}) < (\lambda_{K3}/\lambda_{L3})$ where λ_{ji} is the proportion of the jth input employed in the ith sector.

We now make assumptions regarding relative factor intensities of the two informal sectors. The informal agricultural sector (sector 1) is more child labour-intensive (with respect to adult labour) and less capital-intensive (with respect to adult labour) relative to the informal manufacturing sector (sector 2). It then follows that sector 1 is also less capital-intensive compared to sector 2 with respect to child labour. In mathematical terms, we may write

[3]Empirical evidences suggest that the informal sector units mostly produce intermediate inputs for the formal sector. See, for example, Joshi and Joshi (1976), Bose (1978), Papola (1981) and Romatet (1983). However, there are a few theoretical papers like Grinols (1991), Chandra and Khan (1993) and Gupta (1997), which have formalized the urban informal sector as a sector that produces an internationally traded final commodity.

[4]This simplifying assumption rules out the possibility of substitution between the non-traded input and other factors of production in sector 3. See footnote 29, Chap. 5, for its rationale.

[5]The substitution axiom emphasizes that adult labour and child labour are substitutes. In other words, it means that adults can do what children do. Some studies presume that there are certain tasks specific to children. Expressions like 'nimble fingers' to describe child labour tend to perpetuate this belief. The substitution axiom expresses a contrary view on this. The 'nimble fingers' argument, put forward as an excuse by employers, especially in carpet weaving, fails to convince researchers (see Burra (1997) and Weiner (1991)). A careful study of the technology of production involving children by Levison et al. (1998) lends strong support to the substitution axiom. They show that adults in India are as good, if not better, in producing hand-knit carpets as children. So from a purely technical point of view, it is possible to replace child labour with adults. But since adults cost more, firms may be reluctant to make the transition to adults-only labour. This argument is also applicable to girl child labour helping household chores where from a purely technical point of view adult female labour can do what girls do.

$$\left(\frac{\lambda_{C1}}{\lambda_{L1}}\right) > \left(\frac{\lambda_{C2}}{\lambda_{L2}}\right), \left(\frac{\lambda_{K1}}{\lambda_{L1}}\right) < \left(\frac{\lambda_{K2}}{\lambda_{L2}}\right); \quad \text{and} \quad \left(\frac{\lambda_{K1}}{\lambda_{C1}}\right) < \left(\frac{\lambda_{K2}}{\lambda_{C2}}\right) \tag{8.1}$$

From (8.1) it follows that

$$\left(\frac{\theta_{C1}}{\theta_{L1}}\right) > \left(\frac{\theta_{C2}}{\theta_{L2}}\right), \left(\frac{\theta_{K1}}{\theta_{L1}}\right) < \left(\frac{\theta_{K2}}{\theta_{L2}}\right); \quad \text{and} \quad \left(\frac{\theta_{K1}}{\theta_{C1}}\right) < \left(\frac{\theta_{K2}}{\theta_{C2}}\right) \tag{8.1.1}$$

where θ_{ji} is the distributive share of the *j*th input in the *i*th sector.

Available empirical evidences suggest that the concentration of child labour is the highest in the rural sector of developing economies and that child labour is used intensively directly or indirectly in the agricultural sector. In backward agriculture, the production techniques are primitive, use of capital is very low and child labour can almost do whatever adult labour does. Farming in backward agriculture is mostly done by using bullocks and ploughs, and the cattle-feeding is entirely done by child labour. Besides, during sowing of seeds and harvesting, children often work in the family farms for helping adult members of the family. Although most of the adult employment in developing countries is still in agriculture, the proportion of child labour used in agriculture is greater than that of adult labour.[6] On the other hand, in carpet weaving, leather bag and shoe manufacturing, diamond cutting, matchbox and fireworks and garments industries, etc., child labour is often used in many intermediate stages of production. Many of these industries split up into tiny units and shift the production process to urban slums, in order to utilize labour services including child labour at lower wages.[7] According to the ILO (2002) report (Figure 4, p. 36), more than 70 % of economically active children in the developing countries are engaged in agriculture and allied sectors and less than 9 % are involved in manufacturing. The corresponding figures are 79.1 % and 3.3 % in the case of India where the concentration of child labour is the largest in the world. If all other activities are included, 19.9 % of child labour in India is engaged in nonagricultural activities. On the other hand, in India 64.81 % of the adult labour force are engaged in agriculture and allied sectors, while 25.84 % are employed in the informal manufacturing sector (Census of India 1991, Selected Socioeconomic Statistics, India 2002).[8] Comparison of the two types of production activities in the agricultural and informal manufacturing sectors and the employment statistics from India[9] should justify the factor intensity conditions as expressed in (8.1) and (8.1.1).

[6]See Ashagrie (1998) and NSSO (2000).

[7]One may go through Swaminathan (1998).

[8]Using these figures we find that in India in 1991 the child labour–adult labour ratios in agriculture, $(\lambda_{C1}/\lambda_{L1})$, and nonagricultural informal sector, $(\lambda_{C2}/\lambda_{L2})$, were 1.22 and 0.77, respectively. The difference between these two ratios has, however, narrowed somewhat in 2004–2005 as per calculations based on NSSO (2006) data. See also Chaudhuri and Dwibedi (2006) in this context.

[9]See footnote 8.

Production functions exhibit constant returns to scale[10] with diminishing marginal productivity to each factor. All the markets, except the formal sector labour market, are perfectly competitive and all inputs are fully employed. Owing to the small open economy assumption, the final commodity prices, P_1 and P_3, are given internationally. Since X_2 is non-traded its price, P_2, is endogenously determined by the demand–supply mechanism.

8.2.1 Derivation of Supply Function of Child Labour

We derive the supply function of child labour from the utility maximizing behaviour of the representative altruistic poor household. There are L number of working families, which are classified into two groups on the basis of the earnings of their adult members. The adult workers who work in the higher paid formal manufacturing sector comprise the richer section of the working population. On the contrary, labourers who are engaged in the two informal sectors constitute the poorer section. There is considerable evidence and theoretical reason for believing that, in developing countries, parents send their children to work out of sheer poverty.[11] Therefore, following the *Luxury Axiom* of Basu and Van (1998), we assume that there exists a critical level of family (or adult labour) income, $\overline{W}$ from non-child labour sources, such that the parents will send their children out to work if and only if the actual adult wage rate is less than this critical level. We assume that each worker in the formal manufacturing sector earns a wage income, W^*, sufficiently greater than this critical level. So, the workers belonging to this group do not send their children to work. On the other hand, adult workers employed in the informal sectors earn W amount of wage income, which is less than $\overline{W}$, and, therefore, send many of their children to the job market to supplement their low family income.

The supply function of child labour by each poor working family is determined from the utility maximizing behaviour of the representative altruistic household. We assume that each working family consists of one adult member and 'n' number of children. The altruistic adult member of the family (guardian) decides the number of children to be sent to the work place, denoted by l_C. The utility function of the household is given by

$$U = U\left(C_1, C_3, (n - l_C)\right)$$

[10]Production in the import-competing sector, apart from capital and labour inputs, requires a non-traded input, per-unit requirement of which is assumed to be technologically fixed. However, labour and capital are substitutes and the production function displays the property of constant returns to scale in these two inputs.

[11]In Sect. 8.1, a discussion has been made on the role of poverty behind the widespread existence of child labour in the developing world.

The household derives utility from the consumption of the final goods, C_i, and the children's leisure, represented by the number of children not going to work, $(n - l_C)$. For analytical simplicity, let us consider the following Cobb–Douglas type of the utility function:

$$U = A(C_1)^{\alpha}(C_3)^{\beta}(n - l_C)^{\gamma} \tag{8.2}$$

with $A > 0$, $1 > \alpha, \beta, \gamma > 0$ and $(\alpha + \beta + \gamma) = 1$.

It satisfies all the standard properties and is homogeneous of degree 1. The parameter γ denotes the degree of altruism of the guardian towards the well-being of his children.

The household maximizes its utility subject to the following budget constraint:

$$P_1C_1 + P_3C_3 = (W_C l_C + W) \tag{8.3}$$

where W is the income of the adult worker. $W_C l_C$ measures the income from child labour where W_C is the child wage rate.

Maximization of the utility function subject to the above budget constraint gives us the following child labour supply function[12]:

$$l_C = \left\{ (\alpha + \beta)\, n - \gamma \left(\frac{W}{W_C} \right) \right\} \tag{8.4}$$

This is the supply function of child labour by each poor family. We now analyse its properties. First, l_C varies negatively with the adult wage rate, W. A rise in W produces a positive income effect so that the adult worker chooses more leisure for his children and therefore decides to send a lower number of children to the workplace. An increase in W_C, on the other hand, produces a negative price effect, which increases the supply of child labour from the family.[13]

There are $L_I (= L - a_{L3}X_3)$ number of adult workers engaged in the two informal sectors and each of them sends l_C number of children to the workplace. Thus, the aggregate supply function of child labour in the economy is given by

$$L_C = \left[n\,(\alpha + \beta) - \gamma \frac{W}{W_C} \right] (L - a_{L3}X_3) \tag{8.5}$$

---

[12]See Appendix 8.1 for the mathematical derivations.

[13]It may be checked that the results of this section hold for any utility function generating supply function of child labour satisfying these two properties.

8.2.2 The General Equilibrium Analysis

Given the assumption of perfectly competitive markets, the usual price–unit cost equality conditions relating to the three sectors of the economy are given by the following three equations, respectively:

$$Wa_{L1} + W_C a_{C1} + ra_{K1} = 1 \tag{8.6}$$

$$Wa_{L2} + W_C a_{C2} + ra_{K2} = P_2 \tag{8.7}$$

$$W^* a_{L3} + ra_{K3} + P_2 a_{23} = P_3 \tag{8.8}$$

where a_{ji} is the amount of the jth input required to produce one unit of the ith commodity and r is the return to capital.

The factor endowment equations for adult labour, capital and child labour are the following, respectively:

$$a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 = L \tag{8.9}$$

$$a_{K1}X_1 + a_{K2}X_2 + a_{K3}X_3 = K_{\mathrm{D}} + K_{\mathrm{F}} = K \tag{8.10}$$

$$a_{C1}X_1 + a_{C2}X_2 = L_C \tag{8.11}$$

Sector 2 produces the non-traded input, which is completely utilized in sector 3. So the demand–supply equality condition for good 2 is as follows:

$$a_{23}X_3 = X_2 \tag{8.12}$$

Using (8.5) Eq. (8.11) can be rewritten as follows:

$$a_{C1}X_1 + a_{C2}X_2 = \left[n(\alpha + \beta) - \gamma \frac{W}{W_C} \right] (L - a_{L3}X_3) \tag{8.11.1}$$

There are eight endogenous variables in the system: $W, W_C, r, P_2, X_1, X_2, X_3$ and L_C and the same number of independent equations (namely, Eqs. (8.5), (8.6), (8.7), (8.8), (8.9), (8.10), (8.11.1) and (8.12)). The parameters in the system are as follows: $P_1, P_3, L, K, W^*, \alpha, \beta, \gamma$ and n. Equations (8.6), (8.7) and (8.8) constitute the price system. The system is an indecomposable one since there are four unknowns, W, W_C, r and P_2, in the price system which cannot be solved from the three zero-profit conditions. However, W, W_C and r are solved from Eqs. (8.6), (8.7) and (8.8) as functions of P_2. Then X_1, X_2 and X_3 are obtained as functions of P_2 and other parameters of the system from (8.9), (8.10) and (8.11.1). Finally, P_2 is solved from (8.12). Once P_2 is known, the equilibrium values of all other endogenous variables are obtained. L_C is then determined from (8.5).

8.2.3 Consequences of an Inflow of Foreign Capital

An overall economic expansion induced by an inflow of foreign capital is likely to take the developing countries into higher growth orbits, the benefits of which would percolate down to the poor people. Thus, this policy is expected to exert downward pressure on the incidence of poverty-induced child labour. It may be noted that the policy affects the supply of child labour in two ways: (i) through a change in the size of the adult labour force engaged in the two informal sectors, $(L_I = L - a_{L3}X_3)$, as these families are considered to be the suppliers of child labour (we call this the *adult labour reallocation effect*), and (ii) through a change in l_C (the number of child workers supplied by each poor working family), which results from a change in the (W_C/W) ratio (this may be called the *relative wage effect*).

Differentiating Eqs. (8.6), (8.7), (8.8), (8.9), (8.10), (8.11.1) and (8.12) and using the stability condition in the market for the non-traded input[14], one can prove the following proposition.[15]

Proposition 8.1 *An inflow of foreign capital leads to (i) an increase in the price of the non-traded commodity, (ii) an increase in the adult wage rate, (iii) a decrease in the child wage and (iv) a fall in the* (W_C/W) *ratio. Furthermore, the formal sector (sector 3) is likely to expand due to the policy.*[16]

Proposition 8.1 can be explained as follows. As the system does not possess the decomposition property, factor prices depend on factor endowments. An inflow of foreign capital lowers the return to capital (r) which in turn raises the price of the non-traded input (P_2) to satisfy the zero-profit condition in sector 3 since W^* and P_3 are exogenously given (see Eq. (8.8)). An increase in P_2 leads to a Stolper–Samuelson-like effect in sectors 1 and 2. The informal adult wage (W) rises while that of child labour (W_C) falls as sector 2 uses adult labour more intensively with respect to child labour compared to sector 1 (see (8.1) and (8.11)). The policy also leads to a change in the output composition. As P_2 increases, sector 2 (sector 1) is likely to expand (contract), which in turn produces an expansionary effect on sector 3 since the output of sector 2 is used as an input (in a fixed proportion) in the latter. On the other hand, as adult labour becomes dearer relative to other inputs, producers in all the three sectors of the economy substitute adult labour by other factors, causing the labour–output ratios (a_{Li}s) to fall and capital–output ratios (a_{Ki}s) to rise. Now the question is whether the extra amount of capital injected into the economy in the form of FDI is capable of expanding all the sectors simultaneously. This certainly depends on the substitutability between different inputs in the different sectors and on the ultimate change in the aggregate supply of child labour in the economy. Our analysis shows that sectors 2 and 3 expand

[14] See Appendix 8.3.

[15] These results have been proved in Appendices 8.2, 8.4 and 8.5.

[16] In fact, sector 3 expands under the sufficient condition that $A_3 \geq 0$. See Appendix 8.5 in this context.

while sector 1 contracts under the sufficient condition as provided in Appendix 8.5. However, if technologies of production are of fixed coefficient in nature, there would be no factor substitutions. Sector 2 expands while sector 1 contracts unambiguously since P_2 increases. This also causes an unequivocal expansion of sector 3.

Finally, differentiating Eq. (8.5) one can easily establish the following proposition.

Proposition 8.2 *An inflow of FDI is likely to ameliorate the problem of child labour in the economy. The problem definitely improves in the fixed-coefficient technology case.*

While explaining Proposition 8.1 we have discussed how an inflow of foreign capital lowers the (W_C/W) ratio and causes the formal sector to expand. As (W_C/W) falls the supply of child labour by each poor working family, l_C, decreases due to relative wage effect. On the other hand, an expansion of the formal sector suggests that the number of poor working families employed in the two informal sectors also falls. This is the adult labour reallocation effect that also works positively on the problem of child labour in the society. Hence, both the effects work hand in hand and cause the incidence of child labour to decline.

8.3 Perverse Effect of FDI Flow on Child Labour and Need for Alternative Policies

In this section we try to provide a theoretical answer to the apparently perplexing empirical finding as to how a liberalized investment policy might fail and in fact worsen the problem of child labour in some cases despite high economic growth achieved with foreign capital inflow. We also intend to prescribe a few alternative policies that might prove useful in combating the menace of child labour in such situations.[17]

8.3.1 The Model

We consider a three-sector full-employment model with child labour. The economy is divided into one formal and two informal sectors. Two types of labour are available in the economy: adult labour and child labour. Sector 1 (an informal sector) produces an agricultural commodity, X_1, with the help of adult labour, child labour and capital. However, there is substitutability between adult labour and child labour. Sector 2 (the informal sector) produces a non-traded final commodity, X_2, with child labour and adult labour. Domestic services, prostitution, collection of seashells

[17]This section has been developed following Chaudhuri and Dwibedi (2007).

and shoe shining are some of the classic examples of such production activities.[18] Usually, these types of goods and services are consumed (used) by the richer section of the working class employed in the higher wage-paying formal sector and by the owners of capital.[19] The formal sector (sector 3), which is the import-competing sector of the economy, produces a manufacturing commodity, X_3, using adult labour and capital.[20] Workers in the formal sector are unionized and receive a higher wage, W^*, than what their counterparts receive (W) in the two informal sectors. Low adult wage rate in the informal sector (a typical developing economy phenomenon) forces the poor families to send some of their children to the job market to supplement low family income.

Production functions satisfy constant returns to scale with positive but diminishing returns to each factor. Markets, except the formal sector labour market, are perfectly competitive. Adult labour and child labour are completely mobile between the two informal sectors but adult labour is perfectly mobile between the formal and the informal sectors. On the other hand, capital is completely mobile between sectors 1 and 3. The prices of the two internationally traded commodities (P_i for $i = 1, 3$) are given by the small open economy assumption. On the contrary, as the commodity produced by sector 2 is produced and consumed domestically, its price is determined within the economy by demand and supply forces. The formal sector (sector 3) is more capital-intensive vis-à-vis the agricultural sector (sector 1) with respect to adult labour in physical sense. However, we at this stage do not make any assumption regarding the relative intensities at which child labour and adult labour are used in the two informal sectors. In a subsequent section, we shall consider both the cases separately and see how the results of the model change under alternative factor intensity conditions. Finally, commodity 1 is chosen as the numeraire.

8.3.2 Household Behaviour and Derivation of Family Supply Function of Child Labour

The derivation of supply function of child labour of each poor working family has already been discussed in details in Sect. 8.2.1. However, the budget constraint of the household is slightly different in the present case because of the presence of public education system, for all children in the society, which is entirely financed by government subsidy. The children of the poor altruistic household who do not work go to school. There are provisions for the children from the poorer families to get stipend, free educational goods and free mid-day meals. It is sensible to assume that the higher the subsidy on education, E, the higher the free educational facilities and

[18]These production activities use very little amount of capital and so we can ignore capital as an input in this sector.

[19]See footnote 17 in this context.

[20]The use of child labour in sector 3 is legally prohibited, as it is the formal sector of the economy.

the related benefits, B, associated with child schooling. On the other hand, the larger the number of children sent to school, the higher the aggregate benefits accruing to the poor families. We make the simplifying assumption that the money value of such benefits is strictly proportional to the number of children sent to school.

The household derives utility from the consumption of the two traded (final) commodities and from children's leisure. Since the poor households do not consume the non-traded final commodity, it is not included in their utility function. However, children's leisure here does not imply that the children who are not sent out to work are kept at home; rather they are sent to school. The altruistic guardian of the family derives utility from this source because at least some of his children have been kept out from the work hazards. Besides, by sending some of the children to school, the family secures current income gain from access to the different incentives that the subsidized education scheme provides. For analytical simplicity, let us consider the Cobb–Douglas type of the utility function as in the expression (8.2).

$$U = A(C_1)^{\alpha}(C_3)^{\beta}(n - l_C)^{\gamma} \tag{8.13}$$

with $A > 0$; $1 > \alpha, \beta, \gamma > 0$; and $(\alpha + \beta + \gamma) = 1$.

Ruling out the possibility for any child attending school to undertake any part time job, the budget constraint of the representative poor household is given by the following:

$$C_1 + P_3 C_3 = (W_C l_C + W) + (n - l_C)\, B(E) \tag{8.14}$$

where W is the income of the adult worker, $W_C l_C$ measures the income from child labour and $(n - l_C)B(E)$ is the money value of the benefits derived by the household from sending $(n - l_C)$ number of children to school. Note that $B'(.)$ is positive. Here the effective child wage rate is $(W_C - B(E))$.[21]

Maximization of the utility function subject to the above budget constraint gives us the following first-order conditions:

$$l_C = \frac{[n\,\{(\alpha + \beta)\, W_C - B(E)\} - \gamma W]}{(W_C - B(E))} \tag{8.15}$$

There are $L_I (= L - a_{L3} X_3)$ number of adult workers engaged in the two informal sectors and each of them sends l_C number of children to the job market. Thus, the aggregate supply of child labour in the economy is given by

$$L_C = \left[\frac{[n\,\{(\alpha + \beta)\, W_C - B(E)\} - \gamma W]}{(W_C - B(E))}\right](L - a_{L3} X_3) \tag{8.16}$$

[21] We assume that $W_C > B(E)$. Otherwise, no child is sent to the job market.

8.3.3 The General Equilibrium Analysis

The usual price–unit cost equality conditions relating to the three sectors of the economy are given by the following three equations, respectively:

$$Wa_{L1} + W_C a_{C1} + ra_{K1} = 1 \tag{8.17}$$

$$Wa_{L2} + W_C a_{C2} = P_2 \tag{8.18}$$

$$W^* a_{L3} + ra_{K3} = P_3 \tag{8.19}$$

The demand for the commodity produced in sector 2 comes from the richer section of the society.[22] Hence, the demand function for commodity 2 is as follows:

$$D = D\,(P_2, Y) \tag{8.20}$$

with usual price and income effects, i.e. $(\partial D/\partial P_2) < 0$ and $(\partial D/\partial Y) > 0$. These imply that the own price elasticity (E_{P2}) and the income elasticity (E_Y) of demand are negative and positive, respectively. It is worth noting that prices of the other two commodities also figure in the demand function for commodity 2. However, as these are exogenously (internationally) given, these have not been included in the demand function.

The total income of the richer section of the society, denoted Y, consists of wage income of the formal sector workers and the rental income of the owners of domestic capital and can be written as[23]

$$Y = W^* a_{L3} X_3 + rK_{\mathrm{D}} - T \tag{8.21}$$

where T is the lump-sum tax on the richer section of the population.

In equilibrium, the supply of the non-traded final commodity must equal its demand. So, using (8.20) we have

$$X_2 = D\,(P_2, Y) \tag{8.22}$$

Using (8.21), Eq. (8.22) may be rewritten as follows:

$$X_2 = D\left(P_2, W^* a_{L3} X_3 + rK_{\mathrm{D}} - T\right) \tag{8.22.1}$$

[22] It may be checked that the qualitative results of this model hold under different sufficient conditions even if the poorer section of the working class is allowed to consume this commodity.

[23] We assume that the rental income from foreign capital is fully repatriated. Therefore, it is not included in Y.

Full utilization of adult labour, capital and child labour imply the following three equations respectively:

$$a_{L1}X_1 + a_{L2}X_2 + a_{L3}X_3 = L \tag{8.23}$$

$$a_{K1}X_1 + a_{K3}X_3 = K \tag{8.24}$$

$$a_{C1}X_1 + a_{C2}X_2 = L_C \tag{8.25}$$

Using (8.16), one may rewrite Eq. (8.25) as follows:

$$a_{C1}X_1 + a_{C2}X_2 = \left[\frac{[n\{(\alpha+\beta)W_C - B(E)\} - \gamma W]}{(W_C - B(E))}\right](L - a_{L3}X_3) \tag{8.25.1}$$

In this general equilibrium model, we have ten endogenous variables (namely, $W, W_C, r, P_2, D, Y, X_1, X_2, X_3$ and L_C) and the same number of independent equations (namely, Eqs. (8.16), (8.17), (8.18), (8.19), (8.20), (8.21), (8.22.1), (8.23), (8.24) and (8.25.1)). The policy parameters are K, E and T. Equations (8.17), (8.18) and (8.19) together form the price system with four endogenous variables: W, W_C, r and P_2. Clearly, this is an indecomposable production structure. r is obtained from (8.19) since W^* is given. It is to be noted that once r is known, sectors 1 and 2 can effectively be viewed as a *Heckscher–Ohlin Subsystem (HOSS)*. So, W and W_C can be obtained from Eqs. (8.17) and (8.18) as functions of P_2. Then solving Eqs. (8.23), (8.24) and (8.25.1) simultaneously, one can find out X_1, X_2 and X_3 as functions of P_2. The equilibrium value of P_2 can be obtained from (8.22.1). Y is now found from (8.21). One can get D from (8.20). Finally, L_C is obtained from Eq. (8.16). Note that once the factor prices are known, the factor coefficients a_{ji} are also known since these are functions of the input prices.

8.3.4 Comparative Static Exercises

According to the conventional wisdom, an inflow of foreign capital is expected to exert downward pressure on the incidence of poverty-induced child labour due to the resulting overall economic expansion and the benefits accruing to the poor as well. On the other hand, a policy of education subsidy is likely to reduce the supply of child labour directly while a lump-sum tax on the richer section of the population, who consume the non-traded final commodity produced using child labour (and adult labour), is likely to lessen the gravity of the problem from the demand side through a decline in their disposable income. In this section, we shall examine the efficacy of these policies to control the supply of child labour in the given set-up.

Totally differentiating Eqs. (8.17), (8.18) and (8.19) and solving by Cramer's rule, the following expressions can be obtained:

$$\widehat{r} = 0 \tag{8.26}$$

$$\widehat{W} = -\left(\frac{1}{|\theta|}\right)\theta_{C1}\widehat{P}_2 \tag{8.27}$$

$$\widehat{W}_C = \left(\frac{1}{|\theta|}\right)\theta_{L1}\widehat{P}_2 \tag{8.28}$$

where $|\theta| = (\theta_{L1}\theta_{C2} - \theta_{C1}\theta_{L2})$.

Differentiating Eqs. (8.23), (8.24) and (8.25.1), solving by Cramer's rule and using (8.26, 8.27) and (8.28), one can get the following expressions:[24]

$$\widehat{X}_1 = \left(\frac{1}{|\lambda|}\right)\left[\lambda_{L3}\left(\lambda_{C2} - \frac{\lambda_{L2}}{1-\lambda_{L3}}\right)\widehat{K} + Z_1\widehat{P}_2 - \lambda_{L2}\lambda_{K3}G_3\widehat{E}\right] \tag{8.29}$$

$$\widehat{X}_2 = \left(\frac{1}{|\lambda|}\right)\left[\lambda_{L3}\left(\frac{\lambda_{L1}}{1-\lambda_{L3}} - \lambda_{C1}\right)\widehat{K} + Z_2\widehat{P}_2 + (\lambda_{L1}\lambda_{K3} - \lambda_{K1}\lambda_{L3})\,G_3\widehat{E}\right] \tag{8.30}$$

and

$$\widehat{X}_3 = \left(\frac{1}{|\lambda|}\right)\left[(\lambda_{L2}\lambda_{C1} - \lambda_{L1}\lambda_{C2})\,\widehat{K} - Z_3\widehat{P}_2 + \lambda_{L2}\lambda_{K1}G_3\widehat{E}\right] \tag{8.31}$$

where[25]

$$|\lambda| = (\lambda_{L2}\lambda_{C1} - \lambda_{L1}\lambda_{C2})\left(\frac{\lambda_{K3} - \lambda_{L3}}{1-\lambda_{L3}}\right) \tag{8.32.1}$$

[24] See Appendix 8.6 for derivation.

[25] Actually, the expression for $|\lambda|$ is somewhat different which, however, has been simplified to this present form. See Appendix 8.10 in this context.

$$\left.\begin{aligned}
A_1 &= \left[\left(\lambda_{L1}S^1_{LC} + \lambda_{L2}S^2_{LC}\right)(\theta_{L1} + \theta_{C1}) + \lambda_{L1}S^1_{LK}\theta_{C1}\right]\left(\tfrac{1}{|\theta|}\right)\\
A_2 &= \left(\frac{\lambda_{K1}}{|\theta|}\right)\left[S^1_{KL}\theta_{C1} - S^1_{KC}\theta_{L1}\right]; \quad G_1 = \frac{\gamma W_C\{W + nB(E)\}}{l_C\{W_C - B(E)\}^2} > 0\\
G_2 &= \frac{\gamma W}{l_C\{W_C - B(E)\}} > 0; \quad G_3 = \frac{\gamma B' E\{W + nW_C\}}{l_C\{W_C - B(E)\}^2} > 0\\
A_3 &= \frac{1}{|\theta|}\left[\lambda_{C1}S^1_{CL}(\theta_{C1} + \theta_{L1}) + \lambda_{C2}S^2_{CL}(\theta_{C1} + \theta_{L1}) + \lambda_{C1}S^1_{CK}\theta_{L1}\right.\\
&\quad \left. + G_2\theta_{C1} + G_1\theta_{L1}\right]\\
Z_1 &= \left[\lambda_{K3}(A_1\lambda_{C2} + A_3\lambda_{L2}) + \lambda_{L3}A_2\left(\lambda_{C2} - \tfrac{\lambda_{L2}}{1-\lambda_{L3}}\right)\right]\\
Z_2 &= \left[A_2\lambda_{L3}\left(\tfrac{\lambda_{L1}}{1-\lambda_{L3}} - \lambda_{C1}\right) - A_3(\lambda_{L1}\lambda_{K3} - \lambda_{K1}\lambda_{L3}) + \right.\\
&\quad \left. A_1\left(\tfrac{\lambda_{K1}\lambda_{L3}}{(1-\lambda_{L3})} - \lambda_{K3}\lambda_{C1}\right)\right]\\
Z_3 &= \left[-A_2(\lambda_{L2}\lambda_{C1} - \lambda_{L1}\lambda_{C2}) + A_3\lambda_{L2}\lambda_{K1} + A_1\lambda_{K1}\lambda_{C2}\right]
\end{aligned}\right\} \tag{8.32.2}$$

Differentiating Eq. (8.20) and using (8.31) and (8.32.1), it is easy to check[26] that the stability condition in the market for the non-traded final commodity is as follows:

$$\left[E_{P2} - \left(\frac{E_Y}{|\lambda|}\right)\left(\frac{W^* L\lambda_{L3}}{Y}\right)Z_3 - \left(\frac{Z_2}{|\lambda|}\right)\right] = \Delta < 0 \tag{8.33}$$

where E_{P2} and E_Y are the own price and income elasticities of demand for commodity 2, respectively.

Differentiating Eq. (8.20) once more, using (8.30) and (8.31) and simplifying, one can find[27]

$$\widehat{P}_2 = Q_1\widehat{K} + Q_2\widehat{E} + Q_3\widehat{T} \tag{8.34.1}$$

where

$$\left.\begin{aligned}
Q_1 &= \left(\tfrac{1}{|\lambda|}\right)\left(\tfrac{1}{\Delta}\right)\left[\lambda_{L3}\left(\tfrac{\lambda_{L1}}{1-\lambda_{L3}} - \lambda_{C1}\right) - \left(\tfrac{E_Y W^* L\lambda_{L3}}{Y}\right)(\lambda_{L2}\lambda_{C1} - \lambda_{L1}\lambda_{C2})\right]\\
Q_2 &= \left(\tfrac{G_3}{|\lambda|}\right)\left(\tfrac{1}{\Delta}\right)\left[\underset{(-)}{(\lambda_{L1}\lambda_{K3}} - \underset{(+)}{\lambda_{K1}\lambda_{L3})} - \underset{(+)}{\left(\tfrac{E_Y W^* L\lambda_{L3}}{Y}\right)}\lambda_{L2}\lambda_{K1}\right]\\
Q_3 &= \left(\underset{(-)}{\left(\tfrac{E_Y}{\Delta}\right)}\underset{(+)}{\left(\tfrac{T}{Y}\right)}\right) < 0 \quad (\text{using } (8.33))
\end{aligned}\right\} \tag{8.34.2}$$

[26] This has been derived in Appendix 8.7.

[27] See Appendix 8.8 for derivation of equation (8.34.1).

Finally, differentiating Eq. (8.16) and using (8.27), (8.28) and (8.31), the following expression[28] may be obtained.

$$\widehat{L}_C = \left(\frac{G_1}{|\theta|}\right)\theta_{L1}\widehat{P}_2 + \left(\frac{G_2}{|\theta|}\right)\theta_{C1}\widehat{P}_2 - G_3\widehat{E} - \left(\frac{\lambda_{L3}}{1-\lambda_{L3}}\right)\left(\frac{1}{|\lambda|}\right)\left[(\lambda_{L2}\lambda_{C1} - \lambda_{L1}\lambda_{C2})\,\widehat{K} - Z_3\widehat{P}_2 + \lambda_{L2}\lambda_{K1}G_3\widehat{E}\right] \tag{8.35.1}$$

Now substituting $\widehat{P}_2$ from (8.34.1) into (8.35.1) and simplifying, we get

$$\widehat{L}_C = \left[(I_{WC} + I_W + I_L)\,Q_1 - \left(\frac{\lambda_{L3}}{\lambda_{K3} - \lambda_{L3}}\right)\right]\widehat{K} + \left[(I_{WC} + I_W + I_L)\,Q_2 - \left\{1 + \left(\frac{\lambda_{L3}}{1-\lambda_{L3}}\right)\left(\frac{\lambda_{L2}\lambda_{K1}}{|\lambda|}\right)\right\}G_3\right]\widehat{E} + [(I_{WC} + I_W + I_L)\,Q_3]\,\widehat{T} \tag{8.35.2}$$

where

$$I_{WC} = \left(\frac{G_1}{|\theta|}\right)\theta_{L1};\ I_W = \left(\frac{G_2}{|\theta|}\right)\theta_{C1};\ I_L = \left(\frac{\lambda_{L3}}{1-\lambda_{L3}}\right)\left(\frac{1}{|\lambda|}\right)Z_3 \tag{8.36}$$

Now we analyse the consequences of different policies on the incidence of child labour in the society. Any change in the policy parameters affects the aggregate supply of child labour in the society both directly and indirectly. The indirect effects arise due to change in the price of the non-traded commodity and take place through changes in the adult and child wage rates and the use of capital in the export sector (sector 1). In order to find out the overall impact of a policy, we need to identify each effect separately. For that purpose one can find Eq. (8.35.1) quite useful. In some cases, the different effects work in the opposite directions and it is not possible to predict the net outcome of a policy on child labour unequivocally. However, we can at least find out reasonable condition(s) under which the qualitative results may be predicted. In such cases we shall use Eq. (8.35.2).

From Eq. (8.16) we find that the aggregate supply of child labour in the economy, L_C, depends on three factors. It depends negatively on the informal sector adult wage, W, and positively on both the child wage, W_C, and the number of poor families supplying child labour, $(L - a_{L3}X_3)$. So, a decline in W_C and/or a rise in W and/or a decrease in $(L - a_{L3}X_3)$ causes the aggregate supply of child labour to decline and vice versa. These three broad effects may, respectively, be termed as *child wage effect, adult wage effect* and *adult labour reallocation effect*. The first two effects can only be of induced type while the last effect can be of both direct and induced types.

[28]Equations (8.35.1 and 8.35.2) have been derived in Appendix 8.9.

Since sectors 1 and 2 together effectively form a *HOSS*, the two wage rates change (in the opposite directions) only if there occurs a change in the price of the non-traded commodity, P_2 (*Stolper–Samuelson effect*). So, the two *wage effects* produce only indirect effects on child labour. The first two terms in the right-hand side of Eq. (8.35.1) capture the *child wage effect* and the *adult wage effect*, respectively. Moreover, a change in P_2 also produces a *Rybczynski-type effect*[29] in the *HOSS* resulting in a change in the sectoral composition of output. If sector 1 expands (contracts), it requires more (less) capital than before, which has to be released (absorbed) by sector 3. Consequently, sector 3 contracts (expands) in terms of both output and employment. This is the *induced adult labour reallocation effect* which arises owing to a change in P_2 and is captured by the second term within square brackets in the right-hand side of (8.35.1).

Policies like an inflow of foreign capital and an increase in the subsidy on education have both direct and indirect effects on the incidence of child labour, while imposition of a lump-sum tax on the richer section of the population has only indirect effects. An inflow of foreign capital produces a *Rybczynski effect* and leads to an expansion of sector 3 and a contraction of sector 1 since sector 3 is more capital-intensive relative to sector 1 in physical sense. But the return to capital, r, does not change since it is determined from the zero-profit condition for sector 3 (Eq. (8.19)). As more adult workers are now employed in sector 3, there is a reduction in the number of working families supplying child labour. This is the *direct adult labour reallocation effect* of an inflow of foreign capital that lowers the incidence of child labour given the two wage rates and is captured by the first term within square brackets in the right-hand side of (8.35.1). Sector 2 contracts with sector 1 as the availability of the two types of labour shrinks in the *HOSS*. Now since the higher wage-paying sector (sector 3) expands, the aggregate income of the richer people rises, which, in turn, enhances the demand for the non-traded final commodity. The price of the non-traded good, P_2, rises unambiguously generating a *Stolper–Samuelson effect* and causes the two wage rates to change. This produces two induced wage effects on the supply of child labour. As explained above, an *induced adult labour reallocation effect* also takes place. These are the three induced effects of an inflow of foreign capital that work through a change in P_2.

On the other hand, an increase in the educational subsidy, E, ceteris paribus, lowers the effective child wage rate, $(W_C - B(E))$, and hence the supply of child labour. This is the first direct effect of this policy and is represented by the third term in the right-hand side of (8.35.1). This may be called the *effective child wage effect*. It produces a *Rybczynski effect* in the *HOSS* leading to a (an) contraction (expansion) of the more (less) child labour-intensive sector depending on the relative child labour intensities of the two sectors. If sector 1 contracts (expands), some amount of capital is released (absorbed), which is now absorbed in (released by) sector 3. So, sector 3 expands (contracts) in terms of both output and employment of adult labour,

[29]A *Stolper–Samuelson effect* contains an element of *Rybczynski effect* if the technologies of production are of the variable-coefficient type. This is a well-known result in the theory of international trade.

and consequently the number of working families supplying child labour decreases (increases). This is the *direct adult labour reallocation effect*, which takes place without any changes in P_2. This second direct effect of an education subsidy policy is encapsulated by the third term within square brackets in the right-hand side of (8.35.1). This causes the aggregate income of the richer people to change, affecting the demand for the non-traded final commodity. The supply of this commodity also changes, consequently changing its price. Thus, two induced *wage effects* on the supply of child labour take place.

A lump-sum tax on the affluent section of the population affects the aggregate supply of child labour only indirectly through a change in P_2. We have already discussed in details how a change in P_2 generates *child wage effect*, *adult wage effect* and an *induced adult labour reallocation effect*.

Since both sectors 1 and 2 use adult labour and child labour and effectively form a *HOSS*, these can be classified in terms of factor intensities.[30] The signs of different effects, especially those of induced effects, depend crucially on the relative factor intensities of these two sectors. Depending on this classification there can arise two cases, which we discuss one by one. For the sake of analytical simplicity, we assume that the per-unit requirement of capital, a_{K1}, is given technologically.[31]

Let us first consider the case where the export sector (sector 1) is more intensive in the use of child labour relative to the non-traded sector (sector 2). From Eq. (8.35.2) the following proposition can be proved.[32]

Proposition 8.3 *When the export sector is more child labour-intensive than the non-traded sector with respect to adult labour, the incidence of child labour in the economy (i) falls unambiguously due to an inflow of foreign capital; (ii) falls following an education subsidy policy if* $(\lambda_{L1}\lambda_{K3} \leq E_Y W^* L \lambda_{L3}\lambda_{L2}\lambda_{K1}/Y)$*; and (iii) increases unambiguously due to imposition of a lump-sum tax on the richer section of the population.*

We have already explained how an inflow of foreign capital lowers the incidence of child labour through the *direct adult labour reallocation effect* and leads to an increase in the price of the non-traded commodity, P_2. This in turn lowers the child wage rate, W_C, and raises the informal adult wage rate, W, following a *Stolper–Samuelson effect* since sector 2 is more intensive in the use of adult labour vis-à-vis

[30]There can arise two cases. Either sector 1 is child labour-intensive and the non-traded sector (sector 2) is adult labour-intensive or vice versa. We consider both the cases here and examine how the effects of different policies on child labour change under different factor intensity conditions.

[31]It rules out the possibility of substitution between capital and other factors of production (i.e. adult labour and child labour) in sector 1. Although this is a simplifying assumption, it is not totally unrealistic. For cultivation with HYV seeds frequently used in several areas of developing economies, different inputs like fertilizers, pesticides, herbicides and water are used in recommended doses. In other words, there are complementarities between these inputs and these are not substitutable with labour. See Dasgupta (1977) for a detailed discussion on this aspect. It may, however, be checked that the qualitative results of the model hold under different condition(s) even if we allow substitutability between labour and capital.

[32]See Appendix 8.10 for the mathematical proof.

sector 1. So the two *induced wage effects* also exert downward pressures on the supply of child labour. In this case, all the effects work in the same direction and together contribute to an unambiguous drop in the incidence of child labour in the economy.

Next, an increase in the subsidy on education raises the marginal benefit of sending children to school. Other things remaining unchanged, this lowers the effective child wage rate and hence produces a direct contractionary effect on child labour. A *Rybczynski effect* in the *HOSS* takes place leading to a (an) contraction (expansion) of the more (less) child labour-intensive sector, i.e. sector 1 (sector 2). As sector 1 contracts, some amount of capital is released, which is now absorbed in sector 3 so that it expands in terms of both output and employment of adult labour. This is the *direct adult labour reallocation effect*, which lowers the supply of child labour. The aggregate income of the richer section of the population rises since more adult workers are now employed in the higher wage-paying sector. This leads to an increase in the demand for commodity 2. Thus, we find that there are two opposite effects on the price of commodity 2, P_2, since both the demand and the supply of this commodity increase. However, the positive effect of an increase in demand on P_2 outweighs the negative effect of an increase in supply under the sufficient condition as stated in Proposition 8.3. The rise in P_2 increases the competitive adult wage, W, and reduces the child wage, W_C, following a *Stolper–Samuelson effect*. Thus, all the direct and indirect effects work in the same direction and together lead to a reduction in the incidence of child labour subject to the sufficient condition as mentioned above. However, it should be pointed out that one might get the same result under a few other sufficient conditions as well.

Finally, a lump-sum tax, T, on the richer people has no direct effects on child labour. However, it lowers the aggregate disposable income, $(Y - T)$, of this section of the population and hence the demand for the non-traded commodity. This leads to a fall in P_2, which lowers W and raises W_C following a *Stolper–Samuelson effect*, since sector 2 is more intensive in the use of adult labour with respect to child labour relative to sector 1 in this case. Besides, sector 1 expands at the cost of sector 2 following a *Rybczynski-type effect*. This leads to a contraction of sector 3 in order to be able to release capital to the expanding sector 1. As a consequence, the number of working families employed in sector 3 falls. This means that more working families will now be supplying child labour. In this case, all the three effects, namely, the *child wage effect*, *adult wage effect* and *induced adult labour reallocation effect*, work in the same direction and together contribute to an unambiguous increase in the incidence of child labour in the society. This is an interesting result since it is counterintuitive to the common wisdom.

Now, we proceed to analyse the case where the non-traded sector is more child labour-intensive with respect to adult labour vis-à-vis the export sector (sector 1). In this case, unlike the previous one, different effects of a policy change work on the supply of child labour in opposite directions. Although unambiguous consequences cannot be predicted, some counterintuitive results may be obtained subject to a few reasonable conditions. For this purpose, we consider Eq. (8.35.2) and derive the following proposition.[33]

Proposition 8.4 *In a situation where the export sector is less child labour-intensive vis-à-vis the non-traded final good sector, the incidence of child labour (i) rises owing to an inflow of foreign capital if* $[(I_{WC}+I_L)Q_1 \geq (\lambda_{L3}/\lambda_{K3}-\lambda_{L3})]$*; (ii) falls due to a hike in subsidy on education if* $(\lambda_{L1}\lambda_{K3} \leq \lambda_{L3}\lambda_{L2}\lambda_{K1}E_Y W^*L/Y)$ *and* $[(I_{WC}+I_W+I_L)Q_2 \leq \lambda_{L3}\lambda_{L2}\lambda_{K1}G_3/(1-\lambda_{L3})|\lambda|]$*; and (iii) decreases following a lump-sum tax on the richer people if* $(I_{WC}+I_L)Q_3 \leq 0$.

As explained previously, an inflow of foreign capital causes sector 3 to expand in terms of both output and employment and exerts a downward pressure on child labour through the *direct adult labour reallocation effect*, causing both sectors 1 and 2 to contract. Besides, the aggregate income of the richer section of the population, Y, increases, raising the demand for commodity 2. So there is an unambiguous hike in the price of commodity 2, P_2. Consequently, the competitive adult wage, W, falls and the child wage, W_C, rises owing to a *Stolper–Samuelson effect*, since sector 2 is now more child labour-intensive vis-à-vis sector 1. Hence, the supply of child labour by each poor working family rises due to the two *induced wage effects*. Sector 1 contracts further following a *Rybczynski-type effect* and releases some more capital to sector 3, causing a supplementary expansion of sector 3. This is the *induced adult labour reallocation effect*, which arises following an increase in P_2. Thus, we find that the two *induced wage effects* tend to increase the incidence of child labour, while both the *direct* and indirect *adult labour reallocation effects* work in the opposite direction. The net result of these effects will be an increase in the aggregate supply of child labour in the society under the sufficient condition: $[(I_{WC}+I_L)Q_1 \geq (\lambda_{L3}/\lambda_{K3}-\lambda_{L3})]$. This condition implies that the strength of the *induced child wage effect* is greater than the joint strength of the two *adult labour reallocation effects*.[34]

A hike in the education subsidy, ceteris paribus, reduces the effective child wage rate and hence lowers the supply of child labour by each poor family through the *effective child wage effect*. This produces a *Rybczynski effect* in the *HOSS* leading to a (an) contraction (expansion) of sector 2 (sector 1). Sector 3 contracts in terms of both output and employment of adult labour since it has to release capital to the expanding sector 1. This leads to a fall in the demand for commodity 2 through a decline in Y. Thus, we find that both the demand and supply of commodity 2 fall, and hence there arise two opposite effects on P_2. However, P_2 falls under the sufficient condition that $(\lambda_{L1}\lambda_{K3} \leq E_Y W^*L\lambda_{L3}\lambda_{L2}\lambda_{K1}/Y)$. As P_2 falls, W rises and W_C falls due to a *Stolper–Samuelson effect*. There will be an additional expansionary effect on sector 1 following a *Rybczynski-type effect* in the *HOSS* demanding more capital from sector 3. Sector 3 contracts further in terms of both output and employment.

[33] This has been proved in Appendix 8.10.

[34] This result holds even if the *induced adult wage effect* is stronger than the two *adult labour reallocation effects*. In mathematical terms this is expressed as $[(I_W+I_L)Q_1 \geq (\lambda_{L3}/\lambda_{K3}-\lambda_{L3})]$.

This is the *induced adult labour reallocation effect*. So, there are now more child labour-supplying families with each of them sending out a lower number of children to work than before. The net outcome will be a fall in the incidence of child labour in the society if $[(I_{WC} + I_W + I_L)Q_2 \leq \lambda_{L3}\lambda_{L2}\lambda_{K1}G_3/(1-\lambda_{L3})|\lambda|]$. This condition implies that the two *induced wage effects* collectively dominate over the two *adult labour reallocation effects*.[35]

Finally, imposition of a lump-sum tax on the richer people lowers the price of commodity 2, P_2. This produces a *Stolper–Samuelson effect* in the *HOSS* and leads to an increase in the competitive adult wage, W, and a fall in the child wage, W_C, as sector 2 is now more child labour-intensive relative to sector 1. Thus, the supply of child labour by each poor family decreases due to the two *induced wage effects*. Also, sector 1 expands and sector 2 contracts following a *Rybczynski-type effect*. Sector 3 contracts in order to release capital to the expanding sector 1. The number of child labour-supplying families, $(L - a_{L3}X_3)$, increases since sector 3 contracts in terms of both output and employment. This is the *induced adult labour reallocation effect* that produces an upward pressure on child labour. The net outcome will be a fall in the aggregate supply of child labour if $(I_{WC} + I_L)Q_3 \leq 0$. This restriction implies that the magnitude of the *induced child wage effect* is greater than the extent of the *induced adult labour reallocation effect*. However, this result also holds under an alternative sufficient condition as well (see Appendix 8.10).

It is interesting to note that the effects of a lump-sum tax on the richer people on the incidence of child labour in the economy completely differ in the two cases considered above. When the export sector (sector 1) is more intensive in the use of child labour vis-à-vis the non-traded sector, the policy works unfavourably on child labour while it produces the desired result in the opposite case. Hence, an education subsidy policy should not be financed by imposing a lump-sum tax when the export sector is more intensive in the use of child labour than the non-traded sector. However, when the non-traded sector is relatively child labour-intensive both the policies may be undertaken concurrently and a balanced-budget change fortifies the possibility of getting the desired result on the problem of child labour.

8.4 Effects of Foreign Capital Inflow on Child Labour and Welfare of Working Households in a Dynamic Set-Up

This section introduces a dynamic set-up to study the different mechanisms through which economic reforms may affect the incidence of child labour. A three-sector specific-factor HT-type general equilibrium model is developed to demonstrate that reduction in poverty is not a necessary condition for mitigating the menace of child

[35] One may find other sufficient conditions incorporating the *effective child wage effect*.

labour. There are factors other than reduction of poverty that not only mitigate the child labour problem but also improve the welfare of the families that supply child labour.[36]

8.4.1 Derivation of Family Supply Function of Child Labour

The supply function of child labour by each working family is determined from its intertemporal utility maximizing behaviour. Let us consider a two-period optimization problem of the representative working family consisting of one adult member (the guardian) and n number of children with $n \geq 1$. Staying in line with the traditional model of the household (Becker 1964), we consider each household as a single decision-making unit. On behalf of the family, the guardian unilaterally takes decision regarding allocation of consumption in the two periods and the labour supply of his children. The guardian in the first period works in the adult labour market and earns a wage, W_0.[37] In this period, he takes decision about his children's work effort and schooling. l_C number of children are sent out to work at the wage rate, W_C. The non-existence of a market for loans against future earnings compels the parent to use income from child work to smooth out the family consumption.[38] The remaining children who are not sent out to work are sent to school.[39] Hence, $(n-l_C)$ numbers of children are sent to school. So, l_C number of child workers earns the child wage (W_C) in the first period and the unskilled adult wage (W) in the second period, while the remaining $(n-l_C)$ children earn nothing in the first period and the skilled wage (W_S) in the second period.[40] In the presence of positive return to education, W_S is greater than W. In the second period, the guardian earns nothing and lives on the income he receives from his children who have become adult workers by this time.

---

[36]This section is based on Chaudhuri (2011) and Dwibedi and Chaudhuri (2010).

[37]W_0 can take two values, W(unskilled wage) and W_S(skilled wage), depending on the type of the representative working household.

[38]There are informal credit markets in developing countries as a substitute to the missing formal credit market, but they mainly deal with short-term loans. Poor households need long-term credit to be able to compensate for the foregone earnings of their children, which is lacking in these countries. See, for example, Baland and Robinson (2000), Ranjan (1999, 2001) and Jafarey and Lahiri (2002) in this context.

[39]This is a simplifying assumption that ignores the existence of non-labour non-school goers.

[40]Introduction of uncertainty in securing a skilled job in the second period would be an interesting theoretical exercise. However, the major findings of the model remain unaffected if the probability in finding a high-skill job is given exogenously.

We assume that the parent cares only about the lifetime family consumption and does not attach any value to the child's leisure.[41] The utility is therefore a function of consumption levels in the two periods (1 and 2). For algebraic simplicity, we assume a logarithmic utility function with unitary intertemporal elasticity of substitution.

$$V = \log \; C_1 + \beta \log \; C_2 \tag{8.37}$$

where β is the time discount factor.

The first period's consumption (C_1) consists of wage income of the guardian and child wage income from the working children. So we have

$$C_1 = (W_0 + l_C W_C) \tag{8.38}$$

The second period's consumption (C_2) can be thought of as the sum of skilled wage income of educated adult (schooled in the first period) workers and unskilled wage income of uneducated adult labourers (worked in the first period). Therefore, C_2 is given as follows:

$$C_2 = (l_C W + (n - l_C) W_S) \tag{8.39}$$

We assume that the only cost of education is the opportunity cost in terms of forgone earnings of children.[42]

The guardian maximizes the lifetime utility (Eq. (8.37)) with respect to l_C and subject to (8.38) and (8.39). Maximization gives the following first-order condition:

$$\left[\frac{(l_C W + (n - l_C) W_S)}{(W_0 + l_C W_C)}\right] = \frac{\beta (W_S - W)}{W_C} \tag{8.40}$$

By solving Eq. (8.40) the following child labour function by each working family is obtained:

$$l_C = \frac{n W_S}{(1 + \beta)(W_S - W)} - \frac{\beta W_0}{(1 + \beta) W_C} \tag{8.41}$$

The properties of the child labour supply function, given by (8.41), are as follows. An increase in the current income, W_0 (income from non-child source), raises both C_1 and C_2 and hence lowers l_C through a positive income effect. An increase in the child wage rate implies an increase in the opportunity cost of education and hence leads to more child labour supply (i.e. less schooling). Any change in skilled

[41] This is a marked departure from the Basu and Van (1998) paper that considers an altruistic parent who cares about the well-being of his children and derives disutility from the labour supplied by his offspring.

[42] One can, of course, incorporate direct schooling cost without affecting the qualitative results of the model.

and/or unskilled wage affects the return to education and therefore influence the guardian's decision regarding allocation of his children between education and work. For example, an increase in skilled wage (W_S) or a fall in unskilled wage (W) will make education more attractive and raise the number of school-going children from each family thereby lowering the supply of child labour by the household.

8.4.2 The General Equilibrium Analysis

We consider a small open dual economy with two broad sectors: rural and urban. The urban sector is further subdivided into two sub-sectors so that in all we have three sectors. Sector 1 produces an agricultural commodity, X_1, using adult unskilled labour (L), child labour (L_C) and capital (K). The capital–output ratio in sector 1, a_{K1}, is assumed to be technologically given.[43] Sector 2 is an urban sector that produces a low-skill manufacturing good, X_2, by means of capital and unskilled labour.[44] The presupposition that child labour is used only in the agricultural sector is simplifying. However, it is partly justified on the ground that more than 70 % of economically active children in the developing countries are engaged in agriculture and allied sectors and less than 9 % are involved in manufacturing (ILO 2002). Finally, sector 3, the other urban sector, uses capital and skilled labour (S) to produce a high-skill commodity, X_3. Skilled labour is a specific input in sector 3 while child labour is specific to sector 1. Unskilled labour is perfectly mobile between sectors 1 and 2, while capital is completely mobile among all the three sectors of the economy.

Sector 2 faces a unionized labour market where unskilled workers receive a contractual wage, W^*, while the unskilled wage rate in the rural sector, W, is market determined, with $W^* > W$. The two wage rates are related by the Harris–Todaro (1970) condition of migration equilibrium where the expected urban wage equals the rural wage rate. Hence, there is urban unemployment of unskilled labour. The capital endowment of the economy includes both domestic capital, K_D, and foreign capital, K_F. Incomes from foreign capital are completely repatriated. Sector 2 uses capital more intensively with respect to unskilled labour vis-à-vis sector 1. Production functions exhibit constant returns to scale[45] with positive and diminishing marginal productivity to each factor. Except the urban unskilled labour market, all other markets are perfectly competitive. All the three commodities are

[43]This assumption of constant capital–output ratio in agricultural sector has also been made in the previous model in a different context. See footnote 31 for the rationale of the assumption.

[44]Even if sector 2 is allowed to use child labour, the results of model hold under different sufficient conditions containing terms of relative intensities in which child labour and other two inputs are used in the first two sectors.

[45]Even though the capital–output ratio in sector 1 is technologically given, adult labour and child labour are substitutes and the production function displays the constant returns to scale property in these two inputs.

traded internationally; their prices are determined in the international market and are exogenous to the small economy. Finally, commodity 3 is chosen as the numeraire.

A general equilibrium of the system is represented by the following set of equations:

$$Wa_{L1} + W_C a_{C1} + Ra_{K1} = P_1 \tag{8.42}$$

$$W^* a_{L2} + Ra_{K2} = P_2 \tag{8.43}$$

$$W_S a_{S3} + Ra_{K3} = 1 \tag{8.44}$$

where a_{ji}s are input–output ratios and R is the return to capital.

$$a_{C1} X_1 = L_C \tag{8.45}$$

$$a_{K1} X_1 + a_{K2} X_2 + a_{K3} X_3 = K_{\mathrm{D}} + K_{\mathrm{F}} = K \tag{8.46}$$

$$a_{S3} X_3 = S \tag{8.47}$$

$$a_{L1} X_1 + a_{L2} X_2 + L_{\mathrm{U}} = L \tag{8.48}$$

where L_C is the aggregate supply of child labour in the economy.

Equations (8.42), (8.43) and (8.44) are the three competitive industry equilibrium conditions in the three sectors. On the other hand, Eqs. (8.45), (8.46) and (8.47) are the full-employment conditions for child labour, capital[46] and skilled labour, respectively. The unskilled labour endowment is given by (8.48).

Since the probability of finding a job in the low-skill urban manufacturing sector is $a_{L2}X_2/(a_{L2}X_2 + L_{\mathrm{U}})$, the expected unskilled wage in the urban area is $(W^* a_{L2}X_2)/(a_{L2}X_2 + L_{\mathrm{U}})$. Therefore, the allocation mechanism of adult unskilled labour between rural and urban areas is expressed as

$$\frac{(W^* a_{L2} X_2)}{(a_{L2} X_2 + L_{\mathrm{U}})} = W$$

or, equivalently,

$$\left(\frac{W^*}{W}\right) a_{L2} X_2 + a_{L1} X_1 = L \tag{8.49}$$

[46] It is assumed that the capital stock of the economy consists of both domestic capital and foreign capital, which are perfect substitutes. It may be mentioned that this assumption has been widely used in the theoretical literature on trade and development.

The firms in the low-skill urban sector have well-organized trade unions. Through successful collective bargaining, these unions are able to ensure a wage for their members which is higher than their reservation wage, i.e. the rural sector unskilled wage.[47] The relationship for the unionized wage rate is specified as[48]

$$W^* = W^*(W, U) \tag{8.50}$$

This function satisfies the following properties:

$W^* = W$ for $U = 0$; $W^* > W$ for $U > 0$; $(\partial W^*/\partial W), (\partial W^*/\partial U) > 0$; and $1 > E_W \geq 0$ where E_W is the elasticity of the W^* function with respect to W. These properties have been explained earlier.

Using (8.50) Eq. (8.43) can be rewritten as

$$W^*(W, U)\, a_{L2} + R a_{K2} = 1 \tag{8.43.1}$$

Both unskilled and skilled working families are potential suppliers of child labour and their current wage incomes (W_0) are W and W_S, respectively. Besides, there are L and S numbers of unskilled and skilled working families in the economy, respectively. Using Eq. (8.41) the aggregate child labour supply in the economy is obtained as follows:

$$L_C = \left(\frac{1}{1+\beta}\right)\left[L\left\{\frac{nW_S}{(W_S - W)} - \frac{\beta W}{W_C}\right\} + S\left\{\frac{nW_S}{(W_S - W)} - \frac{\beta W_S}{W_C}\right\}\right] \tag{8.51}$$

Using (8.51) Eq. (8.45) can be rewritten as follows:

$$a_{C1}X_1 = \left(\frac{1}{1+\beta}\right)\left[L\left\{\frac{nW_S}{(W_S - W)} - \frac{\beta W}{W_C}\right\} + S\left\{\frac{nW_S}{(W_S - W)} - \frac{\beta W_S}{W_C}\right\}\right] \tag{8.45.1}$$

8.4.3 Comparative Statics

The general equilibrium structure consists of nine equations, namely, (8.42), (8.43.1), (8.44), (8.45.1), (8.46), (8.47), (8.48), (8.49), and (8.51), and the same number of variables, $W, W_C, W_S, R, X_1, X_2, X_3, L_C$ and L_U. This is an indecomposable system. The factor prices depend on both commodity prices and factor endowments. Given the child wage rate, sectors 1 and 2 together effectively form a miniature Heckscher–Ohlin system as they use both adult unskilled labour and capital. It is sensible to assume that sector 1 is more adult labour-intensive than sector 2

[47] See Bhalotra (2002) in this context.

[48] This relationship has already been adequately explained in earlier chapters.

with respect to capital. Totally differentiating Eqs. (8.42), (8.43.1), (8.44), (8.45.1), (8.46), (8.47) and (8.49) and solving by Cramer's rule, the following proposition can be established.[49]

Proposition 8.5 *An inflow of foreign capital leads to (i) increases in both adult unskilled wage and skilled wage, (ii) a decline in child wage rate and (iii) an expansion of the low-skill urban manufacturing sector. The skilled–unskilled wage inequality*[50] *worsens if the high-skill sector is capital-intensive (in a special sense) relative to the low-skill sector.*

Proposition 8.5 can be intuitively explained in the following fashion. An inflow of foreign capital lowers the return to capital, R, as the supply rises given the demand. A Rybczynski effect takes place in the miniature HOS system comprising of sectors 1 and 2 leading to a contraction of sector 1 and an expansion of sector 2 since the latter is more capital-intensive relative to the former sector with respect to adult unskilled labour. Sector 3 also expands since it uses capital but a different type of labour (skilled labour). The demand for child labour falls in sector 1, while that of skilled labour rises in sector 3 since these are the two sector-specific inputs. Consequently, the child wage falls while the skilled wage rises. Owing to reduction in capital cost, the unionized unskilled wage, W^*, has to rise so as to satisfy the zero-profit condition in sector 2 (see Eq. (8.43.1)). But W^* can increase only if the competitive unskilled wage, W rises. The reason behind increases in W and W^* is easily comprehensible. Sector 2 expands in terms of both output and employment following an inflow of foreign capital. The expected urban wage for a prospective rural unskilled migrant rises unambiguously that paves the way for fresh migration into the urban sector. The availability of unskilled labour in the rural sector falls, which in turn causes the rural unskilled wage, W, to go up. W^* also increases since W rises. What happens to the skilled–unskilled wage inequality depends on the rates of increases in W_S and W. If $(\theta_{K2}/\theta_{L2}) < (\theta_{K3}/\theta_{S3})$, the saving on capital cost in the low-skill manufacturing sector (sector 2) is less than that in the high-skill sector, which, in turn, implies that the rate of increase in the unionized unskilled wage, W^* (and hence that of W since $1 > E_W \geq 0$) is smaller than that of the skilled wage, W_S. Thus, the wage inequality worsens if the low-skill manufacturing sector is less capital-intensive vis-à-vis the high-skill sector in a special sense.[51]

---

[49] These results have been derived in Appendix 8.11.

[50] See Eq. (5.10.1) and the preceding discussions.

[51] Here sectors 2 and 3 use two different types of labour. However, there is one intersectorally mobile input, that is, capital. So, these two sectors cannot be classified in terms of factor intensities as is usually done in the Heckscher–Ohlin–Samuelson model. However, a special type of factor intensity classification in terms of the relative distributive shares of the mobile factor, that is, capital can be made for analytical purposes. The sector in which this share is higher relative to the other may be considered as capital-intensive in a special sense. See Jones and Neary (1984) for details.

To analyse the outcome of foreign capital inflow on the supply of child labour in the economy, after totally differentiating Eq. (8.51), the following proposition can be proved.[52]

Proposition 8.6 *An inflow of foreign capital lowers the incidence of child labour in the economy if the high-skill sector is capital-intensive relative to the low-skill sector.*

We intuitively explain Proposition 8.6 as follows. In Proposition 8.5 it has been explained how different factor prices and the relative wage inequality respond to inflows of foreign capital. A fall in the child wage rate, W_C, means a decrease in the opportunity cost of education. On the other hand, the return to education rises as wage inequality increases. Finally, the initial incomes from non-child source of both the unskilled and skilled working families increase and lower the supply of child labour by each family via the positive income effect. Hence, under the sufficient condition that the high-skill sector is capital-intensive, all these three effects work in the same direction and lower the problem of child labour in the society.

Let us now turn to analyse the outcome of an inflow of foreign capital on the unemployment of unskilled labour in the urban sector. Subtraction of (8.48) from (8.49) yields

$$L_U = a_{L2}X_2\left(\frac{W^*}{W} - 1\right) \tag{8.52}$$

Differentiating (8.52) the following proposition can be established.[53]

Proposition 8.7 *An inflow of foreign capital produces an ambiguous effect on the unemployment of unskilled labour in the urban sector.*

Proposition 8.7 can be explained in the following manner. In the migration equilibrium the expected urban wage for a prospective unskilled rural migrant equals the actual unskilled rural wage. An inflow of foreign capital affects the migration equilibrium in two ways. First, the low-skill urban manufacturing sector expands following a Rybczynski effect. This leads to an increase in the number of jobs available in this sector. The expected urban wage for prospective rural migrant $[W^*/\{1 + (L_U/a_{L2}X_2)\}]$ increases as the probability of getting a job in this sector rises for every unskilled worker. This is *the centrifugal force*, which paves the way for fresh migration from the rural to the urban sector. Second, an inflow of foreign capital raises the rural unskilled wage (see Proposition 8.5). This is *the centripetal force* that prevents rural workers from migrating into the urban sector. Thus, there are clearly two opposite effects working on determination of the size of the unemployed urban unskilled workforce. The net effect on unemployment is, therefore, ambiguous.

---

[52]The proof is available in Appendix 8.12.

[53]See Appendix 8.13 for detailed derivations.

Finally, we now examine the consequence of foreign capital inflow on the welfare of the child labour-supplying families. Differentiating Eqs. (8.37), (8.38) and (8.39) and using (8.41), the final proposition of the model can be established as follows.[54]

Proposition 8.8 *An inflow of foreign capital improves the welfare of the child labour-supplying families if* $\beta \geq nW_S(W_S - W)$.

Since the two wage rates and the relative wage inequality increase and the incidence of child labour declines, the consumption of the household in period 2, C_2, rises unequivocally owing to inflow of foreign capital. However, the effect on the consumption level in period 1, C_1, is not so obvious. This is because C_1 rises as W_0 rises, but it falls since the income from child labour, $W_C l_C$, declines. However, the expansionary effects on C_2 outweigh the negative effects on C_1 under the sufficient condition as stated in the proposition. Consequently, the welfare of the working families improves.

8.5 Concluding Remarks and Policy Analysis

The chapter develops three different models to study the consequences of liberalized investment policy on the incidence of child labour. The first model considers a three-sector full-employment model with child labour being employed in two informal sectors. It finds that FDI is likely to exert a downward pressure on the incidence of child labour in the society.

The second model explains in the context of a full-employment model how an overall economic expansion with foreign capital might produce paradoxical results on child labour under different circumstances. While the policy to liberalize foreign investment lowers the incidence of child labour in the situation where the traded sector is more child labour-intensive than the non-traded informal sector, it might produce a counterproductive effect in the alternate case. On the contrary, an education subsidy policy is likely to produce the desired result on child labour in both the situations. However, when the traded sector is relatively intensive in the use of child labour, the subsidy on education should not be financed by a lump-sum tax on the more affluent people as the latter policy might invalidate the favourable effect of the education subsidy policy. But, in the other case, both the policies can be undertaken concurrently, and a balanced-budget change is the best policy option in the given set-up. Hence, an education subsidy policy might be a more effective instrument in comparison with the policy of economic growth with foreign capital in combating the problem of child labour in a developing economy. But, whether the subsidy should be financed by a lump-sum tax on the wealthier people depends on the technological and institutional factors of the economy.

[54]This result has been proved in Appendix 8.14.

Finally, the third model shows that inflows of foreign capital might exert a downward pressure on the child labour incidence by raising the return to education (premium on skill) and the initial non-child incomes of the working families and by lowering the child wage that constitutes the opportunity cost of schooling. The child labour incidence may improve even if non-child incomes of the families do not increase. There are enough other forces brought about by economic reforms that can overcompensate for reduced parental incomes. Hence, reduction of poverty is not a necessary condition for the problem of child labour to improve in developing economies following economic reforms. These results are consistent with empirical findings that the incidence of child labour has lessened at least in relative terms although the problem of poverty has increased in many developing countries following economic reforms. Besides, the analysis shows that inflows of foreign capital are likely to improve the welfare of the families that supply child labour although the urban unemployment problem of unskilled labour may not improve.

Appendices

Appendix 8.1: (Model 1) Derivation of Child Labour Supply Function

Maximizing Eq. (8.2) with respect to C_1, C_3 and l_C subject to the budget constraint (8.3), the following first-order conditions are obtained:

$$\left(\frac{(\alpha U)}{(P_1 C_1)}\right) = \left(\frac{(\beta U)}{(P_3 C_3)}\right) = \left(\frac{(\gamma U)}{(n - l_C)\, W_C}\right) \tag{8.A.1}$$

From (8.A.1) we get the following expressions:

$$C_1 = \left\{\frac{\alpha\,(n - l_C)\, W_C}{(\gamma P_1)}\right\} \tag{8.A.2}$$

$$C_3 = \left\{\frac{\beta\,(n - l_C)\, W_C}{(\gamma P_3)}\right\} \tag{8.A.3}$$

Substitution of the values of C_1 and C_3 into the budget constraint and further simplifications give us the following child labour supply function of each poor working household:

$$l_C = \left\{(\alpha + \beta)\, n - \gamma\left(\frac{W}{W_C}\right)\right\} \tag{8.4}$$

Appendix 8.2: (Model 1) Effects on $\mathbf{X}_1$ *and* $\mathbf{X}_2$

Totally differentiating Eqs. (8.6), (8.7) and (8.8) and writing in a matrix notation, we obtain

$$\begin{bmatrix} \theta_{L1} & \theta_{C1} & \theta_{K1} \\ \theta_{L2} & \theta_{C2} & \theta_{K2} \\ 0 & 0 & \theta_{K3} \end{bmatrix} \begin{bmatrix} \widehat{W} \\ \widehat{W}_C \\ \widehat{r} \end{bmatrix} = \begin{bmatrix} 0 \\ \widehat{P}_2 \\ -\theta_{23}\widehat{P}_2 \end{bmatrix} \tag{8.A.4}$$

where θ_{ji} = distributive share of the *j*th input in the *i*th sector and '$\bigwedge$' = proportional change.

Solving (8.A.4) by Cramer's rule and using (8.1.1), we find the following expressions:

$$\widehat{W} = \underset{(-)}{\left(\frac{\widehat{P}_2}{|\theta|}\right)} \underset{(-)}{\left[(\theta_{K1}\theta_{C2} - \theta_{C1}\theta_{K2})\,\theta_{23} - \theta_{C1}\theta_{K3}\right]} \tag{8.A.5}$$

$$\widehat{W}_C = \underset{(-)}{\left(\frac{\widehat{P}_2}{|\theta|}\right)} \underset{(+)}{\left[\theta_{L1}\theta_{K3} + \theta_{23}\,(\theta_{L1}\theta_{K2} - \theta_{K1}\theta_{L2})\right]} \tag{8.A.6}$$

$$\widehat{r} = \left(\frac{\theta_{23}\widehat{P}_2}{|\theta|}\right)(\theta_{C1}\theta_{L2} - \theta_{L1}\theta_{C2}) = -\left(\frac{\theta_{23}}{\theta_{K3}}\right)\widehat{P}_2 \tag{8.A.7}$$

$$|\theta| = \theta_{K3}\,(\theta_{L1}\theta_{C2} - \theta_{L2}\theta_{C1}) < 0. \tag{8.A.8}$$

where $|\theta|$ is the determinant to the coefficient matrix given by (8.A.4).

Again differentiating (8.9), (8.10) and (8.11.1) and arranging in a matrix notation, one finds

$$\begin{bmatrix} \lambda_{L1} & \lambda_{L2} & \lambda_{L3} \\ \lambda_{K1} & \lambda_{K2} & \lambda_{K3} \\ \lambda_{C1} & \lambda_{C2} & \frac{\lambda_{L3}}{1-\lambda_{L3}} \end{bmatrix} \begin{bmatrix} \widehat{X}_1 \\ \widehat{X}_2 \\ \widehat{X}_3 \end{bmatrix} = \begin{bmatrix} -A_1\widehat{P}_2 \\ \widehat{K} - A_2\widehat{P}_2 \\ -A_3\widehat{P}_2 \end{bmatrix} \tag{8.A.9}$$

where

$$\begin{aligned} A_1 = \underset{(-)}{\left(\frac{1}{|\theta|}\right)} \Big[& \underset{(-)}{\left(\lambda_{L1}S^1_{LL} + \lambda_{L2}S^2_{LL}\right)} \underset{(-)}{\{\theta_{K1}\theta_{23}\theta_{C2} - \theta_{C1}\,(\theta_{K3} + \theta_{23}\theta_{K2})\}} \\ & + \underset{(+)}{\left(\lambda_{L1}S^1_{LC} + \lambda_{L2}S^2_{LC}\right)} \underset{(+)}{\{\theta_{L1}\,(\theta_{K3} + \theta_{23}\theta_{K2}) - \theta_{K1}\theta_{23}\theta_{L2}\}} \\ & + \underset{(+)}{\left(\lambda_{L1}S^1_{LK} + \lambda_{L2}S^2_{LK} + \lambda_{L3}S^3_{LK}\right)} \theta_{23} \underset{(+)}{(\theta_{C1}\theta_{L2} - \theta_{L1}\theta_{C2})} \Big] < 0 \end{aligned} \tag{8.A.10.1}$$

$$
\begin{aligned}
A_2 = \left(\tfrac{1}{|\theta|}\right) \Big[& \underset{(-)}{} \big(\lambda_{K1} S^1_{KL} + \lambda_{K2} S^2_{KL}\big) \underset{(+)}{} \{\theta_{K1}\theta_{23}\theta_{C2} - \theta_{C1}(\theta_{K3} + \theta_{23}\theta_{K2})\} \\
& \qquad\qquad\qquad\qquad\qquad (-) \\
& + \underset{(+)}{\big(\lambda_{K1} S^1_{KC} + \lambda_{K2} S^2_{KC}\big)} \underset{(+)}{\{\theta_{L1}(\theta_{K3} + \theta_{23}\theta_{K2}) - \theta_{K1}\theta_{23}\theta_{L2}\}} \\
& + \underset{(-)}{\big(\lambda_{K1} S^1_{KK} + \lambda_{K2} S^2_{KK} + \lambda_{K3} S^3_{KK}\big)} \underset{(+)}{\theta_{23}(\theta_{C1}\theta_{L2} - \theta_{L1}\theta_{C2})} \Big] = ?
\end{aligned}
\tag{8.A.10.2}
$$

$$
\begin{aligned}
A_3 = \left(\tfrac{1}{|\theta|}\right) \Bigg[& \Big(\underset{(-)}{\lambda_{C1} S^1_{CL}} + \underset{(+)}{\lambda_{C2} S^2_{CL} + \tfrac{\gamma W}{l_C W_C}}\Big) \underset{(-)}{\{\theta_{K1}\theta_{23}\theta_{C2} - \theta_{C1}(\theta_{K3} + \theta_{23}\theta_{K2})\}} \\
& + \underset{(-)}{\Big(\lambda_{C1} S^1_{CC} + \lambda_{C2} S^2_{CC} - \tfrac{\gamma W}{l_C W_C}\Big)} \underset{(+)}{\{\theta_{L1}(\theta_{K3} + \theta_{23}\theta_{K2}) - \theta_{K1}\theta_{23}\theta_{L2}\}} \\
& + \underset{(+)}{\Big(\lambda_{C1} S^1_{CK} + \lambda_{C2} S^2_{CK} + \tfrac{\lambda_{L3}}{1-\lambda_{L3}} S^3_{LK}\Big)} \underset{(+)}{\theta_{23}(\theta_{C1}\theta_{L2} - \theta_{L1}\theta_{C2})} \Bigg] = ?
\end{aligned}
\tag{8.A.10.3}
$$

$$
|\lambda| = \left(\frac{\lambda_{L3}}{1-\lambda_{L3}}\right) |\lambda|^{12}_{LK} + \lambda_{K3} |\lambda|^{12}_{CL} - \lambda_{L3} |\lambda|^{12}_{CK} \tag{8.A.10.4}
$$

where $|\lambda|$ is the determinant of the coefficient matrix and

$$
\left.
\begin{aligned}
& |\lambda|^{12}_{LK} = (\lambda_{L1}\lambda_{K2} - \lambda_{L2}\lambda_{K1}) > 0; \; |\lambda|^{12}_{CL} = (\lambda_{C1}\lambda_{L2} - \lambda_{C2}\lambda_{L1}) > 0; \\
& |\lambda|^{12}_{CK} = (\lambda_{C1}\lambda_{K2} - \lambda_{C2}\lambda_{K1}) > 0
\end{aligned}
\right\}
\tag{8.A.11}
$$

(The signs are found by using (8.1.1).)
From (8.A.10.4) and (8.A.11), it follows that

$$
|\lambda| > 0 \;\text{ if }\; \left(\frac{\lambda_{K3}}{\lambda_{L3}}\right) \geq \left(\frac{|\lambda|^{12}_{CK}}{|\lambda|^{12}_{CL}}\right); \;\text{ or, }\; \text{if} \left(\frac{1}{1-\lambda_{L3}}\right) \geq \left(\frac{|\lambda|^{12}_{CK}}{|\lambda|^{12}_{LK}}\right) \tag{8.A.12}
$$

Solving (8.A.9) by Cramer's rule, the following expressions are found:

$$
\begin{aligned}
\widehat{X}_2 = \left(\frac{\widehat{P}_2}{|\lambda|}\right) \Bigg[& A_3(\lambda_{L1}\lambda_{K3} - \lambda_{L3}\lambda_{K1}) + A_2 \lambda_{L3} \left(\lambda_{C1} - \frac{\lambda_{L1}}{1-\lambda_{L3}}\right) \\
& + A_1 \left(\frac{\lambda_{K1}\lambda_{L3}}{1-\lambda_{L3}} - \lambda_{K3}\lambda_{C1}\right) \Bigg] + \left(\frac{\lambda_{L3}\widehat{K}}{|\lambda|}\right) \left(\frac{\lambda_{L1}}{1-\lambda_{L3}} - \lambda_{C1}\right)
\end{aligned}
\tag{8.A.13}
$$

$$\widehat{X}_3 = \left(\frac{\widehat{P}_2}{|\lambda|}\right)\left[A_3\left(\lambda_{L2}\lambda_{K1} - \lambda_{L1}\lambda_{K2}\right) + A_2\left(\lambda_{L1}\lambda_{C2} - \lambda_{L2}\lambda_{C1}\right) + A_1\left(\lambda_{K2}\lambda_{C1} - \lambda_{K1}\lambda_{C2}\right)\right] + \left(\frac{\widehat{K}}{|\lambda|}\right)\left(\lambda_{L2}\lambda_{C1} - \lambda_{L1}\lambda_{C2}\right) \tag{8.A.14}$$

Appendix 8.3: Derivation of Stability Condition in the Market for the Non-traded Input (in Model 1)

For Walrasian static stability in the market for the non-traded input (good 2), we need

$$\left(\frac{\widehat{X}_3}{\widehat{P}_2}\right) - \left(\frac{\widehat{X}_2}{\widehat{P}_2}\right) < 0 \tag{8.A.15}$$

Using (8.A.13) and (8.A.14) from (8.A.15), we can write

$$\left[\left(\frac{\widehat{X}_3}{\widehat{P}_2}\right) - \left(\frac{\widehat{X}_2}{\widehat{P}_2}\right)\right] = \left(\frac{1}{|\lambda|}\right)\left[A_3\left(\lambda_{L2}\lambda_{K1} - \lambda_{L1}\lambda_{K2}\right) + A_2\left(\lambda_{L1}\lambda_{C2} - \lambda_{L2}\lambda_{C1}\right) + A_1\left(\lambda_{K2}\lambda_{C1} - \lambda_{K1}\lambda_{C2}\right)\right] - \left(\frac{1}{|\lambda|}\right)\left[A_3\left(\lambda_{L1}\lambda_{K3} - \lambda_{L3}\lambda_{K1}\right) + A_2\lambda_{L3}\left(\lambda_{C1} - \frac{\lambda_{L1}}{1-\lambda_{L3}}\right) + A_1\left(\frac{\lambda_{K1}\lambda_{L3}}{1-\lambda_{L3}} - \lambda_{K3}\lambda_{C1}\right)\right] < 0$$

or

$$\left(\frac{A_3}{|\lambda|}\right)\left[\lambda_{K1}\left(\lambda_{L2} + \lambda_{L3}\right) - \lambda_{L1}\left(\lambda_{K2} + \lambda_{K3}\right)\right] + \left(\frac{A_2}{|\lambda|}\right)\left[\lambda_{L1}\left(\lambda_{C2} + \frac{\lambda_{L3}}{1-\lambda_{L3}}\right) - \lambda_{C1}\left(\lambda_{L2} + \lambda_{L3}\right)\right] + \left(\frac{A_1}{|\lambda|}\right)\left[\lambda_{C1}\left(\lambda_{K2} + \lambda_{K3}\right) - \lambda_{K1}\left(\lambda_{C2} + \frac{\lambda_{L3}}{1-\lambda_{L3}}\right)\right] = D < 0 \tag{8.A.15.1}$$

Thus, for static stability in the market for good 2, we require that

$$D < 0$$

Appendix 8.4: Effect of FDI on $\mathbf{P}_2$ *(in Model 1)*

Differentiating Eq. (8.12) we obtain

$$\widehat{X}_3 = \widehat{X}_2 \tag{8.A.16}$$

Using Eq. (8.A.13) and (8.A.14) from Eq. (8.A.16), it follows that

$$\begin{aligned}
&\left(\frac{\widehat{P}_2}{|\lambda|}\right)[A_3(\lambda_{L2}\lambda_{K1}-\lambda_{L1}\lambda_{K2})+A_2(\lambda_{L1}\lambda_{C2}-\lambda_{L2}\lambda_{C1})\\
&\quad +A_1(\lambda_{K2}\lambda_{C1}-\lambda_{K1}\lambda_{C2})]+\left(\frac{\widehat{K}}{|\lambda|}\right)(\lambda_{L2}\lambda_{C1}-\lambda_{L1}\lambda_{C2})\\
&=\left(\frac{\widehat{P}_2}{|\lambda|}\right)\left[A_3(\lambda_{L1}\lambda_{K3}-\lambda_{L3}\lambda_{K1})+A_2\lambda_{L3}\left(\lambda_{C1}-\frac{\lambda_{L1}}{1-\lambda_{L3}}\right)\right.\\
&\quad \left.+A_1\left(\frac{\lambda_{K1}\lambda_{L3}}{1-\lambda_{L3}}-\lambda_{K3}\lambda_{C1}\right)\right]+\left(\frac{\lambda_{L3}\widehat{K}}{|\lambda|}\right)\left(\frac{\lambda_{L1}}{1-\lambda_{L3}}-\lambda_{C1}\right)
\end{aligned}$$

Collecting terms, simplifying and using (8.A.15.1), one finds

$$\left(\frac{\widehat{P}_2}{\widehat{K}}\right)=\underset{(-)\,(+)}{\left(\frac{1}{D\,|\lambda|}\right)}\underset{(-)}{\left[\frac{\lambda_{L1}\lambda_{C2}-\lambda_{C1}\lambda_{L2}}{(\lambda_{L1}+\lambda_{L2})}\right]}>0 \tag{8.A.17}$$

So, an inflow of foreign capital raises the price of the non-traded input.

Appendix 8.5: Effect of FDI on Factor Prices, $\mathbf{P}_2$ *and* $\mathbf{X}_3$ *(in Model 1)*

Using (8.A.17) from (8.A.5), (8.A.6) and (8.A.7), one obtains the following expressions:

$$\left(\frac{\widehat{W}}{\widehat{K}}\right)=\underset{(-)\,(+)\,(-)}{\left(\frac{1}{D\,|\lambda|\,|\theta|}\right)}\underset{(-)}{\left[\frac{\lambda_{L1}\lambda_{C2}-\lambda_{C1}\lambda_{L2}}{(\lambda_{L1}+\lambda_{L2})}\right]}\underset{(-)}{[(\theta_{K1}\theta_{C2}-\theta_{C1}\theta_{K2})\,\theta_{23}-\theta_{C1}\theta_{K3}]}>0 \tag{8.A.5.1}$$

$$\left(\frac{\widehat{W}_C}{\widehat{K}}\right) = \underset{(-)\,(+)\,(-)}{\left(\frac{1}{D\,|\lambda|\,|\theta|}\right)} \underset{(-)}{\left[\frac{\lambda_{L1}\lambda_{C2} - \lambda_{C1}\lambda_{L2}}{(\lambda_{L1} + \lambda_{L2})}\right]} \underset{(+)}{[\theta_{L1}\theta_{K3} + \theta_{23}\,(\theta_{L1}\theta_{K2} - \theta_{K1}\theta_{L2})]} < 0 \tag{8.A.6.1}$$

$$\left(\frac{\widehat{r}}{\widehat{K}}\right) = \left(\frac{\theta_{23}\widehat{P}_2}{|\theta|\,\widehat{K}}\right)(\theta_{C1}\theta_{L2} - \theta_{L1}\theta_{C2}) = -\left(\frac{\theta_{23}}{\theta_{K3}}\right) \underset{(-)(+)}{\left(\frac{1}{D\,|\lambda|}\right)} \underset{(-)}{\left[\frac{\lambda_{L1}\lambda_{C2} - \lambda_{C1}\lambda_{L2}}{(\lambda_{L1} + \lambda_{L2})}\right]} < 0. \tag{8.A.7.1}$$

Subtraction of (8.A.6.1) from (8.A.5.1) shows that

$$\left(\underset{(+)}{\frac{\widehat{W}}{\widehat{K}}} - \underset{(-)}{\frac{\widehat{W}_C}{\widehat{K}}}\right) > 0 \tag{8.A.18}$$

Therefore, from (8.A.5.1), (8.A.6.1), (8.A.7.1) and (8.A.18), one finds that an inflow of foreign capital raises the adult wage rate and lowers both the return to capital and the child wage rate. The (W_C/W) ratio decreases as a consequence.

Using (8.A.17) and (8.A.10.1), (8.A.10.2), (8.A.10.3) and (8.A.10.4) and simplifying from (8.A.14), we find

$$\left(\frac{\widehat{X}_3}{\widehat{K}}\right) = \underset{(-)}{\left[\frac{\lambda_{L3}\,(\lambda_{L1} + \lambda_{L2})\,|\lambda|_{CL}^{12}}{(1 - \lambda_{L3})\,D(|\lambda|)^2}\right]} \underset{(-)}{\left[\frac{(\lambda_{K1} + \lambda_{K2})}{(\lambda_{L1} + \lambda_{L2})} - \frac{\lambda_{K3}}{\lambda_{L3}}\right]} \underset{(-)}{[\lambda_{L1}A_3 - \lambda_{C1}A_1]} \tag{8.A.14.1}$$

> 0 if $A_3 \geq 0$

Note that if technologies of production are of fixed-coefficient type, $S_{ji}^k = 0$. From (8.A.10.1) and (8.A.10.3) it then follows that $A_1 = 0$ and $A_3 > 0$. From (8.A.14.1) it is, therefore, evident that

$$\left(\frac{\widehat{X}_3}{\widehat{K}}\right) > 0$$

So, the formal sector (sector 3) expands following inflows of foreign capital under the sufficient condition that $A_3 \geq 0$. Sector 3 unambiguously expands if the technologies of production are of fixed-coefficient type.

Appendix 8.6: (Model 2) Derivations for Obtaining the Expressions for Changes in Output Composition

Total differential of (8.23) yields

$$\Sigma a_{Li} dX_i = -\Sigma X_i da_{Li}$$

or

$$\Sigma\left(\frac{X_i a_{Li}}{L}\right)\widehat{X}_i = -\left(\frac{X_1}{L}\right)\left\{\left(\frac{\partial a_{L1}}{\partial W}\right)dW + \left(\frac{\partial a_{L1}}{\partial W_C}\right)dW_C + \left(\frac{\partial a_{L1}}{\partial R}\right)dR\right\}$$
$$-\left(\frac{X_2}{L}\right)\left\{\left(\frac{\partial a_{L2}}{\partial W}\right)dW + \left(\frac{\partial a_{L2}}{\partial W_C}\right)dW_C\right\}$$
$$-\left(\frac{X_3}{L}\right)\left\{\left(\frac{\partial a_{L3}}{\partial R}\right)dR\right\} \tag{8.A.19}$$

Using the result that $\widehat{r} = 0$ (see (8.26)) from the above expression, we can write

$$\lambda_{L1}\widehat{X}_1 + \lambda_{L2}\widehat{X}_2 + \lambda_{L3}\widehat{X}_3 = -\left(\lambda_{L1}S_{LL}^1 + \lambda_{L2}S_{LL}^2\right)\widehat{W} - \left(\lambda_{L1}S_{LC}^1 + \lambda_{L2}S_{LC}^2\right)\widehat{W}_C \tag{8.A.20}$$

Substituting the values of $\widehat{W}$ and $\widehat{W}_C$ from (8.27) and (8.28) into (8.A.20) and simplifying, we get the following:

$$\lambda_{L1}\widehat{X}_1 + \lambda_{L2}\widehat{X}_2 + \lambda_{L3}\widehat{X}_3 = -A_1\widehat{P}_2 \tag{8.A.21}$$

where $A_1 = \left[\left(\lambda_{L1}S_{LC}^1 + \lambda_{L2}S_{LC}^2\right)(\theta_{L1} + \theta_{C1}) + \lambda_{L1}S_{LK}^1\theta_{C1}\right]\left(\frac{1}{|\theta|}\right)$

(Note that $S_{LL}^1 + S_{LC}^1 + S_{LK}^1 = 0 \Rightarrow S_{LL}^1 = -(S_{LC}^1 + S_{LK}^1)$ and $S_{LL}^2 + S_{LC}^2 = 0$)

Now differentiating (8.24) we get

$$\lambda_{K1}\widehat{X}_1 + \lambda_{K3}\widehat{X}_3 = \widehat{K} - \lambda_{K1}\left(S_{KL}^1\widehat{W} - S_{KC}^1\widehat{W}_C\right)$$

Substituting the values of $\widehat{W}$ and $\widehat{W}_C$ from (8.27) and (8.28) into the above expression and simplifying, one gets the following:

$$\lambda_{K1}\widehat{X}_1 + \lambda_{K3}\widehat{X}_3 = \widehat{K} + \left(\frac{\lambda_{K1}}{|\theta|}\right)\left[S_{KL}^1\theta_{C1} - S_{KC}^1\theta_{L1}\right]\widehat{P}_2$$

or

$$\lambda_{K1}\widehat{X}_1 + \lambda_{K3}\widehat{X}_3 = \widehat{K} + A_2\widehat{P}_2 \tag{8.A.22}$$

where $A_2 = \left(\frac{\lambda_{K1}}{|\theta|}\right)\left[S^1_{KL}\theta_{C1} - S^1_{KC}\theta_{L1}\right]$

Similarly differentiating Eq. (8.25.1) we get

$$\lambda_{C1}\widehat{X}_1 + \lambda_{C2}\widehat{X}_2 + \left(\frac{\lambda_{L3}}{1-\lambda_{L3}}\right)\widehat{X}_3 = -\left\{\lambda_{C1}S^1_{CL} + \lambda_{C2}S^2_{CL} + G_2\right\}\widehat{W} - \left\{\lambda_{C1}S^1_{CC} + \lambda_{C2}S^2_{CC} - G_1\right\}\widehat{W}_C - G_3\widehat{E} \tag{8.A.23}$$

Substituting the values of $\widehat{W}$ and $\widehat{W}_C$ into (8.A.23) and simplifying, we get the following:

$$\lambda_{C1}\widehat{X}_1 + \lambda_{C2}\widehat{X}_2 + \left(\frac{\lambda_{L3}}{1-\lambda_{L3}}\right)\widehat{X}_3 = \frac{\widehat{P}_2}{|\theta|}\left[\lambda_{C1}S^1_{CL}\left(\theta_{C1} + \theta_{L1}\right) + \lambda_{C2}S^2_{CL}\left(\theta_{C1} + \theta_{L1}\right) + \lambda_{C1}S^1_{CK}\theta_{L1} + G_2\theta_{C1} + G_1\theta_{L1}\right] - G_3\widehat{E}$$

This is rewritten as follows:

$$\lambda_{C1}\widehat{X}_1 + \lambda_{C2}\widehat{X}_2 + \left(\frac{\lambda_{L3}}{1-\lambda_{L3}}\right)\widehat{X}_3 = A_3\widehat{P}_2 - G_3\widehat{E} \tag{8.A.24}$$

where

$$G_1 = \frac{\gamma W_C\left\{W + nB(E)\right\}}{l_C\{W_C - B(E)\}^2} > 0;\quad G_2 = \frac{\gamma W}{l_C\left\{W_C - B(E)\right\}} > 0;$$
$$G_3 = \frac{\gamma B' E\left\{W + nW_C\right\}}{l_C\{W_C - B(E)\}^2} > 0$$

and

$$A_3 = \frac{1}{|\theta|}\left[\lambda_{C1}S^1_{CL}\left(\theta_{C1} + \theta_{L1}\right) + \lambda_{C2}S^2_{CL}\left(\theta_{C1} + \theta_{L1}\right) + \lambda_{C1}S^1_{CK}\theta_{L1} + G_2\theta_{C1} + G_1\theta_{L1}\right]$$

(8.A.21), (8.A.22) and (8.A.24) can be written in a matrix notation as follows:

$$\begin{bmatrix} \lambda_{L1} & \lambda_{L2} & \lambda_{L3} \\ \lambda_{K1} & 0 & \lambda_{K3} \\ \lambda_{C1} & \lambda_{C2} & \left(\frac{\lambda_{L3}}{1-\lambda_{L3}}\right) \end{bmatrix}\begin{bmatrix} \widehat{X}_1 \\ \widehat{X}_2 \\ \widehat{X}_3 \end{bmatrix} = \begin{bmatrix} -A_1\widehat{P}_2 \\ \left(\widehat{K} + A_2\widehat{P}_2\right) \\ \left(A_3\widehat{P}_2 - G_3\widehat{E}\right) \end{bmatrix} \tag{8.A.25}$$

Solving (8.A.25) by Cramer's rule and simplifying, one gets

$$\widehat{X}_1 = \left(\frac{1}{|\lambda|}\right)\left[\lambda_{L3}\left(\lambda_{C2} - \frac{\lambda_{L2}}{1-\lambda_{L3}}\right)\widehat{K} + Z_1\widehat{P}_2 - \lambda_{L2}\lambda_{K3}G_3\widehat{E}\right] \tag{8.29}$$

$$\widehat{X}_2 = \left(\frac{1}{|\lambda|}\right)\left[\lambda_{L3}\left(\frac{\lambda_{L1}}{1-\lambda_{L3}} - \lambda_{C1}\right)\widehat{K} + Z_2\widehat{P}_2 + (\lambda_{L1}\lambda_{K3} - \lambda_{K1}\lambda_{L3})\,G_3\widehat{E}\right] \tag{8.30}$$

and

$$\widehat{X}_3 = \left(\frac{1}{|\lambda|}\right)\left[(\lambda_{L2}\lambda_{C1} - \lambda_{L1}\lambda_{C2})\,\widehat{K} - Z_3\widehat{P}_2 + \lambda_{L2}\lambda_{K1}G_3\widehat{E}\right] \tag{8.31}$$

where

$$\begin{aligned}
Z_1 &= \left[\lambda_{K3}\,(A_1\lambda_{C2} + A_3\lambda_{L2}) + \lambda_{L3}A_2\left(\lambda_{C2} - \frac{\lambda_{L2}}{1-\lambda_{L3}}\right)\right]\\
Z_2 &= \left[A_2\lambda_{L3}\left(\frac{\lambda_{L1}}{1-\lambda_{L3}} - \lambda_{C1}\right) - A_3\,(\lambda_{L1}\lambda_{K3} - \lambda_{K1}\lambda_{L3})\right.\\
&\qquad \left. + A_1\left\{\frac{\lambda_{K1}\lambda_{L3}}{(1-\lambda_{L3})} - \lambda_{K3}\lambda_{C1}\right\}\right] \qquad (8.32.1)\\
|\lambda| &= \lambda_{K3}\,(\lambda_{L2}\lambda_{C1} - \lambda_{L1}\lambda_{C2}) + \left(\frac{\lambda_{K1}\lambda_{L3}}{1-\lambda_{L3}}\right)(\lambda_{C2}\,(1-\lambda_{L3}) - \lambda_{L2})\\
&= (\lambda_{L2}\lambda_{C1} - \lambda_{L1}\lambda_{C2})\left(\frac{\lambda_{K3} - \lambda_{L3}}{1-\lambda_{L3}}\right)
\end{aligned}$$

(see Appendix 8.A.10)
and

$$Z_3 = [-A_2\,(\lambda_{L2}\lambda_{C1} - \lambda_{L1}\lambda_{C2}) + A_3\lambda_{L2}\lambda_{K1} + A_1\lambda_{K1}\lambda_{C2}]$$

Appendix 8.7: (Model 2) Derivation of the Stability Condition in the Market for the Non-traded Final Commodity

Differentiating the demand function for commodity 2 given by Eq. (8.20), we can derive

$$\widehat{X}_2^D = E_{P2}\widehat{P}_2 + E_Y\left(\frac{W^*L\lambda_{L3}}{Y}\right)\widehat{X}_3 - \left(\frac{T}{Y}\right)E_Y\widehat{T} \tag{8.A.26}$$

Substituting $\widehat{X}_3$ from (8.31) and simplifying, one obtains the following:

$$\widehat{X}_2^D = E_{P2}\widehat{P}_2 + \left(\frac{E_Y}{|\lambda|}\right)\left(\frac{W^* L\lambda_{L3}}{Y}\right)\{(\lambda_{L2}\lambda_{C1} - \lambda_{L1}\lambda_{C2})\,\widehat{K}$$
$$-Z_3\widehat{P}_2 + \lambda_{L2}\lambda_{K1}G_3\widehat{E}\Big\} - \left(\frac{T}{Y}\right)E_Y\widehat{T} \tag{8.A.27}$$

Allowing only P_2 to change, while keeping all parameters unchanged, we find that

$$\frac{\widehat{X}_2^D}{\widehat{P}_2} = E_{P2} - \left(\frac{E_Y}{|\lambda|}\right)\left(\frac{W^* L\lambda_{L3}}{Y}\right)Z_3 \tag{8.A.28}$$

Similarly, from Eq. (8.30) one obtains the following:

$$\frac{\widehat{X}_2}{\widehat{P}_2} = \left(\frac{Z_2}{|\lambda|}\right) \tag{8.A.29}$$

For static stability we require that

$$\left(\frac{\widehat{X}_2^D}{\widehat{P}_2} - \frac{\widehat{X}_2}{\widehat{P}_2}\right) = \left[E_{P2} - \left(\frac{E_Y}{|\lambda|}\right)\left(\frac{W^* L\lambda_{L3}}{Y}\right)Z_3 - \left(\frac{Z_2}{|\lambda|}\right)\right] = \Delta < 0 \tag{8.33}$$

Appendix 8.8: (Model 2) Derivation of Eq. (8.34.1)

In equilibrium in the market for commodity 2, we have $\widehat{X}_2^D = \widehat{X}_2$. Now using (8.A.27) and (8.30), we can write

$$E_{P2}\widehat{P}_2 + \left(\frac{E_Y}{|\lambda|}\right)\left(\frac{W^* L\lambda_{L3}}{Y}\right)\left\{(\lambda_{L2}\lambda_{C1} - \lambda_{L1}\lambda_{C2})\,\widehat{K} - Z_3\widehat{P}_2 + \lambda_{L2}\lambda_{K1}G_3\widehat{E}\right\}$$
$$-\left(\frac{T}{Y}\right)E_Y\widehat{T}$$
$$= \left(\frac{1}{|\lambda|}\right)\left[\lambda_{L3}\left(\frac{\lambda_{L1}}{1-\lambda_{L3}} - \lambda_{C1}\right)\widehat{K} + Z_2\widehat{P}_2 + (\lambda_{L1}\lambda_{K3} - \lambda_{K1}\lambda_{L3})\,G_3\widehat{E}\right]$$

or

$$\left[E_{P2}-\left(\frac{E_Y}{|\lambda|}\right)\left(\frac{W^*L\lambda_{L3}}{Y}\right)Z_3-\frac{Z_2}{|\lambda|}\right]\widehat{P}_2$$
$$=\left(\frac{1}{|\lambda|}\right)\left[\lambda_{L3}\left(\frac{\lambda_{L1}}{1-\lambda_{L3}}-\lambda_{C1}\right)-\left(\frac{E_Y W^*L\lambda_{L3}}{Y}\right)(\lambda_{L2}\lambda_{C1}-\lambda_{L1}\lambda_{C2})\right]\widehat{K}$$
$$+\left(\frac{1}{|\lambda|}\right)\left[(\lambda_{L1}\lambda_{K3}-\lambda_{K1}\lambda_{L3})-\left(\frac{E_Y W^*L\lambda_{L3}}{Y}\right)\lambda_{L2}\lambda_{K1}\right]G_3\widehat{E}+\left(\frac{T}{Y}\right)E_Y\widehat{T}$$

Using (8.33) the above expression may be rewritten as follows:

$$\widehat{P}_2 = Q_1\widehat{K} + Q_2\widehat{E} + Q_3\widehat{T} \tag{8.34.1}$$

where

$$\left.\begin{aligned}
Q_1 &= \left(\frac{1}{|\lambda|}\right)\left(\frac{1}{\Delta}\right)\left[\lambda_{L3}\left(\frac{\lambda_{L1}}{1-\lambda_{L3}}-\lambda_{C1}\right)-\left(\frac{E_Y W^*L\lambda_{L3}}{Y}\right)(\lambda_{L2}\lambda_{C1}-\lambda_{L1}\lambda_{C2})\right];\\
Q_2 &= \left(\frac{G_3}{|\lambda|}\right)\left(\frac{1}{\Delta}\right)\left[(\lambda_{L1}\lambda_{K3}-\lambda_{K1}\lambda_{L3})-\left(\frac{E_Y W^*L\lambda_{L3}}{Y}\right)\lambda_{L2}\lambda_{K1}\right];\quad \text{and}\\
Q_3 &= \left(\left(\frac{E_Y}{\Delta}\right)\left(\frac{T}{Y}\right)\right) < 0
\end{aligned}\right\} \tag{8.34.2}$$

Appendix 8.9: (Model 2) Derivation of Eqs. (8.35.1) and (8.35.2)

Differentiating Eq. (8.16) we get

$$\widehat{L}_C = G_1\widehat{W}_C - G_2\widehat{W} - G_3\widehat{E} - \left(\frac{\lambda_{L3}}{1-\lambda_{L3}}\right)\widehat{X}_3 \tag{8.A.30}$$

Substitution of $\widehat{W}$, $\widehat{W}_C$ and $\widehat{X}_3$ from (8.27), (8.28) and (8.31) into (8.A.30) yields

$$\widehat{L}_C = \left(\frac{G_1}{|\theta|}\right)\theta_{L1}\widehat{P}_2 + \left(\frac{G_2}{|\theta|}\right)\theta_{C1}\widehat{P}_2 - G_3\widehat{E}$$
$$-\left(\frac{\lambda_{L3}}{1-\lambda_{L3}}\right)\left(\frac{1}{|\lambda|}\right)\left[(\lambda_{L2}\lambda_{C1}-\lambda_{L1}\lambda_{C2})\widehat{K} - Z_3\widehat{P}_2 + \lambda_{L2}\lambda_{K1}G_3\widehat{E}\right] \tag{8.35.1}$$

Rearranging terms we write

$$\widehat{L}_C = \left[\left(\frac{G_1}{|\theta|}\right)\theta_{L1} + \left(\frac{G_2}{|\theta|}\right)\theta_{C1} + \left(\frac{\lambda_{L3}}{1-\lambda_{L3}}\right)\left(\frac{1}{|\lambda|}\right)Z_3\right]\widehat{P}_2 - \left(\frac{\lambda_{L3}}{1-\lambda_{L3}}\right)\left(\frac{1}{|\lambda|}\right)$$
$$(\lambda_{L2}\lambda_{C1} - \lambda_{L1}\lambda_{C2})\,\widehat{K} - \left\{1 + \left(\frac{\lambda_{L3}}{1-\lambda_{L3}}\right)\left(\frac{1}{|\lambda|}\right)\lambda_{L2}\lambda_{K1}\right\}G_3\widehat{E}$$

Now substituting $\widehat{P}_2$ from (8.34.1) into the above expression, using (8.32.1) and simplifying, one finally gets

$$\widehat{L}_C = \left[(I_{WC} + I_W + I_L)\,Q_1 - \left(\frac{\lambda_{L3}}{\lambda_{K3}-\lambda_{L3}}\right)\right]\widehat{K} + [(I_{WC} + I_W + I_L)\,Q_2$$
$$- \left\{1 + \left(\frac{\lambda_{L3}}{1-\lambda_{L3}}\right)\left(\frac{\lambda_{L2}\lambda_{K1}}{|\lambda|}\right)\right\}G_3\Big]\widehat{E} + [(I_{WC} + I_W + I_L)\,Q_3]\,\widehat{T} \tag{8.35.2}$$

where

$$I_{WC} = \left(\frac{G_1}{|\theta|}\right)\theta_{L1}; \quad I_W = \left(\frac{G_2}{|\theta|}\right)\theta_{C1}; \quad I_L = \left(\frac{\lambda_{L3}}{1-\lambda_{L3}}\right)\left(\frac{1}{|\lambda|}\right)Z_3 \tag{8.36}$$

Appendix 8.10: (Model 2) Effects on Child Labour Incidence Under Alternate Factor Intensity Conditions

In this model, sector 3 has been assumed to be more capital-intensive (in physical sense) vis-à-vis sector 1 with respect to adult labour. This implies the following:

$$\frac{\lambda_{K3}}{\lambda_{L3}} > \frac{\lambda_{K1}}{\lambda_{L1}} \Rightarrow \frac{\lambda_{K3}}{\lambda_{K1}} > \frac{\lambda_{L3}}{\lambda_{L1}} \Rightarrow \frac{1}{\lambda_{K1}} > \frac{(\lambda_{L3}+\lambda_{L1})}{\lambda_{L1}} \Rightarrow \lambda_{L1} > \lambda_{K1}\,(\lambda_{L3}+\lambda_{L1}) \tag{8.A.31}$$

and

$$\frac{\lambda_{L1}}{\lambda_{L3}} > \frac{\lambda_{K1}}{\lambda_{K3}} \Rightarrow \frac{(\lambda_{L1}+\lambda_{L3})}{\lambda_{L3}} > \frac{1}{\lambda_{K3}} \Rightarrow \lambda_{K3} > \frac{\lambda_{L3}}{(\lambda_{L1}+\lambda_{L3})} \Rightarrow \lambda_{K3} > \lambda_{L3} \tag{8.A.32}$$

(Note that $(\lambda_{L1} + \lambda_{L3}) < 1$)

The expression for $|\lambda|$ is as follows:

$$|\lambda| = \lambda_{K3}\,(\lambda_{L2}\lambda_{C1} - \lambda_{L1}\lambda_{C2}) + \left(\frac{\lambda_{K1}\lambda_{L3}}{1-\lambda_{L3}}\right)(\lambda_{C2}\,(1-\lambda_{L3}) - \lambda_{L2}) \tag{8.A.33}$$

Substitution of $(\lambda_{L1} + \lambda_{L2})$ in place of $(1 - \lambda_{L3})$ in (8.A.33) and simplification yield

$$|\lambda| = (\lambda_{L2}\lambda_{C1} - \lambda_{L1}\lambda_{C2})\left(\frac{\lambda_{K3} - \lambda_{L3}}{1 - \lambda_{L3}}\right) \tag{8.32.1}$$

From the stability condition in the market for commodity 2, we have

$$\left[E_{P2} - \left(\frac{E_Y}{|\lambda|}\right)\left(\frac{W^* L\lambda_{L3}}{Y}\right)Z_3 - \left(\frac{Z_2}{|\lambda|}\right)\right] = \Delta < 0 \tag{8.33}$$

As both sectors 1 and 2 use adult labour and child labour as inputs, these together form a *HOSS* given the rental to capital, *R*. So, these sectors can be classified in terms of relative factor intensities.

Case I

We first consider the case where the export sector is more child labour-intensive vis-à-vis the non-traded sector with respect to adult labour. In other words,

$$\left(\frac{a_{C1}}{a_{L1}}\right) > \left(\frac{a_{C2}}{a_{L2}}\right) \Rightarrow \left(\frac{\lambda_{C1}}{\lambda_{L1}}\right) > \left(\frac{\lambda_{C2}}{\lambda_{L2}}\right) \Rightarrow (\lambda_{L2}\lambda_{C1} - \lambda_{L1}\lambda_{C2}) > 0 \tag{8.A.34}$$

In this case, we also have

$$(\theta_{C1}\theta_{L2} > \theta_{C2}\theta_{L1}) \Rightarrow |\theta| = (\theta_{L1}\theta_{C2} - \theta_{C1}\theta_{L2}) < 0 \tag{8.A.35}$$

$$\left.\begin{array}{r} \text{From (8.A.34) we find that } \frac{\lambda_{L2}}{\lambda_{L1}} > \frac{\lambda_{C2}}{\lambda_{C1}} \Rightarrow \frac{(1-\lambda_{L3})}{\lambda_{L1}} > \frac{1}{\lambda_{C1}} \Rightarrow \lambda_{C1} > \frac{\lambda_{L1}}{(1-\lambda_{L3})} \\ \text{Alternatively } \frac{\lambda_{C1}}{\lambda_{C2}} > \frac{\lambda_{L1}}{\lambda_{L2}} \Rightarrow \frac{1}{\lambda_{C2}} > \frac{(1-\lambda_{L3})}{\lambda_{L2}} \Rightarrow \frac{\lambda_{L2}}{(1-\lambda_{L3})} > \lambda_{C2} \end{array}\right\} \tag{8.A.36}$$

Assuming a_{K1} to be technologically given and using (8.33), (8.A.31), (8.A.32) and (8.A.34), (8.A.35) and (8.A.36) from (8.32.1), (8.32.2) and (8.34.2), it is easy to check that

$$\begin{array}{ll} \text{(i)} & |\lambda| > 0; \\ \text{(ii)} & A_1 < 0; \\ \text{(iii)} & A_2 = 0; \\ \text{(iv)} & A_3 < 0; \\ \text{(v)} & Q_1 > 0; \\ \text{(vi)} & Q_2 > 0 \quad \text{if} \quad \left[\lambda_{L1}\lambda_{K3} \le \left(\frac{E_Y W^* L\lambda_{L3}}{Y}\right)\lambda_{L2}\lambda_{K1}\right] \\ \text{(vii)} & Z_1 < 0; \\ \text{(viii)} & Z_3 < 0; \\ \text{(ix)} & I_{WC}, I_W, I_L < 0. \end{array} \tag{8.A.37}$$

With the help of (8.A.37) from (8.29 and 8.34.1), we can get the following results:

$$\left.\begin{array}{ll}\text{(a) } \widehat{X}_1 < 0 & \text{when } \widehat{K} > 0 \\ \text{(b) } \widehat{X}_1 < 0 & \text{when } \widehat{E} > 0 \\ \text{(c) } \widehat{X}_1 < (>)\,0 & \text{when } \widehat{P}_2 > (<)\,0 \\ \text{(d) } \widehat{P}_2 > 0 & \text{when } \widehat{K} > 0 \\ \text{(e) } \widehat{P}_2 > 0 & \text{when } \widehat{E} > 0 \quad \text{if } \left[\lambda_{L1}\lambda_{K3} \leq \left(\frac{E_Y W^* L\lambda_{L3}}{Y}\right)\lambda_{L2}\lambda_{K1}\right] \\ \text{(f) } \widehat{P}_2 < 0 & \text{when } \widehat{T} > 0 \end{array}\right\} \tag{8.A.38}$$

Using (8.A.34), (8.A.36) and (8.A.37) from (8.30) and (8.31), we find that X_2 decreases (increases) while X_3 increases (increases) following an inflow of foreign capital (an education subsidy policy). Besides, an increase in P_2 raises X_3. We use these results while explaining Proposition 8.3 verbally.

Finally, using (8.A.32) and (8.A.37) from Eq. (8.35.2), the following results trivially follow:

(R.1) $\widehat{L}_C < 0$ when $\widehat{K} > 0$.
(R.2) $\widehat{L}_C < 0$ when $\widehat{E} > 0$ if $Q_2 \geq 0$ i.e. if $[\lambda_{L1}\lambda_{K3} \leq (E_Y W^* L\lambda_{L3}/Y)\lambda_{L2}\lambda_{K1}]$.
(R.3) $\widehat{L}_C > 0$ when $\widehat{T} > 0$.

Note that, in (R.2), $[\lambda_{L1}\lambda_{K3} \leq (E_Y W^* L\lambda_{L3}/Y)\lambda_{L2}\lambda_{K1}]$ is only a sufficient condition for L_C to fall following an education subsidy policy.

Case II

Let us now consider the case where sector 2 is more child labour-intensive relative to sector 1 with respect to adult labour. This implies the case where

$$\left(\frac{a_{C1}}{a_{L1}}\right) < \left(\frac{a_{C2}}{a_{L2}}\right) \Rightarrow \left(\frac{\lambda_{C1}}{\lambda_{L1}}\right) < \left(\frac{\lambda_{C2}}{\lambda_{L2}}\right) \tag{8.A.39}$$

In this case, we find that

$$\left.\begin{array}{l}(\theta_{C1}\theta_{L2} < \theta_{C2}\theta_{L1}) \Rightarrow |\theta| = (\theta_{L1}\theta_{C2} - \theta_{C1}\theta_{L2}) > 0 \\ \frac{\lambda_{L2}}{\lambda_{L1}} < \frac{\lambda_{C2}}{\lambda_{C1}} \Rightarrow \frac{(1-\lambda_{L3})}{\lambda_{L1}} < \frac{1}{\lambda_{C1}} \Rightarrow \lambda_{C1} < \frac{\lambda_{L1}}{(1-\lambda_{L3})} \\ \frac{\lambda_{C1}}{\lambda_{C2}} < \frac{\lambda_{L1}}{\lambda_{L2}} \Rightarrow \frac{1}{\lambda_{C2}} < \frac{(1-\lambda_{L3})}{\lambda_{L2}} \Rightarrow \lambda_{C2} > \frac{\lambda_{L2}}{(1-\lambda_{L3})} \\ |\lambda| < 0 \\ A_1 > 0 \\ A_2 = 0 \text{ (assuming } a_{K1} \text{ to be given technologically)} \\ A_3 > 0 \\ Q_1 > 0 \\ Q_2 < 0 \text{ if } \left[\lambda_{L1}\lambda_{K3} \leq \left(\frac{E_Y W^* L\lambda_{L3}}{Y}\right)\lambda_{L2}\lambda_{K1}\right] \\ Z_1 > 0 \\ Z_3 > 0 \\ I_{WC}, I_W > 0; I_L < 0 \end{array}\right\} \tag{8.A.40}$$

Using (8.A.40) from (8.29) and (8.34.1), the following results follow:

$$\left.\begin{array}{lll}
\text{(a) } \widehat{X}_1 < 0 & \text{when } \widehat{K} > 0 & \\
\text{(b) } \widehat{X}_1 > 0 & \text{when } \widehat{E} > 0 & \\
\text{(c) } \widehat{X}_1 < (>)\, 0 & \text{when } \widehat{P}_2 > (<)\, 0 & \\
\text{(d) } \widehat{P}_2 > 0 & \text{when } \widehat{K} > 0 & \\
\text{(e) } \widehat{P}_2 < 0 & \text{when } \widehat{E} > 0 & \text{if } \left[\lambda_{L1}\lambda_{K3} \le \left(\frac{E_Y W^* L \lambda_{L3}}{Y}\right)\lambda_{L2}\lambda_{K1}\right] \\
\text{(f) } \widehat{P}_2 < 0 & \text{when } \widehat{T} > 0 &
\end{array}\right\} \quad (8.A.41)$$

Using (8.A.39) and (8.A.40) from (8.30) and (8.31), we find that X_2 decreases (increases) while X_3 increases (decreases) following an inflow of foreign capital (an education subsidy policy). Besides, an increase in P_2 raises X_3. These results are useful in explaining proposition 8.4 intuitively.

Using (8.A.32) and (8.A.41) from (8.35.2), it is easy to derive the following results:

$$\text{(R.4)} \quad \widehat{L}_C > 0 \text{ when } \widehat{K} > 0 \text{ if } \left[(I_{WC} + I_L)\, Q_1 \ge \left(\frac{\lambda_{L3}}{\lambda_{K3} - \lambda_{L3}}\right)\right]$$

$$\text{or if } \left[(I_W + I_L)\, Q_1 \ge \left(\frac{\lambda_{L3}}{\lambda_{K3} - \lambda_{L3}}\right)\right].$$

$$\text{(R.5)} \quad \widehat{L}_C < 0 \text{ when } \widehat{E} > 0 \text{ if (i) } \left(\lambda_{L1}\lambda_{K3} \le \frac{\lambda_{L3}\lambda_{L2}\lambda_{K1}E_Y W^* L}{Y}\right)$$

$$\text{and, (ii) } \left[(I_{WC} + I_W + I_L)\, Q_2 \le \frac{\lambda_{L3}\lambda_{L2}\lambda_{K1}G_3}{(1 - \lambda_{L3})\,|\lambda|}\right].$$

$$\text{(R.6)} \quad \widehat{L}_C < 0 \text{ when } \widehat{T} > 0 \text{ if } (I_{WC} + I_L)\, Q_3 \le 0$$

$$\text{or, if } (I_W + I_L)\, Q_3 \le 0.$$

Appendix 8.11: (Model 3) Derivations for Obtaining Expressions for Effects of FDI on Child Wage, Skilled and Unskilled Wages and Inequality Thereof

Totally differentiating Eqs. (8.42), (8.43.1) and (8.44) and using envelope conditions, the following expressions are obtained:

$$\theta_{L1}\widehat{W} + \theta_{C1}\widehat{W}_C + \theta_{K1}\widehat{R} = 0 \quad (8.A.42)$$

$$\theta_{L2}E_W\widehat{W} + \theta_{K2}\widehat{R} = 0 \quad (8.A.43)$$

$$\theta_{S3}\widehat{W}_S + \theta_{K3}\widehat{R} = 0 \quad (8.A.44)$$

Totally differentiating Eqs. (8.45.1), (8.46), (8.47) and (8.49), collecting terms and simplifying, we get the following expressions:

$$\overline{S}_{LL}\widehat{W} + \lambda_{L1}S^{1}_{LC}\widehat{W}_C + \overline{S}_{LK}\widehat{R} + \lambda_{L1}\widehat{X}_1 + \lambda_{L2}\widehat{X}_2 = 0 \tag{8.A.45}$$

$$\overline{S}_{KL}\widehat{W} + A_2\widehat{R} + A_1\widehat{W}_S + \lambda_{K1}\widehat{X}_1 + \lambda_{K2}\widehat{X}_2 = \widehat{K} \tag{8.A.46}$$

$$\left(S^{1}_{CL} + E\right)\widehat{W} + \left(S^{1}_{CC} - F\right)\widehat{W}_C + G\widehat{W}_S + \widehat{X}_1 = 0 \tag{8.A.47}$$

(Note that we have used $\widehat{X}_3 = -S^{3}_{SS}\widehat{W}_S - S^{3}_{SR}\widehat{R}$ from (8.47)).
where

$$\left.\begin{array}{l}
\overline{S}_{LL} = \left[\lambda^{*}_{L2}\left\{(E_W - 1) + S^{2}_{LL}\right\} + \left(\lambda_{L1}S^{1}_{LL}\right)\right] < 0; \overline{S}_{LK} = \lambda^{*}_{L2}S^{2}_{LK} > 0 \\
\overline{S}_{KK} = \left(\lambda_{K2}S^{2}_{KK} + \lambda_{K3}S^{3}_{KK}\right) < 0; \overline{S}_{KL} = \lambda_{K2}S^{2}_{KL} > 0; \\
A_1 = \lambda_{K3}\left(S^{3}_{SK} + S^{3}_{KS}\right) > 0 \\
A_2 = \left(\overline{S}_{KK} - \lambda_{K3}S^{3}_{SK}\right) < 0; \lambda^{*}_{L2} = \frac{W^{*}}{W}\lambda_{L2} > 0 \\
A = \frac{W_S.W}{(1+\beta)L_C(W_S - W)^2} > 0; B = \frac{\beta}{(1+\beta)L_C W_C} > 0 \\
E = (-nA\,(L + S) + BLW)\,; F = B\,(LW + SW_S) > 0; \\
G = [nA\,(L + S) + BSW_S] > 0
\end{array}\right\} \tag{8.A.48}$$

S^{k}_{ji} = the degree of substitution between factors $j$and i in the kth sector, $j, i = L, S, L_C, K$ and $k = 1, 2, 3$. $S^{k}_{ji} > 0$ for $j \neq i$; $S^{k}_{jj} < 0$; and λ_{ji} = proportion of the jth input employed in the ith sector.

Arranging (8.A.42), (8.A.43), (8.A.44), (8.A.45), (8.A.46), (8.A.47) in the matrix notation, we get the following:

$$\begin{bmatrix}
\theta_{L1} & \theta_{C1} & \theta_{K1} & 0 & 0 & 0 \\
\theta_{L2}E_W & 0 & \theta_{K2} & 0 & 0 & 0 \\
0 & 0 & \theta_{K3} & \theta_{S3} & 0 & 0 \\
\overline{S}_{LL} & \lambda_{L1}S^{1}_{LC} & \overline{S}_{LK} & 0 & \lambda_{L1} & \lambda^{*}_{L2} \\
\overline{S}_{KL} & 0 & A_2 & A_1 & \lambda_{K1} & \lambda_{K2} \\
\left(S^{1}_{CL} + E\right) & \left(S^{1}_{CC} - F\right) & 0 & G & 1 & 0
\end{bmatrix}
\begin{bmatrix}
\widehat{W} \\ \widehat{W}_C \\ \widehat{R} \\ \widehat{W}_S \\ \widehat{X}_1 \\ \widehat{X}_2
\end{bmatrix}
=
\begin{bmatrix}
0 \\ 0 \\ 0 \\ 0 \\ \widehat{K} \\ 0
\end{bmatrix} \tag{8.A.49}$$

Solving (8.A.49) by Cramer's rule the following expressions are obtained:

$$\widehat{W} = -\left(\frac{\theta_{S3}\theta_{C1}\theta_{K2}\lambda^{*}_{L2}}{\Delta}\right)\widehat{K} \tag{8.A.50}$$

$$\widehat{W}_C = \left(\frac{\theta_{S3}\,|\theta|\,\lambda^*_{L2}}{\Delta}\right)\widehat{K} \tag{8.A.51}$$

$$\widehat{R} = \left(\frac{\theta_{S3}\theta_{C1}E_W\theta_{L2}\lambda^*_{L2}}{\Delta}\right)\widehat{K} \tag{8.A.52}$$

$$\widehat{W}_S = -\left(\frac{\theta_{K3}\theta_{C1}E_W\theta_{L2}\lambda^*_{L2}}{\Delta}\right)\widehat{K} \tag{8.A.53}$$

$$\left(\widehat{W}_S - \widehat{W}\right) = -\left(\frac{\theta_{C1}\lambda^*_{L2}\left(\theta_{L2}E_W\theta_{K3} - \theta_{S3}\theta_{K2}\right)}{\Delta}\right)\widehat{K} \tag{8.A.54}$$

$$\begin{aligned}\widehat{X}_2 = \left(\tfrac{\widehat{K}}{\Delta}\right)&\left[-\theta_{S3}\lambda_{L1}\,|\theta|\left\{S^1_{LC} - \left(S^1_{CC} - F\right)\right\} - \theta_{L2}\theta_{C1}E_W\left(\theta_{K3}\lambda_{L1}G + \theta_{S3}\overline{S}_{LK}\right)\right.\\ &\left.+\theta_{C1}\theta_{K2}\theta_{S3}\left\{\overline{S}_{LL} - \lambda_{L1}\left(S^1_{CL} + E\right)\right\}\right]\end{aligned} \tag{8.A.55}$$

where

$$\begin{aligned}\Delta = &-\theta_{K3}\theta_{C1}E_W\theta_{L2}\left\{BSW_S\,|\lambda| + A_1\lambda^*_{L2}\right\} - \theta_{S3}\theta_{C1}\theta_{L2}E_W\left(\overline{S}_{LK}\lambda_{K2} - A_2\lambda^*_{L2}\right)\\ &+\theta_{S3}\,|\theta|\left\{\left(S^1_{CC} - F\right)|\lambda| - \lambda_{K2}\lambda_{L1}S^1_{LC}\right\} - \theta_{S3}\theta_{C1}\theta_{K2}\left\{\left(S^1_{CL} + BLW\right)\right.\\ &\left.|\lambda| - \left(\lambda_{K2}\overline{S}_{LL} - \lambda^*_{L2}\overline{S}_{KL}\right)\right\}\\ &+nA\,(L+S)\,\theta_{C1}\,|\lambda|\,(\theta_{K2} - \theta_{K3})\end{aligned} \tag{8.A.56}$$

$$\left.\begin{aligned}|\lambda|_{LK} &= \left(\lambda_{L1}\lambda_{K2} - \lambda_{K1}\lambda^*_{L2}\right) > 0 \quad \text{and}\\ |\theta|_{LK} &= \left(\theta_{L1}\theta_{K2} - \theta_{K1}E_W\theta_{L2}\right) > 0\end{aligned}\right\} \tag{8.A.57}$$

(Note that $|\lambda|, |\theta| > 0$ as sector 2 is more capital-intensive than sector 1 with respect to adult unskilled labour.)

Using (8.A.48) and (8.A.57) from (8.A.56), it follows that

$$\Delta < 0 \quad \text{if } \theta_{K3}E_W\theta_{L2} > \theta_{K2}\theta_{S3} \tag{8.A.58}$$

However, $\theta_{K3}E_W\theta_{L2} > \theta_{K2}\theta_{S3}$ is only a sufficient condition for Δ to be negative.

Using (8.A.48), (8.A.56) and (8.A.57) from (8.A.50), (8.A.51), (8.A.52), (8.A.53), (8.A.54) and (8.A.55), we can obtain the following results:

$$\left.\begin{array}{l}\text{(i)}\ \ \widehat{W} > 0 \text{ when } \widehat{K} > 0\\ \text{(ii)}\ \ \widehat{W}_C < 0 \text{ when } \widehat{K} > 0\\ \text{(iii)}\ \ \widehat{R} < 0 \text{ when } \widehat{K} > 0\\ \text{(iv)}\ \ \widehat{W}_S > 0 \text{ when } \widehat{K} > 0\\ \text{(v)}\ \ \left(\widehat{W}_S - \widehat{W}\right) > 0 \text{ when } \widehat{K} > 0 \quad \text{iff } \theta_{K3}E_W\theta_{L2} > \theta_{K2}\theta_{S3}\\ \text{(vi)}\ \ \widehat{X}_2 > 0 \text{ when } \widehat{K} > 0\end{array}\right\} \tag{8.A.59}$$

Appendix 8.12: (Model 3) Effects of FDI on Incidence on Child Labour

We use Eq. (8.51) to examine the impact of foreign capital inflow on the incidence of child labour in the economy. Totally differentiating Eq. (8.51) we get

$$\widehat{L}_C = -nA(L+S)\left(\widehat{W}_S - \widehat{W}\right) - LBW\widehat{W} - SBW_S\widehat{W}_S + B\widehat{W}_C(W_S S + LW) \tag{8.A.60}$$

Using (8.A.50), (8.A.51), (8.A.52), (8.A.53) and (8.A.54), the expression (8.A.60) may be rewritten as follows:

$$\widehat{L}_C = \left(\frac{1}{\Delta}\right)\left[nA(L+S)\theta_{C1}\lambda^*_{L2}(\theta_{K3}E_W\theta_{L2} - \theta_{S3}\theta_{K2}) + LBW\theta_{S3}\theta_{C1}\theta_{K2}\lambda^*_{L2}\right.$$
$$\left. + SBW_S\theta_{K3}\theta_{C1}\theta_{L2}\lambda^*_{L2} + B(SW_S + LW)\theta_{S3}|\theta|\lambda^*_{L2}\right]\widehat{K} \tag{8.A.61}$$

From (8.A.61) we find that

$\widehat{L}_C < 0$ when $\widehat{K} > 0$ if $\theta_{K3}E_W\theta_{L2} > \theta_{S3}\theta_{K2}$

So, the incidence of child labour decreases following inflows of foreign capital under the sufficient condition: $\theta_{K3}E_W\theta_{L2} > \theta_{S3}\theta_{K2}$. This implies that sector 3 is capital-intensive relative to sector 2. However, this result may hold under other sufficient conditions as well.

Appendix 8.13: (Model 3) Effects of FDI on Unemployment of Unskilled Labour

Differentiating (8.52) one gets

$$\left(\frac{\widehat{L}_U}{\widehat{K}}\right) = \left(\frac{\widehat{X}_2}{\widehat{K}}\right) - \left[S^2_{LK}E_W + \left(\frac{\lambda_{L2} + \lambda_{LU}}{\lambda_{LU}}\right)(1 - E_W)\right]\left(\frac{\widehat{W}}{\widehat{K}}\right) + S^2_{LK}\left(\frac{\widehat{R}}{\widehat{K}}\right) \tag{8.A.62}$$

Using (8.A.50), (8.A.52) and (8.A.55) and simplifying from the above equation, we obtain

$$\left(\frac{\widehat{L}_U}{\widehat{K}}\right) = \left(\frac{1}{\Delta}\right)\left[\left[\theta_{S3}\left\{\theta_{C1}\theta_{K2}\left(\overline{S}_{LL} - \lambda_{L1}S^1_{CL}\right) - \lambda_{L1}|\theta|\left(S^1_{LC} + S^1_{CL} + F\right)\right\}\right.\right.$$
$$\left. - nA(L+S)\theta_{C1}\lambda_{L1}(\theta_{K3}E_W\theta_{L2} - \theta_{S3}\theta_{K2})\right]$$

$$-\left(\frac{\theta_{C1}\theta_{K2}\theta_{S3}}{\Delta}\right)\left[\lambda_{L1}B\left(\frac{\theta_{L2}E_W\theta_{K3}SW_S}{\theta_{K2}\theta_{S3}}+WL\right)\right.$$
$$\left.-\lambda_{L2}^*\left\{E_WS_{LK}^2+\left(\frac{\lambda_{L2}+\lambda_{LU}}{\lambda_{LU}}\right)(1-E_W)\right\}\right] \tag{8.A.63}$$

$$\left(\frac{\widehat{L}_U}{\widehat{K}}\right)>0 \text{ if } \left[\frac{\lambda_{L1}}{\lambda_{L2}^*}B\left(\frac{\theta_{L2}E_W\theta_{K3}SW_S}{\theta_{K2}\theta_{S3}}+WL\right)\right.$$
$$\left.\geq\left\{E_WS_{LK}^2+\left(\frac{\lambda_{L2}+\lambda_{LU}}{\lambda_{LU}}\right)(1-E_W)\right\}\right] \tag{8.A.64}$$

Appendix 8.14: (Model 3) Effects of FDI on the Welfare of the Child Labour-Supplying Families

Differentiation of Eq. (8.37) yields

$$dV=\widehat{C}_1+\beta\widehat{C}_2 \tag{8.A.65}$$

Substituting the expression for l_C from (8.41) into (8.38) and (8.39) and simplifying, one gets

$$C_1=\left[\frac{W(W_S-W)+nW_CW_S}{(1+\beta)(W_S-W)}\right] \quad \text{and} \tag{8.A.66}$$

$$C_2=\beta\left[\frac{W(W_S-W)+nW_CW_S}{(1+\beta)W_C}\right] \tag{8.A.67}$$

Differentiating (8.A.66) and (8.A.67) we, respectively, find

$$\widehat{C}_1=$$
$$\left[\frac{(W_S-W)\left[W(W_S-W)^2\widehat{W}+nW_CW_S\left\{(W_S-W)\widehat{W}_C-W\left(\widehat{W}_S-\widehat{W}\right)\right\}\right]}{[W(W_S-W)+nW_CW_S]}\right. \quad \text{and} \tag{8.A.68}$$

$$\widehat{C}_2=\left[\frac{W_C\left[nW_S\widehat{W}_S+\left(\frac{W}{W_C}\right)\left\{W_S\widehat{W}_S+\widehat{W}(W_S-2W)-(W_S-W)\widehat{W}_C\right\}\right]}{[W(W_S-W)+nW_CW_S]}\right. \tag{8.A.69}$$

Substitution of the expressions for $\widehat{C}_1$ and $\widehat{C}_2$ into (8.A.65) and simplification produce

$$dV = \left[\frac{1}{[W(W_S - W) + nW_C W_S]}\right]\left[W(W_S - W)\widehat{W}\left\{(W_S - W)^2 + nW_C W_S + \beta\right\}\right.$$
$$+ \beta W\left(W_S\widehat{W}_S - W\widehat{W}\right)$$
$$\left. + (W_S - W)\widehat{W}_C\{nW_C W_S(W_S - W) - \beta W\} + nW_C W_S\widehat{W}_S\{\beta - W(W_S - W)\}\right]$$

or

$$\left(\frac{dV}{dK}\right) = \underset{(+)}{\left[\frac{1}{[W(W_S - W) + nW_C W_S]}\right]}\left[(W_S - W)\underset{(+)}{\left(\frac{dW}{dK}\right)}\underset{(+)}{\left\{(W_S - W)^2 + nW_C W_S + \beta\right\}}\right.$$
$$+\beta W\underset{(+)}{\left\{\left(\frac{dW_S}{dK}\right) - \left(\frac{dW}{dK}\right)\right\}}$$
$$\left. + (W_S - W)\underset{(-)}{\left(\frac{dW_C}{dK}\right)}\left\{nW_S(W_S - W) - \beta\frac{W}{W_C}\right\} + nW_C\underset{(+)}{\left(\frac{dW_S}{dK}\right)}\{\beta - W(W_S - W)\}\right] \tag{8.A.70}$$

From (8.A.70) it follows that

$$\left(\frac{dV}{dK}\right) > 0 \quad \text{if } \beta W \geq nW_C W_S(W_S - W) \tag{8.A.71}$$

As $n \geq 1$, $W_S > W$ and $W_C < W$, from (8.A.71), it follows that

$$\left(\frac{dV}{dK}\right) > 0 \quad \text{if } \beta \geq nW_S(W_S - W) \tag{8.A.72}$$

However, from (8.A.70) it is easily seen that $\beta \geq nW_S(W_S - W)$ is only a sufficient condition for $(dV/dK) > 0$. One can find out several other sufficient conditions under which $(dV/dK) > 0$.

References

Ashagrie K (1998) 'Statistics on child labor and hazardous child labor in brief', mimeo. Bureau of Labor Statistics, ILO, Geneva

Baland J, Robinson JA (2000) Is child labour inefficient? J Polit Econ 108(4):663–679

Basu K (1999) Child labour: cause, consequence, and cure, with remarks on international labour standards. J Econ Lit 37(3):1083–1119

Basu K (2000) The intriguing relationship between adult minimum wage and child labour. Econ J 110(462):C50–C61

Basu K, Van PH (1998) The economics of child labour. Am Econ Rev 88(3):412–427
Becker GS (1964) Human capital: a theoretical and empirical analysis, with special reference to education. University of Chicago Press, Chicago
Bhalotra S (2002) The impact of economic liberalization on employment and wages in India. ILO, Geneva
Bonnet M (1993) Child labour in Africa. Int Labour Rev 132:371–389
Bose AN (1978) Calcutta and rural Bengal: small sector symbiosis. Minerva Publications, New Delhi
Burra N (1997) Born to work: child labour in India. Oxford University Press, Delhi
Chandra V, Khan MA (1993) Foreign investment in the presence of an informal sector. Economica 60:79–103
Chaudhuri S (2011) Foreign direct investment, child labour and unemployment of unskilled labour in a dual economy. In: India macroeconomics annual, 2010
Chaudhuri S, Dwibedi JK (2006) Trade liberalization in agriculture in developed nations and incidence of child labour in a developing economy (with J.K. Dwibedi). Bull Econ Res 58(2):129–150
Chaudhuri S, Dwibedi JK (2007) Foreign capital inflow, fiscal policies and the incidence of child labour in a developing economy. Manch Sch 75(1):17–46
Chaudhuri S, Gupta MR (2004) Child labour and trade liberalization in a developing economy. Jap Econ Rev 55(2):201–211
Cigno A, Rosati FC, Guarcello L (2002) Does globalisation increase child labour? World Dev 30(9):1579–1589
Dasgupta B (1977) Agrarian change and the new technology in India. United Nation Research Institute for Social Development, Geneva
Dwibedi JK, Chaudhuri S (2010) Foreign capital, return to education and child labour. Int Rev Econ Financ 19(2):278–286
Grinols EL (1991) Unemployment and foreign capital: the relative opportunity cost of domestic labour and welfare. Economica 57:107–121
Gupta MR (1997) Foreign capital and informal sector: comments on Chandra and Khan. Economica 64:353–363
Harris JR, Todaro MP (1970) Migration, unemployment and development: a two-sector analysis. Am Econ Rev 60:126–142
ILO (2002). A future without child labour?. International labour conference, 90th session June 2002, International Labour Office, Geneva
Jafarey S, Lahiri S (2002) Will trade sanctions reduce child labour? The role of credit markets. J Dev Econ 68(1):137–156
Jones RW, Neary P (1984) Positive theory of international trade. In: Jones RW, Kenen PB (eds) Handbook of development economics, vol 1. North-Holland, Amsterdam
Joshi H, Joshi V (1976) Surplus labour and the city: a study of Bombay. Oxford University Press, New Delhi
Levison D, Anker R, Ashraf S, Barge S (1998) Is child labor really necessary in India's carpet industry. In: Anker R, Barge S, Rajagopal S, Joseph MP (eds) Economics of child labor in hazardous industries in India. Hindustan Publishers, New Delhi
Neumayer E, Soysa I (2005) Trade openness, foreign direct investment and child labour. World Dev 33(1):43–63
NSSO (2000) Report of the Second National Commission on Labour. Ministry of Labour and Employment, Government of India, New Delhi
NSSO (2006) Employment and unemployment situation in India 2004–2005. Government of India, Ministry of Statistics and Programme Implementation, New Delhi
Papola TS (1981) Urban informal sector in a developing economy. Vikash Publishing House, New Delhi
Ranjan P (1999) An economic analysis of child labour. Econ Lett 64:99–105
Ranjan P (2001) Credit constraints and the phenomenon of child labour. J Dev Econ 64:81–102
Romatet E (1983) Calcutta's informal sector: theory and reality. Econ Pol Wkly 18(50):2115–2128

Swaminathan M (1998) Economic growth and the persistence of child labour: evidence from an Indian city. World Dev 26(8):1513–1528

UNCTAD (2008) World investment report: transnational corporations and the infrastructure challenge. United Nations, New York/Geneva

UNCTAD (2013) The world investment report: global value chains: investment and trade for development. United Nations, New York

Weiner M (1991) The child and the state in India: child labor and education policy in comparative perspective. Oxford University Press, Delhi

World Development Report (1995) Oxford University Press/The World Bank, New York

Chapter 9
FDI in Healthcare

9.1 Introduction

The healthcare sector has historically been publicly funded in developing countries due to commitments of governments to provide universal access to health services at low cost.[1] However, the public provision of health services considerably lags behind in these countries.[2] The public health sector is plagued by inefficiencies and lack of physical infrastructure, triggering the emergence of private participation in the provision of healthcare. For example, the private sector accounts for around 80 % of healthcare delivery in India. An estimated 60 % of hospitals, 75 % of dispensaries and 80 % of all qualified doctors are in the private sector (Chanda 2008).

In the post-reform period, the healthcare sector in the developing countries has been undergoing a transition phase due to two reasons: enhancement in affordability for health expenses leading to higher demand and the GATS commitment dissuading the existence of public health services by driving them to open up their service sectors to international trade. The growing potential of the sector coupled with the boost in privatization of the sector and the huge infrastructure needs make investment in the healthcare sector a highly lucrative venture and have resulted in increased foreign players entering the market.[3]

[1]The consumption of healthcare services creates externalities by raising the efficiency of labour. So, its free market provision is not optimal. That is why there should be a consumption subsidy keeping in view the perspective of social welfare.

[2]According to the recently released National Health Accounts (NHA) statistics in India, public health expenditure as a share of GDP increased from 0.96 % in 2004–2005 to just 1.01 % in 2008–2009 as compared to 5 % for high-income countries (Chanda 2002).

[3]However, there are important constraints like high cost involved in setting up hospitals, long gestation period and the relatively low returns on investment that may dissuade foreign investment in healthcare sector. Outreville (2007) identifies some of the determinants of foreign investment of the largest MNCs operating in the healthcare industry.

S. Chaudhuri and U. Mukhopadhyay, *Foreign Direct Investment in Developing Countries: A Theoretical Evaluation*, DOI 10.1007/978-81-322-1898-2_9, © Springer India 2014

Evidence on the changing pattern and extent of foreign direct investment (FDI) in healthcare is erratic since it is difficult to distinguish healthcare investment from other service sector FDI (Fujita 2002). However, some anecdotal evidences suggest rising investment (Chanda 2002). The increase in substantial investment from Europe and the United States into middle-income countries in Latin America, Asia and higher-income transition countries (Waitzkin and Iriart 2001; Fujita 2002) and the emergence of Asian-based MNCs such as Singapore-based Parkway (Lethbridge 2002) are indicative of the augmented role of cross-country investment in healthcare. In India, reportedly at least 20 international players are competing for a share in the hospitals and medical devices segment; about 90 % of the demand in the high-tech medical devices segment accounting for $770 million is met by imports from the United States, Japan and Germany (Chanda 2008).

However, empirical evidence on the likely impact of FDI in health service is virtually non-existent. Most of the literature is analytical in nature, with an apparent polarization of views for and against FDI in the sector.[4] The proponents of liberalization in healthcare assert that FDI provides an impetus to increase physical capacity and infrastructure development such as bed strength, number of speciality and super speciality centres and number of diagnostic centres. It acts as a catalyst in raising the standards and quality of healthcare, in spreading the impact of technological change on drugs and medical technology through market integration and in creating employment opportunities benefiting the health sector and the economy at large (Mackintosh 2003).

On the other hand, it is argued that the opening up of health service to the international market will affect the universal rights of people to public services like health. The use of commercial and business practices in the healthcare sector makes it vulnerable to being considered a business activity and so liable to open its services to competition (Lethbridge 2002). The presence of foreign commercial firms with higher levels of pay and equipments may persuade personnel away from public facilities leading to an 'internal' brain drain (WHO 2002; Mehmet 2002). Liberalization of health provision, by allowing the better off to choose the private sector, may release public sector resources for the poor on the one hand and engender a 'two-tier' system, with high-quality care for the rich and poor quality for the poor (Pollock and Price 2000) on the other, reinforcing polarization and stratification.

The impact of FDI depends on the structure of the healthcare market, that is, whether it is 'commercial'[5] or not (White and Collyer 1998); the regulatory environment in healthcare (Lipson 2001a, b) like standards of healthcare, establishments,

[4] See Smith (2004) for a detailed review of literature.

[5] 'Commercialization' of healthcare refers to the increasing provision of healthcare services through market relationships to those able to pay; the associated investment in and production of those services for the purpose of cash income or profit; an increase in the extent to which healthcare finance is derived from payment systems based in individual payment or private insurance (Mackintosh 2003).

professional accreditation and mutual recognition, cross-subsidization policies and pro-poor regulations; and the status of the health sector in neighbouring countries, since it may also provide opportunities for more regional trade in health services via FDI, as evident from the provision of hospital services across countries in South East Asia (Chanda 2002; Janjararoen and Supakankunti 2002).

In this chapter, we formally investigate the effects of FDI in the healthcare sector on the welfare and human capital stock of an economy in terms of a three-sector, three-factor, full-employment general equilibrium model reasonable for a small open developing economy. The healthcare sector is depicted as a non-traded sector that produces a final good (services) the consumption of which directly raises the efficiency of the workers. The greater the size of the healthcare sector, the more and better the medical facilities available to the members of the population, which in turn produces positive effects on workers' general health and productivity.[6] There are two types of capital: capital of type K and capital of type N. While capital of type K is used in production of all the sectors of the economy, capital of type N is specific to the healthcare sector. The possibility of welfare improvement through FDI has been explored in the backdrop of a developing economy where there are tariff and labour market distortions. The consequence of FDI on the human capital formation has also been studied.

The results of the analysis indicate that although FDI of capital of type N raises the human capital endowment of the economy, it may adversely affect social welfare under reasonable conditions. This indicates the possibility of a trade-off between the twin economic objectives of the government in a developing economy: maintaining high rate of economic growth and expediting human capital formation. On the contrary, an inflow of foreign capital of type K is likely to be welfare improving in the presence of a certain degree of labour market distortion. Although these effects crucially hinge on institutional and technological characteristics and the trade pattern of the country in question, they can at least question the desirability of allowing entry of foreign capital in the healthcare sector that generates externalities. Moreover, these results have important policy implications for an overpopulated developing economy like India with subsidized but inadequate medical facilities.

9.2 The Model

We consider a small open developing economy consisting of three sectors: sector 1, sector 2 and sector G. Sector 1 produces an agricultural commodity (X_1) with labour (L) and capital of type K. Sector 2 produces a manufacturing commodity (X_2) by

---

[6] It is not unreasonable to assume that the average efficiency of the workers depends on their health conditions. This is particularly true in the developing countries, where dearth of adequate medical facilities and infrastructure impinges severely on the health of workers, leading to deterioration in their efficiency or productivity. Therefore, an expansion in the healthcare sector is expected to raise their efficiency.

means of labour and capital of type K. Finally, sector G is the non-traded healthcare sector that uses labour and two types of capital, K and N, to provide health services, X_G.[7] It is assumed that sector 1 is the export sector, sector 2 is the import-competing sector and G is the service sector producing 'healthcare' that is non-traded and consumed domestically.[8] The import-competing sector (sector 2) is protected by an import tariff.[9] Workers in the agricultural sector earn the competitive wage, W, while the wage rate in the manufacturing sector and the non-traded sector is W^*, which is institutionally determined, and $W^* > W$. Both W and W^* are the wage rates per efficiency unit of labour. The labour allocation mechanism is as follows. Workers first compete for getting jobs in sector 2 and sector G where the wage rate is high due to institutional reasons. But those who cannot get employment in those two sectors are automatically absorbed in sector 1 providing the competitive and low wage. So there exists labour market distortion.[10] Due to the assumption of a small open economy, prices of commodity 1 and commodity 2 are internationally given. Since commodity (services) G is internationally non-traded, its price is determined domestically by demand and supply forces. Both labour and capital of type K are perfectly mobile between all the sectors of the economy. Capital of type N is specific to healthcare sector (sector G) and is entirely owned by foreign capitalists[11] so that the return from it is fully repatriated. The endowments of the three primary inputs in the economy are L, K and N, respectively. All the factors of production are fully employed. Production functions in sector 1 and sector 2 exhibit constant returns

[7]Capital of type N includes advanced and precision medical equipments like cardiac pacemakers and valves, defibrillators and stents; electromedical therapeutic, monitoring and imaging devices and apparatus; in vitro diagnostics; and implantable orthopaedic and prosthetic devices and appliances. The United States, the European Union (EU) and Japan together account for about 90 % of global production of medical devices, a lion's share of which comes to the developing countries with FDI in the healthcare sector (USITC 2007).

[8]Trade liberalization of health service is a prominent feature of GATS commitments. For example, medical tourism and aspects of e-health, including teleradiology, telediagnostics and telepathology, have gained increased importance in recent years. However, this model does not consider trade in health services.

[9]From the work of Bhagwati (1971), it is well known that in a small open economy, the optimal tariff is zero. However, the government in a developing economy like India finds no alternative but to keep some tariffs on importables mainly on account of political and social pressures keeping in view the employment-preserving effects of tariffs. Besides, tariff revenue is also an important source of government revenue.

[10]An employment subsidy in the form of a wage subsidy by the same rate in the two unionized sectors may not be desirable in the present context because of the following reasons. It lowers the effective wage cost of labour in the two unionized sectors and raises the return to capital of type K, i.e. r (see Eq. 9.2). Consequently, this lowers the competitive wage, W (see Eq. 9.1), of the common workers. In a large democratic developing country like India, the implementation of this policy would be vehemently opposed by political parties and social activists on the ground that it would increase both poverty and income inequality.

[11]This is only a simplifying assumption. It may be intuitively checked that the qualitative results of the model remain unaltered even if the stock of capital of type N consists of both domestic and foreign capital, which are perfect substitutes.

to scale with diminishing marginal productivity to each factor. In sector G there is fixed-coefficient technology.[12] Finally, commodity 1 is assumed to be the numeraire so that $P_1 = 1$.

The general equilibrium is represented by the following set of equations:

$$Wa_{L1} + ra_{K1} = 1 \tag{9.1}$$

$$W^* a_{L2} + ra_{K2} = P_2 (1 + t) = P_2^* \tag{9.2}$$

$$W^* a_{LG} + ra_{KG} + Ra_{NG} = P_G \tag{9.3}$$

Here, a_{ji} is the amount of the jth input required to produce one unit output of the ith sector for $i = 1$, 2, G and $j = L, K, N$. Besides, r and R are the returns to capital of type K and capital of type N, respectively. t is the ad valorem rate of tariff on the import of good 2. $P_2^*(=P_2(1+t))$ is the effective or tariff-inclusive domestic price of commodity 2. Finally, P_G is the endogenously determined price of the healthcare services provided by sector G.

Equations (9.1), (9.2) and (9.3) are the competitive industry equilibrium conditions in the three sectors.

The average efficiency of the workers, h, is considered to be a positive function of the total amount of production (and hence consumption) of commodity, G[13], and is given by

$$h = h (X_G) ; h' > 0 \tag{9.4}$$

Hence, the labour endowment in efficiency unit is given by

$$a_{L1} X_1 + a_{L2} X_2 + a_{LG} X_G = h (X_G) \tag{9.5}$$

where $a_{Li}X_i$ is the employment of labour (in efficiency unit) in the ith sector of the economy for $i = 1, 2, G$.

It should be pointed out at this stage that sector G uses $a_{LG}X_G$ efficiency units of labour apart from two types of capital in its production to produce X_G units of commodity G. The production of commodity G (healthcare services), which is fully consumed by workers, raises the average efficiency of the workers through creation of externalities. If X_G rises by one per cent, sector G employs λ_{LG} per cent of the labour force additionally while it raises the labour force in efficiency unit by ε_G per cent in the margin, where $\varepsilon_G = \left(\frac{dh(\cdot)}{dX_G} \cdot \frac{X_G}{h(\cdot)} \right) > 0$ is the elasticity of the labour

[12]The use of fixed-coefficient technology in the non-traded sector (sector G) makes focus on the externality due to the consumption of healthcare services sharper and easily tractable.

[13]See footnote 6 in this context.

efficiency function, $h(X_G)$, with respect to X_G. It is sensible to assume that sector G is a net supplier of labour input in efficiency unit which implies that $\lambda_{LG} < \varepsilon_G$.

Complete utilization of capital of types K and N can be expressed respectively as follows:

$$a_{K1}X_1 + a_{K2}X_2 + a_{KG}X_G = K_D + K_F = K \tag{9.6}$$

$$a_{NG}X_G = N \tag{9.7}$$

where K_D and K_F are domestic and foreign components of endowment of capital of type K. K_D and K_F are perfect substitutes.[14] N denotes the stock of capital of type N which is completely owned by foreign capitalists.[15]

Since the consumption of healthcare services (commodity G) creates consumption externalities, its free market provision is not optimal, and therefore, there should be a consumption subsidy keeping in view the perspective of social welfare. The consumers receive a subsidy on the consumption of commodity G at the ad valorem rate, s. So the effective price of healthcare services facing the consumers is $P_G^* = P_G(1-s)$.

Let D_i denote the aggregate demand for the ith commodity by the consumers in the economy for $i = 1, 2, G$. The aggregate demand function for the non-traded healthcare services is given by

$$D_G = D_G\underset{(-)\ \ (+)}{\left(P_G^*, Y\right)} \tag{9.8}$$

This implies that the demand for commodity G has the usual own price and income elasticities of demand.

The consumption subsidy on healthcare services (commodity G), denoted by z, is financed by a portion of the tariff revenue earned by the government from the import of commodity 2 and is given by[16]

$$sP_G D_G = z \tag{9.9}$$

[14]This simplified assumption has been made in Brecher and Alejandro (1977), Khan (1982), Grinols (1991), Chandra and Khan (1993), Gupta (1997), Chaudhuri (2001a, b, 2005, 2007), etc. However, in the papers of Beladi and Marjit (1992a, b) and Marjit and Beladi (1996), foreign capital has been treated differently from domestic capital, and these two types of capital are not engaged in the same sector of the economy.

[15]This is only a simplifying assumption. It may be intuitively checked that the qualitative results of the model remain unaltered even if the stock of capital of type N consists of both domestic and foreign capital, which are perfect substitutes.

[16]In the standard trade theory, it is usually assumed that the government collects the tariff revenue from the import of the importables (commodity 2 in the present case) and pays it back to the consumers in a lump-sum manner. In this case, from the aggregate tariff revenue, the government holds back z amount (exogenously fixed) for financing the consumption subsidy and the rest is transferred to the consumers in a non-distortionary fashion.

The demand function for the import commodity, denoted D_2, is given by

$$D_2 = \underset{(-)\ (+)}{D_2\left(P_2^*, Y\right)} \tag{9.10}$$

All commodities are normal with negative and positive own price and income elasticities of demand, respectively. Commodity G is a necessary good having a low own price elasticity of demand (in absolute terms). It does not depend on the relative price of commodity 2, P_2^*, so that the cross-price elasticity is zero. We make the simplifying assumption that the levels of demand for the other two commodities do not depend on the relative price of commodity G, i.e. $(\partial D_1/\partial P_G^*), (\partial D_2/\partial P_G^*) = 0$.[17] Commodities 1 and 2 are, however, gross substitutes implying $(\partial D_1/\partial P_2^*) > 0$.

The national income at domestic prices, denoted by Y, is given by

$$Y = X_1 + P_2^* X_2 + P_G X_G + tP_2\left(D_2 - X_2\right) - rK_F - RN - z \tag{9.11}$$

where $[tP_2(D_2 - X_2) - z]$ is the tariff revenue net of the subsidy on consumption of healthcare services, which is transferred to the consumers in a lump-sum fashion. All foreign capital incomes are completely repatriated.

Since commodity (services) G is consumed domestically, its supply is circumscribed by its demand. Therefore, in equilibrium, we have

$$D_G = X_G \tag{9.12}$$

In this model there are three types of distortion, namely, commodity market distortion in the form of an import tariff in sector 2, labour market distortion in the form of exogenously given unionized wage in sector 2 and sector G and the presence of a non-traded final good (healthcare services), the consumption of which creates externalities so that there is a consumption subsidy on it. If there were only labour market distortion or tariff distortion, economic liberalization policies like labour market reform or trade reform would have been the right instrument to remove distortion and improve social welfare. However, these two distortions are not easy to be removed completely. Political opposition and social activism are two of the most important reasons.[18]

---

[17] It may be verified that even if the levels of demand for the other two commodities depend positively on P_G^*, implying commodities to be gross substitutes, all the results of the model continue to hold under an additional sufficient condition involving the term $(\partial D_2/\partial P_G^*)$.

[18] Although the developing economies have chosen free trade as their development strategy and been implementing liberalized economic policies for the last two decades or so, they are yet to proceed a long way in liberalizing their economies sufficiently as desired by the international institutions like the IMF and the World Bank. In a developing country like India, there are still a lot of structural rigidities, technological and economic backwardness and different types of dualism which need to be removed fast for achieving high rate of economic growth and development.

There are 12 endogenous variables, $W, r, R, P_G, s, h, X_1, X_2, X_G, D_G, D_2$ and Y, that can be solved from the above 12 equations. The solution techniques of the endogenous variables are as follows. r is obtained from Eq. (9.2) as W^* is exogenously given. Plugging the value of r in Eq. (9.1), W is found. Equation (9.3) determines R as function of P_G. Then, X_G is solved from Eq. (9.7) as function of P_G. Plugging of X_G in Eqs. (9.5) and (9.6) and solving yield the values of X_1 and X_2 again as functions of P_G. By substituting D_2 from Eq. (9.10) in Eq. (9.11), Y is also obtained as function of P_G. Inserting Y in Eq. (9.10), D_2 is found. Also, substituting Y in Eq. (9.8), one can find D_G as functions of s and P_G. Then, from Eq. (9.9), s comes out as function of P_G. Finally, P_G is determined from Eq. (9.12). Once P_G is known, the values of the other variables are also known. This is an indecomposable system. Although W and r are obtained from the price system alone, R cannot be solved from the price system, independent of the output system. Therefore, any changes in factor endowments affect R.[19]

The demand side of the model is represented by a strictly quasi-concave social welfare function. Let V denote the social welfare that depends on the consumption of three commodities denoted by D_1, D_2 and D_G and is depicted as

$$V = V(D_1, D_2, D_G) \tag{9.13}$$

The balance-of-trade equilibrium requires that

$$D_1 + P_2 D_2 = X_1 + P_2 X_2 - rK_F - RN \tag{9.14}$$

or equivalently,

$$D_1 + P_2^* D_2 + P_G^* D_G = X_1 + P_2^* X_2 + P_G X_G + tP_2(D_2 - X_2) - rK_F - RN - z \tag{9.14.1}$$

The volume of import of good 2, denoted M, is given by the following equation:

$$M = D_2\left(P_2^*, Y\right) - X_2 \tag{9.15}$$

However, in many cases in a democratic set-up, the political parties and social activists stand in the way of implementing reformatory policies at the desired pace. See also footnotes 9 and 10 in this context.

[19] Any changes in factor endowments cannot affect factor coefficients in sectors 1 and 2 as W and r do not change. Besides, in sector G we have fixed-coefficient technology of production. So, the a_{ji}' s do not change due to changes in factor endowments.

9.3 Comparative Static Exercises

In the present model, where the average efficiency of labour is determined endogenously by the size of healthcare sector (sector G), an inflow of foreign capital apart from increasing the capital stock of the economy may also affect the effective labour endowment measured in efficiency unit due to externalities. It will affect the output composition, price of the non-traded good and social welfare. In this backdrop we examine the effects of foreign capital of both types on national welfare and the human capital stock of the economy in the presence of a possible concomitant change in the effective labour endowment. We allow changes in the parameters, K and N, one by one, while other parameters like $W^*, t, L, a_{LG}, a_{KG}, a_{NG}$ and z are kept unchanged.

The human capital stock, denoted by C, is the total labour endowment of the economy in efficiency unit which is written as follows:

$$C = h(X_G) \tag{9.16}$$

9.3.1 *Effects of an Inflow of Capital of Type K*

In order to examine the effects of an inflow of foreign capital of type K on social welfare and human capital stock of the economy, it is assumed that $\widehat{K} > 0$, with all other parameters remaining unchanged. Here the '^' symbol suggests proportionate change.

Differentiating Eqs. (9.3), (9.5), (9.6), (9.7), (9.8), (9.9), (9.10), (9.11), (9.12) (9.13), (9.14.1) and (9.15), the following results can be proved[20]:

$$\left.\begin{aligned}
&\text{(i)}\ \left(\frac{\widehat{P}_G}{\widehat{K}}\right) > 0 \quad \text{iff} \quad \left(W^* - W\right) a_{L2} > tP_2; \\
&\text{(ii)}\ \left(\frac{\widehat{X}_1}{\widehat{K}}\right) < 0 \ \text{ and } \ \left(\frac{\widehat{X}_2}{\widehat{K}}\right) > 0; \\
&\text{(iii)}\ \left(\frac{\widehat{X}_G}{\widehat{K}}\right) = 0; \\
&\text{(iv)}\ \frac{dC}{dK} = 0; \text{ and} \\
&\text{(v)}\ \left(\frac{1}{V_1}\right)\frac{dV}{dK} > 0 \quad \text{if} \quad \left(W^* - W\right) a_{L2} > tP_2
\end{aligned}\right\} \tag{9.17}$$

[20]The derivations and sufficient conditions are given in Appendix 9.1.

From (9.17) the following proposition can now be established.[21]

Proposition 9.1 *An inflow of foreign capital of type K leads to an expansion (a contraction) of sector 2 (sector 1) and leaves healthcare sector (sector G) unaffected. It raises the producer price of the healthcare services and improves social welfare iff* $(W^* - W)a_{L2} > tP_2$. *The human capital stock of the economy, however, does not change.*

From (9.17) the following corollaries readily follow.

Corollary 9.1 *When* $W^* = W$, *i.e. there is no labour market distortion,* $\left(\frac{1}{V_1}\right)\frac{dV}{dK} < 0$.

Corollary 9.2 *When* $t = 0$, *i.e. there is no tariff restriction,* $\left(\frac{1}{V_1}\right)\frac{dV}{dK} > 0$.

Corollary 9.3 *In the absence of both labour market distortion and tariff distortion, welfare does not change.*

We can intuitively explain the results presented in Proposition 9.1 and Corollaries 9.1, 9.2 and 9.3 in the following fashion. Sectors 1 and 2 together form a Heckscher–Ohlin subsystem (HOSS) since they use the same two inputs. An inflow of capital of type K leads to a contraction of sector 1 and an expansion of sector 2 following a Rybczynski effect since the latter is more intensive in the use of capital of type K (with respect to labour) than the former. The healthcare sector (sector G) remains unaffected because of the following reasons: (i) production technology of sector G is of fixed-coefficient type and (ii) the endowment of capital of type N, which is specific to sector G, has not changed. Now, as sector 1 contracts, more labour (in efficiency unit) is now absorbed in the higher-wage-paying unionized sector 2. This is the labour reallocation effect (LRE) that raises the aggregate wage income and works positively on social welfare. There is, however, an offsetting effect, which we call the tariff revenue effect (TRE). As sector 2 expands, it lowers the volume of import, and hence, the tariff revenue net of consumption subsidy on healthcare services, which is transferred to the consumers in a non-distortionary manner, declines. This TRE works negatively on welfare. National welfare increases if and only if the LRE is stronger than the TRE, i.e. iff $(W^* - W)a_{L2} > tP_2$. We should note that if welfare improves, it pushes up the demand for the non-traded healthcare services (good, G). Its supply, however, cannot change for reasons already explained earlier. Therefore, the producer price of the good, P_G (and also the consumer price, P_G^*), would adjust upwardly to clear the market for good G.[22] As P_G rises the value of domestic production rises. The value of aggregate consumption (demand) by all consumers in the economy rises as well. For the want of a better term, we call it

[21] If all commodities are gross substitutes, we have $(\partial D_2/\partial P_G^*) > 0$. It can be verified that the necessary and sufficient condition under which the results of Proposition 9.1 are obtained does not change.

[22] As $P_G^* = (1 - s)P_G$ and $z = sP_G D_G$ (see Eqs. (9.9) and (9.12)), it is evident that P_G^* increases at a higher rate than P_G.

the demand value effect (DVE) which raises national income and welfare further. Finally, the human capital stock measured in efficiency does not change as sector G remains unaffected.

In the absence of any labour market distortion, the LRE is zero. Welfare worsens following the negative TRE.

On the contrary, in the absence of any tariff restrictions, there is no negative TRE. So, welfare improves unequivocally.

Finally, in the absence of both labour market distortion and tariff distortion, there is neither LRE nor TRE. So, welfare does not change.

9.3.2 *Effects of an Inflow of Foreign Capital of Type N*

Let us now find out of the consequences of an inflow of foreign capital of type N which is specific to the non-traded healthcare sector. In this case, it is assumed that $\widehat{N} > 0$, with all other parameters remaining unchanged.

Differentiating Eqs. (9.3), (9.5), (9.6), (9.7), (9.8), (9.9), (9.10), (9.11), (9.12), (9.13), (9.14.1) and (9.15) once more, the following results can be proved[23]:

$$\left.\begin{array}{ll}
\text{(vi)} & \left(\dfrac{\widehat{X}_1}{\widehat{N}}\right) > 0 \text{ and } \left(\dfrac{\widehat{X}_2}{\widehat{N}}\right) < 0; \\[2ex]
\text{(vii)} & \left(\dfrac{\widehat{X}_G}{\widehat{N}}\right) = 1 > 0; \\[2ex]
\text{(viii)} & \dfrac{dC}{dN} > 0; \\[2ex]
\text{(ix)} & \left(\dfrac{\widehat{P}_G}{\widehat{N}}\right) < 0 \quad \text{if} \quad \left(W^* - W\right) a_{L2} \geq tP_2; \text{and} \\[2ex]
\text{(x)} & \left(\dfrac{1}{V_1}\right)\dfrac{dV}{dN} < 0 \quad \text{if} \quad \text{(i)} \quad \left(W^* - W\right) a_{L2} \geq tP_2 \text{ and} \\[1ex]
& \qquad\qquad\qquad\qquad \text{(ii)} \quad z \geq W^* \varepsilon_h h L
\end{array}\right\} \tag{9.18}$$

These results can be summarized in terms of the following proposition.

Proposition 9.2 *An inflow of foreign capital of type N (specific to the healthcare sector) leads to (a) expansion of both healthcare sector (sector G) and sector 1 and a contraction of sector 2 and (b) an increase in human capital stock. It lowers the producer price of the healthcare services if* $(W^* - W)a_{L2} \geq tP_2$. *National welfare worsens if additionally* $z \geq W^* \varepsilon_h hL$.

[23] The derivations and sufficient conditions are given in Appendix 9.1.

The following corollary also follows from the set of results given by (9.18).

Corollary 9.4 *In the absence of any tariff, welfare deteriorates following an inflow of foreign capital of type N if* $z \geq W^* \varepsilon_h hL$.[24]

The results presented in Proposition 9.2 and Corollary 9.4 are verbally explained as follows. Technology in sector G is of the fixed-coefficient type and capital of type N is specific to this sector. So, if there occurs an inflow of capital of N type, the healthcare sector (sector G) expands. The expanding sector G requires more capital of type K, which must come from the other two sectors leading to a Rybczynski-type effect (RTE) in the HOSS. Consequently, sector 2 contracts while sector 1 expands as the former is more intensive in the use of capital of type K vis-à-vis sector 1. As sector 1 that pays a lower wage to its workers vis-à-vis the other two sectors expands, aggregate wage income falls. This is the LRE that works negatively on social welfare. On the other hand, as the tariff-protected import-competing sector (sector 2) contracts, the amount of tariff revenue rises via an increase in the volume of imports. The amount of lump-sum transfer (net of consumption subsidy on healthcare services) to the consumers rises. This is the TRE that in this case works favourably on welfare. However, the negative LRE dominates over the positive TRE if $(W^* - W)a_{L2} \geq tP_2$. So these two effects taken together tend to lower not only the national welfare but also the demand for the non-traded healthcare services. On the other hand, as sector G expands the human capital formation gets a boost taking full advantage of externalities. The increase in the effective labour force creates additional wage income. This we call the labour endowment effect (LEE) that works favourably on welfare. This also raises the demand for the healthcare services and exerts an upward pressure on its price. As the supply of this good has increased, it tends to lower the producer price. Therefore, there are two opposite effects on the producer price of the good, P_G. It can be checked that P_G falls if $(W^* - W)a_{L2} \geq tP_2$ and the elasticity of the labour efficiency function, ε_h, is not high.[25] Now if P_G falls, the aggregate value of domestic production falls. The aggregate value of consumption (demand) by all consumers in the economy also falls. This is the demand value effect (DVE) which in the present case works negatively on national welfare. The negative DVE outweighs the positive LEE if $(W^* - W)a_{L2} \geq tP_2$ and $z \geq W^* \varepsilon_h hL$ and worsens social welfare further.[26] Thus, we find that social welfare deteriorates following an inflow of foreign capital of type N under the sufficient

[24] One can easily derive quite a few numbers of alternative sufficient conditions for this result to be valid. See Appendix 9.1 for details.

[25] These are only sufficient conditions, not necessary ones. See Appendix 9.1 for derivations.

[26] The sufficient condition, $z \geq W^* \varepsilon_h hL$, implies that the magnitude of consumption subsidy on healthcare services (decrease in net lump-sum transfer of tariff revenue to consumers) is not less than the additional wage income generated by externalities. However, this is not at all a necessary condition. From derivations presented in Appendix 9.1, it is clear that one can derive quite a few numbers of alternative sufficient conditions for the results to be valid.

conditions as presented in Proposition 9.2. It may, however, be noted that one can easily derive a couple of alternative sufficient conditions which ensure the results to hold.

In the absence of any tariff, there is no positive TRE. There are only negative LRE, negative DVE and positive LEE. The net outcome of the last two effects is unfavourable if $z \geq W^* \varepsilon_h hL$. So, national welfare worsens under this sufficient condition which is stated in Corollary 9.4.

9.4 Policy Implications of the Results

In this chapter we develop a three-sector, three-factor, full-employment general equilibrium model that includes a non-traded healthcare sector and considers segmented labour market, to examine the consequences of FDI on human capital formation and welfare in a small open developing economy. The consumption of healthcare services raises the average efficiency of the workers. There are two types of capital, of which capital of type K is used in all the three sectors of the economy, while capital of type N is specific to the non-traded sector. So an FDI of type N expands the healthcare sector thereby generating externalities.

The analysis finds that FDI of capital of type N although raises the human capital endowment of the economy may affect social welfare adversely. This indicates the possibility of a trade-off between the twin economic objectives of the government in a developing economy: maintaining high rate of economic growth and expediting human capital formation. On the contrary, an inflow of foreign capital of type K is likely to be welfare improving in the presence of a certain degree of labour market distortion although the human capital stock may not change.[27] Policy implications that readily follow are not to go for labour market reform but to implement trade liberalization that lowers the tariff rate. This mix of reforms fortifies the possibility that the condition $(W^* - W)a_{L2} > tP_2$ would be satisfied. On the contrary, owing to an inflow of foreign capital of type N (specific to sector G), social welfare deteriorates if $(W^* - W)a_{L2} \geq tP_2$ and $z \geq W^* \varepsilon_h hL$. So trade liberalization raises the possibility for this kind of foreign capital inflows to be welfare worsening.

Finally, it should be mentioned that although the results of the model crucially hinge on the institutional and technological characteristics and the trade pattern of the country in question, the conditions on which these results depend consist only of the parameters of the system and not of any endogenous variable. So the results hold for a wide range of parameter values, some of which are amenable to policy measures. Even though some of the assumptions, like fixed-coefficient technology in the healthcare sector and sector specificity of one type of capital, are simplifying, the

[27]In the present case the human capital stock, C, does not change as it depends positively on the size of the healthcare sector which remains unaffected due to inflow of foreign capital of type K.

results of the model can at least question the desirability of allowing entry of foreign capital in the non-traded healthcare sector, especially when it generates externalities.

Appendices

Appendix 9.1: Derivations of Certain Useful Expressions

Totally differentiating Eqs. (9.3) and (9.7), one gets, respectively,

$$\left.\begin{array}{l}\widehat{R} = \left(\frac{\widehat{P}_G}{\theta_{NG}}\right)\\ \widehat{X}_G = \widehat{N}\end{array}\right\} \tag{9.A.1}$$

Differentiating Eqs. (9.5) and (9.6) and using (9.A.1) yield

$$\lambda_{L1}\widehat{X}_1 + \lambda_{L2}\widehat{X}_2 = -(\lambda_{LG} - \varepsilon_h)\,\widehat{N} \tag{9.A.2}$$

$$\lambda_{K1}\widehat{X}_1 + \lambda_{K2}\widehat{X}_2 = \widehat{K} - \lambda_{LG}\widehat{N} \tag{9.A.3}$$

where $\varepsilon_h = (dh/dX_G)(X_G/h) > 0$ is the elasticity of the efficiency function of labour with respect to the output of sector G, i.e. X_G.

It is assumed that the healthcare sector (sector G) is a net supplier of labour in efficiency unit, implying that $\lambda_{LG} < \varepsilon_h$ which means $(\lambda_{LG} - \varepsilon_h) < 0$.

Solving (9.A.2) and (9.A.3) by Cramer's rule yields

$$\left.\begin{array}{l}\widehat{X}_1 = (1/|\lambda|)\left[\widehat{N}\,\{\lambda_{KG}\lambda_{L2} - \lambda_{K2}(\lambda_{LG} - \varepsilon_h)\} - \lambda_{L2}\widehat{K}\right] \text{ and}\\ \widehat{X}_2 = (1/|\lambda|)\left[\lambda_{L1}\widehat{K} + \{\lambda_{K1}(\lambda_{LG} - \varepsilon_h) - \lambda_{KG}\lambda_{L1}\}\,\widehat{N}\right]\end{array}\right\} \tag{9.A.4}$$

where

$$|\lambda| = (\lambda_{L1}\lambda_{K2} - \lambda_{L2}\lambda_{K1}) > 0 \tag{9.A.5}$$

(This is because sector 2 is more intensive in the use of capital of type K vis-à-vis sector 1 with respect to labour.)

Using (9.A.5) from (9.A.4), we find that

$$\left.\begin{array}{l}\widehat{X}_1 < 0; \text{ and } \widehat{X}_2 > 0 \text{ when } \widehat{K} > 0; \text{ and}\\ \widehat{X}_1 > 0; \text{ and } \widehat{X}_2 < 0 \text{ when } \widehat{N} > 0\end{array}\right\} \tag{9.A.4.1}$$

Appendix 9.2: Derivation for Change in Welfare

Differentiation of Eq. (9.14.1) gives

$$dD_1 + P_2^* dD_2 + P_G^* dD_G = dX_1 + P_2^* dX_2 + P_G dX_G + X_G dP_G + tP_2 dM - rdK_F - RdN - D_G dP_G^* \tag{9.A.6}$$

(Note that z is a policy parameter, which here does not change. So we have $dz = 0$.)

We also note that $X_1 = F^1(L_1, K_1)$ and $X_2 = F^2(L_2, K_2)$ are the two production functions in sectors 1 and 2, respectively. Besides, we have fixed-coefficient technology in sector G where a_{LG} units of labour (in efficiency unit), a_{KG} units of capital of type K and a_{NG} units of capital of type N together produce one unit output. The full-employment conditions for the three inputs are $L_1 + L_2 + L_G = h(X_G)L; K_1 + K_2 + K_G = K_D + K_F = K;$ and $N_G = N$.

Hence, differentiating Eq. (9.11) and the production functions yields

$$\begin{aligned} dY &= dX_1 + P_2^* dX_2 + P_G dX_G + X_G dP_G - rdK_F - RdN + tP_2 dM \\ &= F_L^1 dL_1 + F_K^1 dK_1 + P_2^* F_L^2 dL_2 + P_2^* F_K^2 dK_2 + P_G dX_G \\ &\quad + X_G dP_G - rdK_F - RdN + tP_2 dM \end{aligned}$$

(Note that $P_G X_G = W^* dL_G + rdK_G + RdN_G$).

So,

$$\begin{aligned} dY &= WdL_1 + W^* (dL_2 + dL_G) + r (dK_1 + dK_2 + dK_G) + RdN_G \\ &\quad + X_G dP_G - rdK_F - RdN + tP_2 dM \\ &= -\left(W^* - W\right) dL_1 + X_G dP_G + tP_2 dM + W^* h'(\cdot) LdX_G \end{aligned} \tag{9.A.7}$$

(Note that $(dL_2 + dL_G = h'(\cdot)LdX_G - dL_1)$ and $(dK_1 + dK_2 + dK_G = dK_F)$ as $dK_D = 0$ and $dN_G = dN$).

Differentiating Eq. (9.15) and using (9.A.7) we find

$$dM = \left(\frac{\partial D_2}{\partial Y}\right) \left[-\left(W^* - W\right) dL_1 + X_G dP_G + tP_2 dM + W^* h'(\cdot) LdX_G\right] - dX_2$$

(Note that P_2^* does not change.)

On simplification we get

$$dM\left(\frac{1+t\,(1-m)}{1+t}\right)=\left(\frac{m}{P_2^*}\right)\left[-\left(W^*-W\right)dL_1+X_G dP_G+tP_2 dM\right.$$
$$\left.+W^* h'(\cdot)\,LdX_G\right]-dX_2$$

$$dM=v\left[\left(\frac{m}{P_2^*}\right)\left\{-\left(W^*-W\right)dL_1+X_G dP_G+tP_2 dM+W^* h'(\cdot)LdX_G\right\}-dX_2\right] \tag{9.A.8}$$

Use of (9.A.8) in (9.A.7) and simplification yield

$$dY=v\left[-\left(W^*-W\right)dL_1+X_G dP_G-tP_2 dX_2+W^* h'(\cdot)\,LdX_G\right] \tag{9.A.9}$$

where $v=[(1+t)/\{1+t(1-m)\}]$ and $m=P_2^*(\partial D_2/\partial Y)$ is the marginal propensity to consume commodity 2.

Differentiating Eq. (9.13) one obtains

$$\left(\frac{1}{V_1}\right)dV=dD_1+P_2^* dD_2+P_G^* dD_G \tag{9.A.10}$$

Differentiation of Eq. (9.9), use of (9.A.6) and (9.A.9) in (9.A.10) and simplification give

$$\left(\frac{1}{V_1}\right)dV=-v\left[\left(W^*-W\right)a_{L1}dX_1+tP_2 dX_2\right]+vX_G dP_G$$
$$+vW^* h' LdX_G-sP_G dD_G \tag{9.A.11}$$

(Note that $dL_1=a_{L1}dX_1$.)

Differentiation of Eq. (9.8) yields

$$\widehat{D}_G=\left(\frac{E^G_{P_G^*}}{P_G^*}\right)dP_G^*+\left(\frac{E^G_Y}{Y}\right)dY \tag{9.A.12}$$

Using (9.A.4) and (9.A.9), Eq. (9.A.12) can be rewritten as follows:

$$\widehat{D}_G=E^G_{P_G^*}\widehat{P}_G^*+\left(\frac{vE^G_Y P_G X_G}{Y}\right)\widehat{P}_G$$
$$-\left(\frac{vE^G_Y}{Y\,|\lambda|}\right)\left[\left(W^*-W\right)a_{L1}X_1\left\{\lambda_{KG}\lambda_{L2}-\lambda_{K2}\left(\lambda_{LG}-\varepsilon_h\right)\right\}\right.$$
$$\left.+tP_2X_2\left\{\lambda_{K1}\left(\lambda_{LG}-\varepsilon_h\right)-\lambda_{KG}\lambda_{L1}\right\}-W^* h'(\cdot)\,LX_G\,|\lambda|\right]\widehat{N}$$
$$-\left[\left(\frac{vE^G_Y\lambda_{L1}X_2}{Y\,|\lambda|}\right)\left\{\left(W^*-W\right)a_{L2}-tP_2\right\}\right]\widehat{K} \tag{9.A.13}$$

Now, differentiating Eq. (9.9) and equation $((P_G^* = (1-s)P_G)$ and simplifying, we obtain

$$\widehat{P}_G = (1-s)\,\widehat{P}_G^* - s\widehat{D}_G \tag{9.A.14}$$

Rearranging terms in (9.A.13) and using (9.A.14) yield

$$H_1\widehat{D}_G = H_2\widehat{P}_G^* - H_3\widehat{N} + H_4\widehat{K} \tag{9.A.15}$$

where

$$\left.\begin{aligned}
H_1 &= \left[1 + \left(\frac{svE_Y^G P_G X_G}{Y}\right)\right] > 0;\\
H_2 &= \left[E_{P_G^*}^G + (1-s)\left(\frac{vE_Y^G P_G X_G}{Y}\right)\right];\\
H_3 &= \left(\frac{vE_Y^G}{Y\,|\lambda|}\right)\left[\left(W^* - W\right)a_{L1}X_1\left\{\lambda_{KG}\lambda_{L2} - \lambda_{K2}\left(\lambda_{LG} - \varepsilon_h\right)\right\}\right.\\
&\quad \left.+tP_2X_2\left\{\lambda_{K1}\left(\lambda_{LG} - \varepsilon_h\right) - \lambda_{KG}\lambda_{L1}\right\} - W^*h'(\cdot)\,LX_G\,|\lambda|\big\}\right];\ \text{and}\\
H_4 &= \left(\frac{vE_Y^G\lambda_{L1}X_2}{Y\,|\lambda|}\right)\left[\left(W^* - W\right)a_{L2} - tP_2\right]
\end{aligned}\right\} \tag{9.A.16}$$

Using (9.A.14) in (9.A.15) and simplifying, we obtain

$$\widehat{D}_G = \left(\frac{\overline{H}_2}{\overline{H}_1}\right)\widehat{P}_G - \left(\frac{H_3}{\overline{H}_1}\right)\widehat{N} + \left(\frac{H_4}{\overline{H}_1}\right)\widehat{K} \tag{9.A.17}$$

where

$$\left.\begin{aligned}
\overline{H}_1 &= \left(H_1 - \frac{sH_2}{1-s}\right)\ \text{and}\\
\overline{H}_2 &= \frac{H_2}{1-s}
\end{aligned}\right\} \tag{9.A.17.1}$$

For the sake of analytical simplicity, let us assume that D_G is a negative function of P_G, i.e. $\left(\widehat{D}_G/\widehat{P}_G\right) < 0$ (from (9.A.14) we find that there is a one-to-one correspondence between P_G^* and P_G). This means (from (9.A.17) that

$$\left(\frac{\widehat{D}_G}{\widehat{P}_G}\right) = \left(\frac{\overline{H}_2}{\overline{H}_1}\right) < 0 \tag{9.A.17.2}$$

Using (9.A.16) and (9.A.17.1) and simplifying from (9.A.17.2), we get

$$\left(\frac{\overline{H}_2}{\overline{H}_1}\right) = \left[\frac{\{H_2/(1-s)\}}{\{((1-s)H_1 - sH_2)/(1-s)\}}\right] = \left[\frac{H_2}{(1-s) - sE^G_{P^*_G}}\right] < 0 \tag{9.A.17.3}$$

$$(-)$$

It follows from (9.A.17.3) that

$$H_2 < 0 \tag{9.A.18}$$

Using Eqs. (9.A.18) and (9.A.16) from Eqs. (9.A.16) and (9.A.17.1), it is easy to check that

$$\left.\begin{aligned}
&\overline{H}_1 = \left(H_1 - \frac{sH_2}{1-s}\right) = \left(1 - \frac{sE^G_{P^*_G}}{1-s}\right) > 0;\\
&\overline{H}_2 = \frac{H_2}{1-s} < 0;\\
&H_2 < 0;\\
&H_2 < 0 \quad \text{if (i) } \left(W^* - W\right) a_{L2} \geq tP_2 \text{ and (ii) } \varepsilon_h \text{ is low;}\\
&H_4 > 0 \quad \text{iff } \left(W^* - W\right) a_{L2} > tP_2
\end{aligned}\right\} \tag{9.A.19}$$

From (9.A.1) one gets

$$\left(\frac{\widehat{X}_G}{\widehat{P}_G}\right) = 0 \tag{9.A.20}$$

Now, Walrasian stability in the market for the non-traded healthcare sector requires that

$$\left(\frac{\widehat{D}_G}{\widehat{P}_G}\right) - \left(\frac{\widehat{X}_G}{\widehat{P}_G}\right) < 0 \tag{9.A.21}$$

This is automatically satisfied as $\left(\left(\widehat{D}_G/\widehat{P}_G\right) < 0 \text{ and } \left(\widehat{X}_G/\widehat{P}_G\right) = 0\right)$ (see Eqs. (9.A.17.2) and (9.A.20)).

At equilibrium in the market for sector G, we have

$$\widehat{D}_G = \widehat{X}_G \tag{9.A.22}$$

Using (9.A.17) and (9.A.1) and collecting terms from (9.A.22), one gets

$$H_5 \widehat{P}_G = H_6 \widehat{N} - H_7 \widehat{K} \tag{9.A.23}$$

where

$$\left.\begin{aligned}
&H_5 = \left(\frac{\overline{H}_2}{\overline{\overline{H}}_1}\right) < 0; \\
&H_6 = \left(\frac{\overline{H}_1 + H_3}{\overline{\overline{H}}_1}\right) > 0 \quad \text{if (i) } \left(W^* - W\right) a_{L2} \geq tP_2 \text{ and (ii) } \varepsilon_h \text{ is low; and} \\
&H_7 = \frac{H_4}{\overline{\overline{H}}_1} > (=) < \text{ according to } \left(W^* - W\right) a_{L2} > (=) < tP_2
\end{aligned}\right\} \tag{9.A.24}$$

From (9.A.23) we find that

$$\left.\begin{aligned}
&\left(\frac{\widehat{P}_G}{\widehat{K}}\right) = (-)\,\frac{H_7}{H_5} > 0 \quad \text{iff } \left(W^* - W\right) a_{L2} > tP_2 \text{ and} \\
&\left(\frac{\widehat{P}_G}{\widehat{N}}\right) = \frac{H_6}{H_5} < 0 \quad \text{if (i) } \left(W^* - W\right) a_{L2} \geq tP_2 \text{ and} \\
&\qquad\qquad\qquad \text{(ii) } \varepsilon_h \text{ is low}
\end{aligned}\right\} \tag{9.A.25}$$

From (9.A.1) and (9.A.22), we have

$$\left(\frac{\widehat{X}_G}{\widehat{K}}\right), \left(\frac{\widehat{D}_G}{\widehat{K}}\right) = 0 \text{ and} \tag{9.A.26.1}$$

$$\left(\frac{\widehat{X}_G}{\widehat{N}}\right), \left(\frac{\widehat{D}_G}{\widehat{N}}\right) = 1 > 0 \tag{9.A.26.2}$$

Welfare Consequence of Capital of *K* Type

From (9.A.11) after using (9.A.26.1), one can write

$$\left(\frac{1}{V_1}\right)\frac{dV}{dK} = -v\left[\left(W^* - W\right) a_{L1}\left(\frac{dX_1}{dK}\right) + tP_2\left(\frac{dX_2}{dK}\right)\right] + vX_G\left(\frac{dP_G}{dK}\right) \tag{9.A.27}$$

The first term in (9.A.27) is the following:

$$T_{1K} = -v\left(W^{*} - W\right)a_{L1}\left(\frac{dX_1}{dK}\right)$$

Using (9.A.4) and simplifying, we obtain

$$T_{1K} = \left[\frac{v\left(W^{*} - W\right)a_{L1}X_1\lambda_{L2}}{|\lambda|\,K}\right] \tag{9.A.28}$$

Now the second term in (9.A.27) is

$$T_{2K} = -vtP_2\left(\frac{dX_2}{dK}\right)$$

Using (9.A.4) and simplifying, one gets

$$T_{2K} = -\left(\frac{vtP_2X_2\lambda_{L1}}{|\lambda|\,K}\right) \tag{9.A.29}$$

Finally, the third term is given by

$$T_{3K} = vX_G\left(\frac{dP_G}{dK}\right)$$

Using (9.A.25), (9.A.24), (9.A.19) and (9.A.16) and simplifying, the above term can be reduced to the following:

$$T_{3K} = -\left[\left(\frac{vE_Y^G\lambda_{L1}X_2}{Y\,|\lambda|\,H_2K}\right)(1-s)\,vP_GX_G\left\{\left(W^{*} - W\right)a_{L2} - tP_2\right\}\right] \tag{9.A.30}$$

Using (9.A.28), (9.A.29) and (9.A.30) and simplifying from (9.A.27), one finally finds that

$$\left(\frac{1}{V_1}\right)\frac{dV}{dK} = \left(\frac{v\lambda_{L1}X_2}{|\lambda|\,K}\right)\left[\left(W^{*} - W\right)a_{L2} - tP_2\right]\left[1 - (1-s)\left(\frac{vE_Y^G P_GX_G}{YH_2}\right)\right] \tag{9.A.31}$$

From (9.A.31) we find that in the absence of both labour market distortion and tariff distortion, $\left(\frac{1}{V_1}\right)\frac{dV}{dK} = 0$. Therefore, welfare does not change.

Using (9.A.18) from (9.A.31), it leads to

$$\left.\begin{aligned}\left(\frac{1}{V_1}\right)\frac{dV}{dK} > 0 \quad \text{iff} \quad \left(W^{*} - W\right)a_{L2} > tP_2 \ \text{ and}\\ \left(\frac{1}{V_1}\right)\frac{dV}{dK} < 0 \quad \text{iff} \quad \left(W^{*} - W\right)a_{L2} < tP_2\end{aligned}\right\} \tag{9.A.32}$$

Besides, from (9.A.32) the following results also follow.
When $W^* = W$, that is, there is no labour market distortion,

$$\left(\frac{1}{V_1}\right)\frac{dV}{dK} < 0 \tag{9.A.33}$$

On the other hand, when $t = 0$, that is, there is no tariff distortion,

$$\left(\frac{1}{V_1}\right)\frac{dV}{dK} > 0 \tag{9.A.34}$$

Welfare Consequence of Capital of Type *N*

From (9.A.11) one can obtain

$$\begin{aligned}\left(\frac{1}{V_1}\right)\frac{dV}{dN} &= -v\left[\left(W^* - W\right)a_{L1}\left(\frac{dX_1}{dN}\right) + tP_2\left(\frac{dX_2}{dN}\right)\right] \\ &\quad + vX_G\left(\frac{dP_G}{dN}\right) + \left[vW^*h'(\cdot)\,L\left(\frac{dX_G}{dN}\right) - sP_G\left(\frac{dD_G}{dN}\right)\right]\end{aligned} \tag{9.A.35}$$

In (9.A.35) the first term is

$$T_{1N} = -v\left[\left(W^* - W\right)a_{L1}\left(\frac{dX_1}{dN}\right) + tP_2\left(\frac{dX_2}{dN}\right)\right]$$

Using (9.A.4) and simplifying, we obtain

$$\begin{aligned}T_{1N} &= -\left(\frac{v}{|\lambda|\,N}\right)\left[\lambda_{KG}\lambda_{L1}X_2\left\{\left(W^* - W\right)a_{L2} - tP_2\right\}\right. \\ &\quad \left. - \left(\lambda_{LG} - \varepsilon_h\right)\left(\frac{a_{L1}X_1\lambda_{K2}}{a_{L2}}\right)\left\{\left(W^* - W\right)a_{L2} - tP_2\left(\frac{a_{L2}a_{K1}}{a_{K2}a_{L1}}\right)\right\}\right]\end{aligned} \tag{9.A.36}$$

Note that $(\lambda_{LG} - \varepsilon_h) < 0$ and that $(a_{L2}a_{K1}/a_{K2}a_{L1}) < 1$ (since sector 1 is labour-intensive relative to sector 2 with respect to capital of type K).
From (9.A.36) it now follows that

$$T_{1N} < 0 \quad \text{if} \quad \left(W^* - W\right)a_{L2} \geq tP_2 \tag{9.A.37}$$

We write the second term and the third term of (9.A.35) together as follows:

$$T_{2N+3N} = vX_G\left(\frac{dP_G}{dN}\right) + vW^*h'(\cdot)\,L\left(\frac{dX_G}{dN}\right) - sP_G\left(\frac{dD_G}{dN}\right)$$

Using (9), (9.A.25), (9.A.24) and (9.A.26.2), we can write

$$\begin{aligned}
T_{2N+3N} &= v\left[\left(X_G\frac{P_G}{N}\right)\left(\frac{H_6}{H_5}\right) + W^*h'L\left(\frac{dX_G}{dN}\right)\right] - \left(\frac{z}{N}\right)\\
&= v\left[\left(\frac{P_GX_G}{N}\right)\left(\frac{\overline{H}_1}{\overline{H}_2}\right) + \left(\frac{P_GX_G}{N}\right)\left(\frac{H_3}{\overline{H}_2}\right) + \left(\frac{W^*\varepsilon_h hL}{N}\right)\right] - \left(\frac{z}{N}\right)\\
&= v\left[\left[\left(\frac{P_GX_G}{N}\right)\left(\frac{1-s-sE^G_{P_G^*}}{H_2}\right) - \left(\frac{P_GX_G}{\overline{H}_2N}\right)\left(\frac{vE^G_YW^*\varepsilon_h hL}{Y}\right)\right.\right.\\
&\quad \left. + \left(\frac{W^*\varepsilon_h hL}{N}\right)\right] + \left(\frac{P_GX_G}{\overline{H}_2N}\right)\left(\frac{vE^G_Y}{Y}\right)\left[\left(W^*-W\right)a_{L1}X_1\left\{\lambda_{KG}\lambda_{L2}\right.\right.\\
&\quad \left.\left.\left. -\lambda_{K2}\big(\lambda_{LG}-\varepsilon_h\big)\right\} + tP_2X_2\left\{\lambda_{K1}\left(\lambda_{LG}-\varepsilon_h\right) - \lambda_{KG}\lambda_{L1}\right\}\right]\right] - \left(\frac{z}{N}\right)
\end{aligned} \tag{9.A.38}$$

Now

$$\begin{aligned}
&\left(\frac{P_GX_G}{\overline{H}_2N}\right)\left(\frac{vE^G_Y}{Y}\right)\left[\left(W^*-W\right)a_{L1}X_1\left\{\lambda_{KG}\lambda_{L2} - \lambda_{K2}\left(\lambda_{LG}-\varepsilon_h\right)\right\}\right.\\
&\quad \left. +tP_2X_2\left\{\lambda_{K1}\left(\lambda_{LG}-\varepsilon_h\right) - \lambda_{KG}\lambda_{L1}\right\}\right]\\
&= \left(\frac{P_GX_G}{\overline{H}_2N}\right)\left(\frac{vE^G_Y}{Y}\right)\left[\lambda_{KG}\lambda_{L1}X_2\left\{\left(W^*-W\right)a_{L2} - tP_2\right\}\right.\\
&\quad \left. -\left(\lambda_{LG}-\varepsilon_h\right)\left(\frac{a_{L1}X_1\lambda_{K2}}{a_{L2}}\right)\left\{\left(W^*-W\right)a_{L2} - tP_2\left(\frac{a_{L2}a_{K1}}{a_{K2}a_{L1}}\right)\right\}\right]
\end{aligned} \tag{9.A.39}$$

$$< 0 \quad \text{if} \quad \left(W^*-W\right)a_{L2} \geq tP_2 \tag{9.A.39.1}$$

(Note that $\overline{H}_2 < 0$, $(\lambda_{LG}-\varepsilon_h) < 0$ and $(a_{L2}a_{K1}/a_{K2}a_{L1}) < 1$)

Besides,

$$\left[\left(\frac{P_G X_G}{N}\right)\left(\frac{1-s-sE^G_{P^*_G}}{H_2}\right)-\left(\frac{P_G X_G}{\overline{H}_2 N}\right)\left(\frac{vE^G_Y W^*\varepsilon_h hL}{Y}\right)+\left(\frac{W^*\varepsilon_h hL}{N}\right)\right]$$
$$=\left[\left(\frac{P_G X_G}{N}\right)\left(\frac{1-s-sE^G_{P^*_G}}{H_2}\right)+\left(\frac{W^*\varepsilon_h hL}{N}\right)\left\{1-\left(\frac{P_G X_G}{\overline{H}_2}\right)\left(\frac{vE^G_Y}{Y}\right)\right\}\right]$$
$$=\left[\left(\frac{P_G X_G}{N}\right)\left(\frac{1-s-sE^G_{P^*_G}}{H_2}\right)+\left(\frac{W^*\varepsilon_h hLE^G_{P^*_G}}{NH_2}\right)\right]$$
$$=\left(\frac{1}{NH_2}\right)\left[(1-s)\,P_G X_G-\left(sP_G X_G-W^*\varepsilon_h hL\right)E^G_{P^*_G}\right]$$
$$=\left(\frac{1}{NH_2}\right)\left[(1-s)\,P_G X_G-\left(z-W^*\varepsilon_h hL\right)E^G_{P^*_G}\right] \tag{9.A.40}$$

$$<0 \quad \text{if } z\geq W^*\varepsilon_h hL \tag{9.A.40.1}$$

(Note that $H_2 < 0$; $E^G_{P^*_G} < 0$; and $z = sP_G X_G$.)

So, using (9.A.39), (9.A.39.1), (9.A.40) and (9.A.40.1) from (9.A.38), we find

$$T_{2N+3N} < 0 \quad \text{if (i)} \quad \left(W^*-W\right)a_{L2} \geq tP_2 \quad \text{and} \quad \text{(ii)} \quad z\geq W^*\varepsilon_h hL \tag{9.A.41}$$

It may be noted that the term T_{2N+3N} measures the net effect of LEE and DVE (defined in the text) on social welfare.

Therefore, using (9.A.36), (9.A.37) and (9.A.38) and (9.A.41) from (9.A.35), it follows that

$$\left(\frac{1}{V_1}\right)\frac{dV}{dN} < 0 \quad \text{if (i)} \quad \left(W^*-W\right)a_{L2} \geq tP_2 \quad \text{and} \quad \text{(ii)} \quad z\geq W^*\varepsilon_h hL \tag{9.A.42}$$

From Eqs. (9.A.38) and (9.A.40), it may be noted that the second sufficient condition (i.e. $z \geq W^*\varepsilon_h hL$) can be replaced by a few other alternative sufficient conditions.

From (9.A.40) it may be noted that the second sufficient condition (i.e. $z \geq W^*\varepsilon_h hL$) can be replaced by a few other alternative sufficient conditions.

From (9.A.42) one may note that in the absence of any tariff we have

$$\left(\frac{1}{V_1}\right)\frac{dV}{dN} < 0 \quad \text{if } z\geq W^*\varepsilon_h hL \tag{9.A.43}$$

Effect of $\widehat{N} > 0$ on Aggregate Labour Endowment in Efficiency Unit

Differentiating Eq. (9.16) with respect to N gives

$$\frac{dC}{dN} = h' L \frac{dX_G}{dN} \tag{9.A.44}$$

Using (9.A.1) Eq. (9.A.44) may be rewritten as follows:

$$\frac{dC}{dN} = \left(\frac{\varepsilon_h h L}{N} \right) > 0 \tag{9.A.45}$$

So an inflow of foreign capital of type N always improves the human capital stock of the economy.

References

Beladi H, Marjit S (1992a) Foreign capital and protectionism. Can J Econ 25:233–238

Beladi H, Marjit S (1992b) Foreign capital, unemployment and national welfare. Jpn World Econ 4:311–317

Bhagwati JN (1971) The generalized theory of distortions and welfare. In: Bhagwati JN, Jones RW, Mundell R, Vanek J (eds) Trade, balance of payments and growth. North Holland, Amsterdam

Brecher RA, Diaz Alejandro CF (1977) Tariffs, foreign capital and immiserizing growth. J Int Econ 7:317–322

Chanda R (2002) Trade in health services. Bull World Health Organ 80(2):158–163

Chanda R (2008) Issues and concerns in an India-EU trade and investment agreement. Final report. Indian Council for Research on International Economic Relations, New Delhi

Chandra V, Khan MA (1993) Foreign investment in the presence of an informal sector. Economica 60:79–103

Chaudhuri S (2001a) Foreign capital inflow, technology transfer, and national income. Pak Dev Rev 40(1):49–56

Chaudhuri S (2001b) Foreign capital inflow, non-traded intermediary, urban unemployment, and welfare in a small open economy: a theoretical analysis. Pak Dev Rev 40(3):225–235

Chaudhuri S (2005) Labour market distortion, technology transfer and gainful effects of foreign capital. Manch Sch 73(2):214–227

Chaudhuri S (2007) Foreign capital, welfare and unemployment in the presence of agricultural dualism. Jpn World Econ 19(2):149–165

Fujita M (2002) FDI trends in health care. Presentation on WHO international consultation on assessment of GATS and Trade in Health Services, Geneva

Grinols EL (1991) Unemployment and foreign capital: the relative opportunity cost of domestic labour and welfare. Economica 57:107–121

Gupta MR (1997) Foreign capital and informal sector: comments on Chandra and Khan. Economica 64:353–363

Janjararoen W, Supakankunti S (2002) Chapter 8: International trade in health services in the millennium: the case of Thailand. In: Drager N, Vieira C (eds) Trade in health services: global, regional and country perspectives. PAHO, Washington, DC

Khan MA (1982) Tariffs, foreign capital and immiserizing growth with urban unemployment and specific factors of production. J Dev Econ 10:245–256

Lethbridge J (2002) Private investment and international finance corporation investment in healthcare. (www.psiru.org)

Lipson D (2001a) GATS and Trade in Health Insurance Services. Paper no WG4: 7. Commission on Macroeconomics and Health, WHO, Geneva

Lipson D (2001b) The World Trade Organisation's health agenda: opening up the health services markets may worsen health equity for the poor. Br Med J 323:1139–1140

Mackintosh M (2003) Health care commercialisation and the embedding of inequality. Draft paper prepared for the RUIG/UNRISD project on globalization, inequality and health. United Nations Research Institute for Social Development (UNRISD)

Marjit S, Beladi H (1996) Protection and gainful effects of foreign capital. Econ Lett 53:311–326

Mehmet O (2002) The emerging global labour market: some implications for international health. Draft paper for the WHO consultation on imbalances in the health workforce, Ottawa

Outreville JF (2007) Foreign direct investment in the healthcare sector and most favoured locations in developing countries. Eur J Health Econ 8(4):305–312

Pollock A, Price D (2000) Rewriting the regulations: how the World Trade Organisation could accelerate privatization in healthcare systems. Lancet 356:1995–2000

Smith RD (2004) Foreign direct investment and trade in health services: a review of the literature. Soc Sci Med 59:2313–2323

USITC (2007) The economic effects of significant U.S. import restraints: fifth update. Investigation no 332-325, USITC Publication 3906. The United States International Trade Commission

Waitzkin H, Iriart C (2001) How the United States exports managed care to developing countries. Int J Health Serv 31(3):495–505

White K, Collyer F (1998) Health care markets in Australia: ownership of the private hospital sector. Int J Health Serv 28(3):487–510

World Health Organisation (2002) Developing evidence-based ethical policies on the migration of health workers: conceptual and practical challenges. WHO, Geneva

Chapter 10
Sketching the Future Research Path of FDI in Developing Countries

A pertinent aspect of the worldwide liberalization wave has been the easing up of transborder investment, whereby countries have been increasingly welcoming foreign capital in the form of both foreign portfolio investment and foreign direct investment. With the former being more volatile and affecting mainly the stock markets of the host countries, it is the FDI that has stupendous effects on a wide array of economic variables in the host countries, particularly the developing ones.

The general contention in development economics is that FDI brings in the much-needed scarce capital and improved technological know-how. In this book we move a step ahead and try to trace out the intricacies that are intertwined in this general optimistic view. We also highlight many of the other likely outcomes of FDI, both positive and negative, not only on the overall welfare of the host country but also on different markets and variables. We employ rigorous theoretical analysis based on general equilibrium framework and obtain comparative static results to substantiate empirical findings and to find out the factors and specific conditions that lead to such results. We also try to find out whether some alternative results are possible and, if so, under what conditions. Since it is quite usual for FDI to have diverse effects on various variables, this insight into the different dimensions of FDI is likely to be pointer for governments on their prospective policies not only regarding the degree of openness with respect to FDI but also cutting back protectionist policies and heading towards structural reforms. It also has significant implication for other government policies with respect to social issues, like subsidy for education and rural infrastructure development.

10.1 Overview and Policy Implications of Results

Although inflow of foreign capital supplements the indigenously scarce capital, traditional development economists have been sceptical regarding its effect on the welfare of the recipient country. We elucidate the popular established approaches that adhere to such pessimism where welfare deteriorates due to FDI, in terms

S. Chaudhuri and U. Mukhopadhyay, *Foreign Direct Investment in Developing Countries: A Theoretical Evaluation*, DOI 10.1007/978-81-322-1898-2_10, © Springer India 2014

of both two- and three-sector full-employment models with the capital-intensive import-competing sector being protected by a tariff. We explain cases where the adverse effect on welfare is obtained even in the absence of tariff but with distortion in the labour market. The validity of the immiserizing effect is also shown in the two-sector mobile capital HT model that considers rural–urban migration and urban unemployment, as well as within the three-sector framework with the presence of an informal sector in the economy. We show that although in a two-sector specific factor model foreign capital inflow in the export sector raises welfare, the immiserizing result may be valid if the foreign capital is accompanied by a technology transfer that lowers the labour-output ratio of the export sector. All these provide a strong theoretical underpinning behind the cynical approach and the resulting austerity towards allowance of FDI.

Nonetheless, subsequent to the sweep of liberalization, countries have been tremendously enthusiastic in attracting more and more FDI. This calls for exploring the possible underlying positive effects that foreign capital may have on welfare. We show that in an HT framework, inflow of foreign capital may be welfare-improving in the presence of an urban informal sector that uses a specific input. The welfare-improving result of FDI is also likely to be valid when foreign capital flows in the intermediate-good producing sector. Furthermore, FDI may improve social welfare in an HT setting under agricultural dualism, where the backward agricultural sector produces a non-traded final commodity. Even in the otherwise H-O-S model with tariff protection and labour market distortions, the positive effects of FDI can be obtained.

An important dimension that emerges is that developing countries which are characterized by dualism within dualism, distortions in commodity and factor markets and different types of non-traded good may experience diverse welfare consequences due to FDI. Hence, the governments in these countries ought to be more pragmatic and cautious regarding labour market reforms; doing away with tariff is more likely to engender gainful effects due to foreign capital. Moreover, initiatives should be made to channelize FDI to the export sector. Thus, the welfare effects of FDI in developing countries depend considerably on the acumen of the government in prioritizing the area where structural reform policies are to be undertaken, the extent of such reforms and the efficacy with which it can influence the destination sector of FDI.

In order to attract FDI, governments of developing countries often set up special economic zones (SEZs) by adopting liberalized economic policies with respect to taxes, duties, etc. A glaring controversy revolves around the acquisition of fertile arable land for setting up SEZs stemming up the problem of displacement and rehabilitation of farmers. We show that both the agricultural sector and the SEZ may grow simultaneously, and the unemployment problem and the economic conditions of the people may also improve if the FDI is accompanied by adequate government subsidies on irrigation projects and other infrastructure development to raise the productivity of land and hence the effective land endowment of the economy.

Apart from improving the overall growth and welfare of the economy, an important task ahead of governments of developing countries is to ensure that the growth is inclusive and the inequalities within different groups are minimized. One such glaring inequality is between the wages received by skilled and unskilled workers. In many of the Latin American and South Asian countries, the skilled–unskilled wage inequality has deteriorated in the post-reform period, which is contrary to the predictions of the conventional trade models. To explain this apparently perplexing empirical result theoretically, in terms of a three-sector HT model with unionized urban unskilled labour market, we initially show that the change in wage inequality crucially hinges on the differences in the factor intensity conditions. In particular, the relative wage gap may improve the wage inequality when the low-skill sector is capital-intensive. However, closer inspection reveals three important aspects: first, if the urban unskilled wage is insensitive to the rural wage, FDI may not only lead to narrowing of the skilled–unskilled wage gap but also reduce the unemployment of unskilled workers; secondly, in the presence of non-traded intermediate goods, FDI may deteriorate wage inequality if the proportion of unskilled labour employed in the low-skill formal sector is significantly low and the high-skill sector is capital-intensive; thirdly, in the case of a non-traded final commodity, wage inequality worsens if the low-skill sector is capital-intensive and employs only a very small proportion of the unskilled workforce and if the primary export sector is unskilled labour-intensive. These findings may act as pointers to appropriate policy prescriptions. In general, adoption of a capital subsidy policy to the low-skill manufacturing sector so as to increase its capital intensity may be a suitable strategy to reduce wage inequality. Additionally, when the urban unskilled wage is insensitive to the rural wage, the government may resort to labour market reforms and not allow trade unions to link up the wages of their members to the rural wage. However, the presence of non-traded (intermediate and final) goods calls for a wage subsidy that may help in increasing the competitive unskilled wage as well as the proportion of employment of unskilled labour in the low-skill sector.

The second type of inequality is in the form of gender wage inequality that seriously impinges on inclusive growth since it severely reins back the economic empowerment of women. Several empirical evidences show that FDI has considerable widening effect on the gender wage inequality. We have theoretically explained the phenomenon on the basis of skewed access to education and health, along with differences in spending patterns and effects of wages on nutrition between men and women in countries with female labour-oriented export sectors commonly found in developing countries. Nonetheless, the favourable effect of FDI on overall welfare in the presence of gender wage inequality cannot be ignored. On the other hand, increased governmental provision of social services like education and health leads to improvement in wage inequality but may be detrimental for welfare. These results have important implications indicating a trade-off between gender wage inequality and welfare of the economy. Therefore, policies designed to promote FDI should be accompanied by enhanced public provision of social services to accomplish the dual objectives of welfare improvement and reduction of gender wage gap.

Two of the many salient characteristics of the developing countries are: (1) a dualistic economic structure with the existence of both formal and informal sectors and (2) the persistence of unemployment of both skilled and unskilled labour. While unemployment of unskilled labour arises due to various distortions in the labour market, unemployment of skilled labour may be explained by the ‘efficiency wage hypothesis’ and its variants. The HT model suggests that with wage inequality between rural and urban sectors, an urban sector development policy like that of a liberalized investment policy raises the urban unemployment of labour. We incorporate the urban informal sector and unemployment arising due to job search by the workers to show that the effect of an inflow of foreign capital on urban unemployment hinges crucially on the factor intensity rankings of the rural and urban informal sectors. Also, there is a trade-off between reduction of unemployment and achieving growth with foreign capital. However, in the presence of unemployment of both skilled and unskilled labour, although an inflow of foreign capital in agriculture improves social welfare, FDI in the secondary sectors may be welfare worsening; but the unemployment situation of both types of labour unequivocally improves in either of the two cases. These results are significant since they highlight the positive effects of FDI on unemployment of both skilled and unskilled labour, although welfare effects may be varied depending upon a number of factors.

Despite attempts to ameliorate the social evil of child labour, it still continues to persist and remains a vital component of the labour markets in developing countries. Though child labour is believed to be triggered mainly by acute poverty, FDI is supposed to have significant consequences on the problem. Inflow of foreign capital alters the employment patterns and adult wages, affecting the incidence of child labour and their wages. We derive the conditions under which FDI may raise the adult wages and reduce the incidence of child labour. We show in terms of an economy with two informal sectors that while investment liberalization lowers the incidence of child labour when the traded sector is more child labour-intensive than the non-traded informal sector, it might produce a counterproductive effect in the case of the alternate factor intensity condition. However, an education subsidy policy may produce favourable effects on child labour in both the situations. Therefore, direct government policies like education subsidy are likely to be more effective than the trickle-down effect produced by FDI led economic growth to curb child labour. On the contrary, we also show that FDI may lower the prevalence of child labour, even if non-child incomes of the families do not increase, by raising the return to education. This implies that reduction of poverty may not be an indispensable condition for child labour reduction if there is adequate flow of foreign capital.

Of late, FDI is being channelized to a relatively newer destination – the healthcare sector of developing countries, which had historically been predominantly government subsidized. With the expansion and intrusion of foreign capital in the healthcare sector, the different effects on the economy need close scrutiny. We show that welfare may increase due to overall foreign capital inflow in the presence of labour market distortion, although human capital stock may not change. On the other hand, foreign capital inflow specifically to the healthcare sector raises the human capital endowment; but it may be welfare worsening and likely to be further intensified due to trade liberalization policies. These results question the desirability of allowing foreign capital inflow directly in the healthcare sector that generates externalities.

10.2 Scope for Future Research

In this book we have made an attempt to discuss many of the aspects in which FDI can interact with a host of factors and affect the recipient country; nonetheless, there still remain some issues that could not be captured within the purview of the book. We provide an outline of a few of them to enable more exhaustive future theoretical research.

An important benefit of FDI is believed to proliferate from technology diffusion to host-country firms. It is contended that foreign investment brings with it advanced technology and ideas that enhance its direct effect on investment and growth if these factors 'spill over' into the rest of an industry and increase the efficiency of domestic producers (Blomstrom 1989). There are broadly three explanations for how technology spills over from multinationals to domestic competitors: the local firm may learn by observing and replicating the multinationals; employees may leave multinationals to create or join local firms; and multinational investment may encourage the entry of international trade brokers, accounting firms, consultant companies and other professional services, which then may become available to local firms as well.

However, evidences suggest that although spillover effects do exist, the effects are diverse mainly due to differences in the host-country features – varying levels of indigenous human resources, private-sector sophistication, competition and policies towards trade and investment. Even when spillovers do transpire, horizontal spillovers are unlikely. Firstly, since the technology gap between foreign and domestic firms is generally wide, local firms may lack the absorptive capacity needed to recognize and adopt the new technology. Secondly, domestic firms may produce for the local market while multinationals produce for export, entailing differences in quality and other attributes of exported and domestically consumed goods, requiring different production methods which reduce the potential for technology transfer. Thirdly, multinationals may enact measures to minimize technology leakage to local competitors. In contrast, technological benefits to local firms through vertical linkages (both backward and forward) are much more plausible since the multinationals have incentives to provide technology to suppliers to reduce input costs and increase quality (Blalock and Gertler 2005). However, merely extensive linkages between multinationals and local suppliers or buyers do not ensure that net benefits accrue to the local economy as a result of FDI. Rodriguez-Clare (1996) develops a model of linkages and shows that multinationals improve welfare only if they generate linkages over and beyond those generated by the local firms they displace.

A number of cross-sectional studies (Blomstrom and Persson 1983; Kokko 1994; Blomstrom and Sjoholm 1999) find a positive correlation between average industry productivity and the presence of foreign firms in the industry, implying positive productivity spillovers. However, time series analysis by Haddad and Harrison (1993) of Moroccan manufacturing plants and Aitken and Harrison (1999) of Venezuela find a weak negative correlation between plant level total factor productivity growth and the presence of foreign firms in the sector. This calls for extensive theoretical analysis of the factors that may lead to such varied empirical results.

Secondly, a prominent aspect that has led to considerable controversies recently, particularly in India, is regarding FDI in retail sector. In accordance with the WTO's General Agreement on Trade in Services (GATS), which includes wholesale and retailing services, a signatory is liable to open up the retail trade sector to foreign investment. A number of growing countries like China have been successful in harvesting the benefits of FDI in retailing by allowing them in phases. It is believed that farmers and small retailers had on the whole, benefitted due to the improved logistics and procurement in the supply chain, although many of them moved out of their jobs to cities leading to rapid urbanization; however, due to simultaneous growth of cities, the job losses could not actually be felt.

However, the initiative to open up multi-brand retailing in India has triggered considerable apprehensions regarding the fate of the farmers and small retailers. There are crucial differences between the Chinese and Indian cases: first, in India there is the predominance of unorganized retailing that is likely to be more affected; secondly, China opened up to retailing gradually giving local chains enough time and protection to compete with foreign entrants along with setting up 'invisible' barriers to limit foreign entry. It is apprehended that the small retailers would not be able to withstand foreign competition spurring job losses; global retailers would connive and exercise monopolistic power to raise prices and monopolistic power to reduce the prices received by the suppliers. On the other hand, the proponents argue that the trading sector in India is highly fragmented, with the dominance of unorganized small and medium retailing and presence of large number of intermediaries. The cost of business operations is very high due to lack of adequate infrastructure facilities, developed supply chain, integrated IT management and trained work force in retail sector. Therefore, the rationale for FDI in retailing is based on the premises that FDI may be catalytic in stimulating competition in retail industry, lead to infrastructure development, bring about improvements in farmer income and agricultural growth and help in lowering consumer prices inflation due to the dwindling role of intermediaries. Since the foreign retail chains are likely to be set up mostly in urban areas, they need large real estate investments and high variable cost of operation, so that they cannot be the lowest-price retailers; hence, they are likely to be potential threat not to the local retail shops, but the domestic multi-brand retailers. Despite the debates on the legitimacy of the strategy to open up the retail sector to foreign investment in developing countries, adequate theoretical exposition to analyse the pros and cons and the country-specific conditions that might deliver the goods is yet to be done.

Third, the signatories of WTO comprising of the service trade negotiations within GATS are committed to remove any barriers to the trade of education services and opening it up to foreign investment, since the private education sector qualifies as a tradable service. Although economic theory recognizes FDI and human capital as two important conduits for economic growth and that FDI can contribute to the accumulation of skilled labour and the participation in middle school education (Zhuang 2008), the entry of foreign capital directly into the education sector of the developing countries necessitates closer analysis. There are two important aspects of the education sector in these countries: on one hand, education is more a social good, with the governments committed towards providing education to a large section of underprivileged population; on the other hand, liberalization coupled with FDI has raised the demand for educated and skilled people, which severely lacks in supply.

Hence, given the massive demand for quality higher education, inviting foreign universities to set up bases may address the supply-side shortfall. They may provide the required infrastructure for high value-added knowledge services and innovation, give a boost to the educational standards and bring about a reversal in the trend of brain drain from the developing countries, saving them of massive outflows of talent and resources. Moreover, in an increasingly globalized world, free flow of knowledge and collaborative academic endeavours may be mutually beneficial. Therefore, with enrolment ratio in higher education in the developing countries much lesser than the developed ones, a sustainable way to address expanding supply to meet growing demand is government investment, supplemented by public–private partnerships including foreign investments.

However, a major concern regarding such foreign investments is that it can lead to commercialization of higher education, which may inflict adversely on a large section of the society. Foreign investors, driven by the objective of profit making, are likely to make higher education more expensive and unaffordable. They are likely to be involved in the development of a small percentage of elite institutions cornering the government or privately funded institutions and making it difficult for the vast majority of students to gain quality education. They are also in no case expected to comply with the general policies of governments for upliftment of the downtrodden. For example, in India the backward classes enjoy a quota for admission in government educational institutions, which a foreign-owned institution would never implement. To fulfil the dual objectives of overcoming the supply shortage of skilled workers and improving the quality of education, along with minimizing inequalities in access to education, the government needs to bridle the foreign investors by framing and enforcing appropriate regulations. This calls for in-depth consideration of the issue theoretically to ascertain the effects of FDI and the policy prescriptions that may bring out the best from FDI without impinging on the national policy objectives.

Fourth, investment liberalization allowing more FDI makes a country increasingly susceptible to the consequences of worldwide financial crisis. The recent economic and financial crisis that initiated in 2008 led to major decline in world FDI inflows mainly due to reduced access to finance, gloomy market prospects and risk aversion. However, the impact was different across countries and regions.

Developed economies in Europe and North America have been the most affected by the global recession. But due to positive and even relatively high economic growth rates that prevailed despite the economic slowdown in several developing and transition economies including, among others, BRICs (Brazil, Russian Federation, India and China), FDI inflows remained more resilient. Among the developing economies, East and Southeast Asia were most affected by the crisis, while the least affected region was sub-Saharan Africa (UNCTAD 2009). However, there have been very little studies that attempt to find out the reasons for the diverse effects of recession on FDI. While a number of empirical studies and a few theoretical ones deal with the impact of recession, they are primarily targeted towards the effect on the labour market.[1] The interface between recession, foreign capital and labour market still remains to be explored.

Fifth, the role of FDI in environmentally sustainable growth in the developing countries has drawn serious cognizance. It is asserted by the pessimists that the environmental quality of the developing countries is jeopardized due to their low environmental standards, fostering migration of 'dirty' industries to these countries (the industrial flight hypothesis). In addition, the developing countries may deliberately undervalue the environment in order to attract the multinational firms (the 'pollution haven' hypothesis) ending up in unwarranted environmental pollution in these countries.

The optimists, on the other hand, highlight the environmental benefits that FDI tends to generate. Apart from promoting higher incomes, possibly leading to higher levels of investment in pollution prevention and control facilities, it constitutes an important catalyst for the transfer of environmentally sound technologies (EST) to those countries. Environmentally sound technologies are those that protect the environment, are less polluting, use all resources in a more sustainable manner, recycle more of their wastes and products and handle residual wastes in a more acceptable manner than the technologies for which they were substitutes.

The possibilities of EST transfer associated with FDI have important role in stimulating the developing countries to attract FDI. However, successful transfer of EST depends on both regulatory instruments and market-based mechanisms. Strong environmental regulation and enforcement are the main incentives for firms to acquire and transfer new technologies, so that to make foreign investment conducive to the influx of EST, it is imperative to progressively develop and implement strong environmental regulation, nonetheless, allowing for flexibility in the enforcement of environmental standards and having positive disposition towards a plant's experimentation with alternative cost-effective solutions.

Moreover, various direct incentives such as the elimination or reduction of taxes on income or sales from investment, the deferment of taxes, tax holidays and taxation graded according to the level of environmental improvement achieved may be instrumental in creating a favourable investment environment for EST transfer.

[1] The small theoretical literature includes Chaudhuri (2011) and Marjit et al. (2011).

Therefore, it is environmentally viable for countries to pull FDI only if the costs that they have to bear in the form of incentives are outweighed by the environmental benefits from transfer of EST.

The environmental impact of FDI on host countries appears even more debatable in the developing countries due to the persistence of a vast and growing urban informal sector. The presence of a large number of pollution sources in the form of informal sector units that lack knowledge, funds, technology and skills to treat their effluent is likely to frustrate environmental instruments and policies. The informal sector consists of small-scale unregistered units, engaged in the production and distribution of goods and services, with the primary objective of generating employment and income to their participants despite capital constraints.

Empirical evidences indicate that the urban informal sector units mostly produce intermediate inputs for the formal manufacturing sector on a subcontracting basis. In a number of cases, the large industries give subcontract to production units that produce a component of the formal sector output, mostly involving environmentally "dirty" tasks and processes, on an informal basis.[2] Perrings et al. (1995) argue that such subcontracting is an economic way for formal sector firms to avoid investment in ESTs made obligatory by the regulatory authority. This is due to the fact that since the informal sector firms are difficult to identify and monitor, they remain outside the purview of environmental regulations and face fewer incentives to prevent pollution.[3] The interlinkages between FDI and pollution of developing countries may occur in two different ways: firstly, pollution increases due to subcontracting between the formal firms (including the foreign-owned ones) and the polluting informal units; secondly, transfer of EST in firms where there is no such subcontracting has favourable effect on pollution.

Unfortunately, the theoretical literature on the transfer of EST through FDI and its consequences on the developing economies has so far been virtually non-existent.[4] However, there is a paper by Chaudhuri and Mukhopadhyay (2013) that focuses on the nexus between, FDI, informal sector and EST. It shows that FDI in the formal sector involving greater adoption of EST may actually aggravate domestic pollution, while foreign capital inflow in the informal sector without transfer of EST may reduce pollution under a wide range of parameter values. These interesting results question the favourable environmental impact of FDI even if it involves transfer of EST. However, this work does not analyse the welfare consequence of FDI with transfer of EST in a developing economy. If this is worked out, the

[2]For example, in the city of Kolkata, India, leather-tanning process is handled by the informal sector. Similarly, for the garment industry the dyeing of garments are done by the informal sector participants on a subcontracting basis. Both tanning and dyeing pollute the environment.

[3]For a few examples of ESTs in individual firms in Brazil, India, China and Zambia, see Perrings et al. (1995).

[4]Initially, we had the plan to include an additional chapter dealing with these issues. However, we later decided to drop this idea due to some reason.

possibility of existence of a trade-off between pollution and social welfare cannot be ruled out.[5] There is ample scope for further applied theoretical research in this area.

Finally, apart from labour market distortions there also exists imperfection in the capital market in the developing countries. There are two different credit markets – formal credit market consisting of banks, credit co-operatives, etc., and informal credit market consisting of professional moneylenders, traders, landlords, etc. The formal credit market is competitive and supplies credit to the organized production sectors of the economy at relatively low rates of interest. On the contrary, the informal credit market is characterized by high degrees of imperfection and is found to be the major source of credit to the unorganized production sectors like agriculture, urban informal sector, etc. Professional moneylenders, having local monopolistic power, charge exorbitantly high rates of interest from their borrowers. In the presence of formal credit, a market for informal credit exists either because the supply of formal credit is inadequate or because there is delay in the disbursement of formal credit.[6] The interactions of the two credit markets are expected to play a crucial role in determination of the informal interest rate. The existing works in the theoretical literature[7] on the interactions of the two credit markets are built in static one period partial equilibrium framework and deal with a pure agrarian economy. Hence, these models neither can focus on the simultaneous determination of all factor prices nor can analyse the effects of various exogenous changes taking place in the different nonagricultural sectors of the economy on the formal and informal interest rates.

The primary task of the new research on capital market would be to endogenize capital market imperfections in a general equilibrium framework and provide a theory of interest rate determination in the informal credit market adequately taking into consideration the salient features of the informal capital market of the developing economies. In this connection mention should be made of a paper by Chaudhuri and Gupta (2014) that has made an attempt to provide such a theory in terms of a three-sector general equilibrium model starting from the microeconomic behaviour of the informal sector lender in an imperfectly competitive credit market. There are two informal sectors which obtain production loans from a monopolistic moneylender and employ labour from the informal labour market. The moneylender borrows funds from the formal credit market and relends it to the informal sector borrowers and in the process maximizes his net interest income. On the other hand, the formal sector employs labour at an institutionally fixed wage rate and takes loans from the competitive formal credit market. It shows that an inflow of foreign capital raises (lowers) the informal (formal) interest rate but lowers the competitive wage

[5] The possibility of existence of such a trade-off has also been demonstrated by Chaudhuri (2006).

[6] See Chaudhuri and Gupta (1996) and Gupta and Chaudhuri (1997) in this context.

[7] See Chaudhuri (1998, 2000, 2001), Chaudhuri and Gupta (1996), Hoff and Stiglitz (1996), Gupta and Chaudhuri (1997), Floro and Ray (1997), Bose (1998), Jain (1999), Chaudhuri and Ghosh Dastidar (2011, 2014) among others.

rate in the informal labour market when the informal manufacturing sector is more capital-intensive vis-à-vis the informal agricultural sector.[8] FDI, therefore, raises the degrees of distortions in both the factor markets in this case.

However, there are some restrictive assumptions embodied in the work of Chaudhuri and Gupta (2014). It does not take into consideration induced migration and unemployment which are two prominent features of a developing economy. Also, the labour input is homogeneous and there is no distinction between workers with respect to their skills. Besides, some of the essential characteristics of the informal credit market like interlinkages with other markets are missing.[9] Furthermore, the informal credit market is fragmented oligopolistic in nature, and there is a segment in the credit market where informal lenders compete with each other.[10] These limitations justify the need for further research in this area.

References

Aitken BJ, Harrison AE (1999) Do domestic firms benefit from direct foreign investment? Evidence from Venezuela. Am Econ Rev 89(3):605–618

Basu K (1998) Analytical development economics – the less developed economy revisited. Oxford University Press, Delhi

Basu K, Bell C (1991) Fragmented duopoly: theory and applications to backward agriculture. J Dev Econ 36:259–281

Bose P (1998) Formal-informal sector interaction in rural credit markets. J Dev Econ 56:265–80

Blalock G, Gertler P (2005) Welfare gains from foreign direct investment through technology transfer to local suppliers. J Int Eco 74(2):402–421

Blomstrom M (1989) Foreign investment and spillovers. Routledge, London/New York

Blomstrom M, Persson H (1983) Foreign investment and spillover efficiency in an underdeveloped economy: evidence from the Mexican manufacturing industry. World Dev 11(6):493–501, Elsevier

Blomstrom M, Sjoholm F (1999) Technology transfer and spillovers: does local participation with multinationals matter?. Eur Econ Rev 43(4–6):915–923, Elsevier

Chaudhuri S (1998) Inadequate formal credit and informal credit market in agriculture: a theoretical analysis. J Quant Econ 14(2):123–134

Chaudhuri S (2000) Interactions between two informal sector lenders and interest rate determination in the informal credit market: a theoretical analysis. India Econ Rev 35(2)

Chaudhuri S (2001) Interaction of formal and informal credit markets in backward agriculture: a theoretical analysis. Indian Econ Rev 36(2):411–428

Chaudhuri S (2004) Some aspects of agricultural credit in a developing economy. Serials Publications, New Delhi

Chaudhuri S (2006) Pollution and welfare in the presence of informal sector: is there any trade-off? Keio Econ Stud 43(1):21–42

Chaudhuri S (2011) Economic recession, skilled unemployment and welfare. Econ Model 28(3):1435–1440

[8] An emigration of labour also produces the same effects.

[9] See Basu (1998).

[10] See Basu and Bell (1991), Mishra (1994), Basu (1998) and Chaudhuri (2004) in this context.

Chaudhuri S, Gupta MR (1996) Delayed formal credit, bribing and the informal credit market in agriculture: a theoretical analysis. J Dev Econ 51:433–49

Chaudhuri S, Ghosh Dastidar K (2011) Corruption in a model of vertical linkage between formal and informal credit sources and credit subsidy policy. Econ Modell 28(6):2596–2599

Chaudhuri S, Mukhopadhyay U (2013) Foreign direct investment, environmentally sound technology and informal sector. Econ Modell 31(March):206–213

Chaudhuri S, Ghosh Dastidar K (2014) Vertical linkage between formal and informal credit markets: corruption and credit subsidy policy'. In: Marjit S, Rajeeve M (eds) Essays in honor of Professors Amitabha Bose and Dipankar Dasgupta. OUP, New Delhi

Chaudhuri S, Gupta MR (2014) International factor mobility, informal interest rate and capital market imperfection: a general equilibrium analysis. Econ Model 37C:184–192

Floro MS, Ray D (1997) Vertical links between formal and informal financial Institutions. Rev Dev Econ 1:34–56

Gupta MR, Chaudhuri S (1997) Formal credit, corruption and the informal credit market in agriculture: a theoretical analysis. Economica 64:331–43

Haddad M, Harrison A (1993) Are there positive spillovers from direct foreign investment? Evidence form panel data for Morocco. J Dev Econ 42:51–74

Hoff K, Stiglitz JE (1996) Moneylenders and bankers: price-increasing subsidies in a monopolistically competitive market. J Dev Econ 52:429–62

Jain S (1999) Symbiosis vs. crowding out: the interaction of formal and informal credit markets in developing countries. J Dev Econ 59:419–444

Kokko A (1994) Technology, market characteristics, and spillovers. J Dev Econ 43(2):279–293, Elsevier

Marjit S, Kar S, Chaudhuri S (2011) Recession in the skilled sector and implications for informal wage. Res Econ 65:158–163

Mishra A (1994) Clientelization and fragmentation in backward agriculture: forward induction and entry deterrence. J Dev Econ 45:271–285

Perrings C, Bhargava S, Gupta J (1995) The transfer of environmentally sound technology to small and medium scale enterprises in developing countries: a survey of the issues. Paper prepared for UNCTAD, Geneva

Rodriguez-Clare A (1996) Multinationals, linkages, and economic development. Am Econ Rev 86(4):852–873, American Economic Association

UNCTAD (2009) World investment report. Also available at: www.unctad.org/wir or www.unctad.org/fdistatistics

Zhuang H (2008) Does FDI diminish local education spending inequality? An analysis of US panel data 1992–2002. Reg Sectoral Econ Stud 8(2):51–72

Index

S. Chaudhuri and U. Mukhopadhyay, *Foreign Direct Investment in Developing Countries: A Theoretical Evaluation*, DOI 10.1007/978-81-322-1898-2, © Springer India 2014

G

T