GENERAL EQUILIBRIUM ANALYSIS OF GLOBALIZING CAPITAL AND LABOR MOBILITY: ITS IMPACTS ON GROWTH, POVERTY AND INEQUALITY

A Dissertation

Submitted to the National Graduate Institute for Policy Studies (GRIPS)

in Partial Fulfillment of the Requirements for the Degree of

Ph.D. in International Economics

by

Sharif Mosharraf Hossain

September 2019

Abstract

Factor availability is a common constraint both in developed and developing countries, but takes different forms. While abundance of labor and shortage of capital are stylized facts in developing countries, the opposite is typically true for developed countries. If factors were freely reallocated across the world, a country's capital and labor would be employed in sectors where they were most productive and world output would increase. All countries could benefit from the exchange of this higher level of output. While traditional trade theories have considered that the abundance of factors determines trade patterns, cross-border factor mobility also matters in the recently globalized world.

Cross-border factor movements typically take the form of foreign direct investment (FDI) and labor migration. Labor-abundant developing countries are expected to benefit from FDI as it is considered to be a supplement to domestic investment for these capital-scarce economies. Similarly, migrant workers' remittances are one of the major sources of foreign exchange earnings in many developing countries. However, in recent years, remittance inflows in some countries have declined steadily because of the real income reductions of migrants. These income losses have increased the number of returning migrants, making domestic employment less secure.

To address these issues of cross-border factor mobility, we develop both static and dynamic computable general equilibrium (CGE) models. In our first study (in Chapter 3), we develop a static CGE model that describes competition between local firms and multinational enterprises (MNEs) in sectors hosting FDI and the distributional impacts of factor mobility among households. In the second study (in Chapter 4), we extend our

static CGE model to a dynamic one by explicitly incorporating labor markets with endogenous labor supply decisions by households in response to market wages. Migration decisions by households are also endogenously determined in our model in response to a foreign wage premium.

We analyze the impacts of cross-border factor mobility in Bangladesh, which faces globalization in factor mobility. Using a static model, we examine how the benefits of an increase in FDI in the ready-made garments (RMG) sector are transmitted and shared among households with different characteristics, and the appropriate government policies to mitigate adverse distributional problems, if any, created from the increased FDI. Our simulation results demonstrate that FDI would promote both output and exports by the RMG multinationals, but would benefit household groups unevenly. We then demonstrate that human capital development programs targeting an adversely affected group of households could create more equitable gains for these households.

Our dynamic CGE analysis describes how a foreign labor market shock affecting migrants reduces household welfare by lowering wages and increasing unemployment, particularly for unskilled workers in the domestic labor market. Using counteractive policy options, we examine the impacts of FDI promotion in the RMG sector and of a human-capital development program. Based on our results, we conclude that the former policy minimizes the negative impacts of foreign labor market shocks, while a combination of both policies is more equitable.

Dedication

To my late mother Mrs. Mahmuda Begum

and

My father Mr. Mohammed Shahjahan Ali

Acknowledgments

First and foremost, I would like to express my deep and respectful gratitude to my main academic advisor, Professor Nobuhiro Hosoe, for his patience, depth of knowledge, scholarly guidance, and advice throughout the years of my PhD program. I am very lucky to have such an advisor who is very generous with his time and knowledge, and who offered insightful comments and suggestions at each stage of my PhD research. Without his support, guidance, and suggestions, this dissertation would have never been completed. I am also very thankful to the rest of my PhD dissertation committee: Professor Hozumi Morohosi, Professor Takashi Tsuchiya, and Professor Tsunehiro Otsuki for their valuable comments and suggestions that improved my dissertation.

I would like to acknowledge the National Graduate Institute for Policy Studies (GRIPS) and Japan Society for the Promotion of Sciences (JSPS) for their financial support which made it possible for me to pursue the PhD program. This work was partly supported by JSPS KAKENHI Grant Number 18J11669.

My appreciation is extended to all professors at GRIPS who enthusiastically shared their knowledge during my intensive coursework as well as my colleagues at GRIPS for their intellectual discussions and encouragement during my study at GRIPS.

To my parents, Mrs. Mahmuda Begum (who passed away during my PhD study) and Mr. Shahjahan Ali, I thank you very much for your sacrifices in providing me with the foundation to my academic career. Last but not least, my loving thanks go to my wife, Mrs. Sohana Mahboob, for her continuous encouragement, keeping me strong during some tough situations, and devoting her time to take care of our son.

Table of Contents

List of Tables

List of Figures

Acronyms and Abbreviations

ADRL	Autoregressive Distributed Lag
BAU	Business-As-Usual
BDT	Bangladeshi Taka
CET	Constant Elasticity of Transformation
CGE	Computable General Equilibrium
EPZ	Export Processing Zone
EV	Equivalent Variation
FDI	Foreign Direct Investment
FTA	Free Trade Agreements
GATS	General Agreement on Trade in Services
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
GNP	Gross National Product
GOB	Government of Bangladesh
GTAP	Global Trade Analysis Project
ILO	International Labor Organization
IMF	International Monetary Fund
MNE	Multinational Enterprise
OECD	Organisation for Economic Co-operation and Development
RMG	Ready-Made Garments
SAM	Social Accounting Matrix

Chapter 1: Introduction

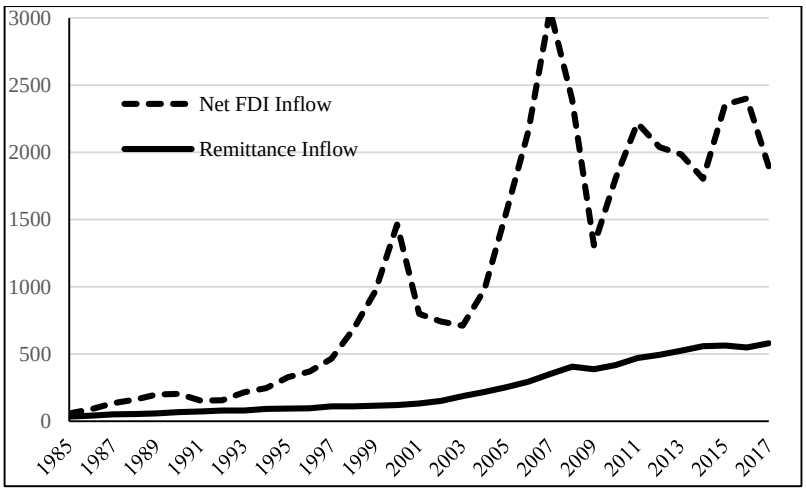
1.1. General Background

Factor availability is a common constraint in both developed and developing countries, although it takes different forms. While abundance of labor and shortage of capital are stylized facts in developing countries, the opposite is typically true for developed countries (Campbell, 2013, p. 8). These allocational differences result in insufficient investment and capital accumulation in developing countries, leading to output constraints in their macroeconomy. In developed countries, shortages of productive workers raise the labor wage and limit production. If factors were to be freely reallocated across the world, countries' capital and labor would be employed in sectors where they were used most productively and world output would increase. All countries would benefit by this exchange through a higher level of domestic output.

In recent decades, different forms of economic integration have increased cross-border trade in goods and services substantially. Traditional trade theories considered that both international trade in goods and cross-border factor mobility have some similar economic consequences (Mundell, 1957, p. 321; Basu, 2009, p. 94). For example, the factor price equalization theorem argues that free trade completely equalizes factor prices, which is a similar consequence to the free movement of factors. Therefore, it is often argued that from the perspective of a labor (capital)-abundant country, imports of capital (labor)-intensive goods and borrowing foreign capital (labor) have similar effects. However, in the real world, these similar economic consequences of free trade in goods and cross-border factor mobility have not been realized, mainly because of the existence

of nontraded goods and services, tariff and non-tariff barriers to trade, high trade and transportation costs, etc. The abovementioned issues raise concerns about factor mobility, arguing that without free movement of capital and flexible labor markets, free trade is not sufficient to accelerate economic growth (Harrison and Rodríguez-Clare, 2010, p. 4042). Therefore, cross-border factor mobility matters in the recently globalized world, and both developed and developing countries could benefit from it.

Figure 1.1: World Net FDI Inflow and Remittance Inflow [Billion USD]



Source: World Bank World Development Indicators

Cross-border factor movements typically take the form of foreign direct investment (FDI) and labor migration. During the last three decades, international capital mobility in the form of FDI and migrant workers' remittances have increased significantly (Figure 1.1). Inward FDI is considered to be the most important source of foreign finance for growth-oriented developing countries (Doytch and Uctum, 2011, p. 411). According to the neoclassical growth model, FDI can promote economic growth by increasing the capital stock in host developing countries (Mallick and Moore, 2008, p. 144). At the same time, recent studies have compared the importance of migrant workers' remittances to

alleviate poverty and hard currency shortages in developing countries (Khatri, 2010, p. 231). When the households of migrant workers receive remittances in foreign currency, the state can increase its holdings of foreign exchange reserves. The home (donor) countries of migrant workers thus have positive impacts both on the microeconomies and macroeconomy of the home countries. In addition, returning migrants, who accumulate human capital by acquiring new skills and knowledge from abroad, help accelerate development of the home (donor) countries.

To boost economic growth, many developing countries are now trying to attract more FDI by liberalizing their investment regimes and providing various incentives and benefits to foreign investors. For example, recently, the Government of Bangladesh has taken initiatives to establish 100 economic zones by 2030, under the *Bangladesh Economic Zone Act 2010*, to attract more FDI by ensuring a business-friendly environment. Similar to Singapore's approach, 150 services needed to establish a business – such as clearance certificates related to foreign borrowing, recruiting foreign employees, access to land, electricity, gas, etc. – will be provided in these economic zones in an automated and digitalized format by implementing the newly enacted *One-Stop Service Act 2018* (Dhaka Tribune, 2018b). Several economic zones are now ready to start operations in fiscal year (FY) 2020. Around USD eight billion worth of investment proposals have already been received from different countries (Dhaka Tribune, 2018a). Similarly, many South and Southeast Asian countries, such as India, Pakistan, Indonesia, and Thailand have also introduced several policies to increase the inward FDI inflow.[1]

[1] For details, please see Ullah (2017).

While the main motive of the FDI attraction policies is the associated economic benefits, there might be some unintended outcomes associated with the increased FDI inflows in developing countries. As FDI usually takes place in the economic zones, growth of multinational enterprises (MNEs) increases the wages of employees working primarily in economic zones. The wage increases in the economic zones then exert upward pressure on the wages of workers in the local firms, harming their competitiveness. It could also create some distributional problems for the benefits of increased FDI because of the changes in factor prices.

1.2. Motivation

Cross-border factor mobility, in the form of both FDI and labor migration, is an important concern for many developing countries. For example, being a capital-scarce country, Bangladesh expects that inward FDI can create new growth opportunities in its major industries. Injection of new foreign capital can provide households with more employment opportunities and alleviate their poverty. The government, in its seventh five-year plan for FY 2016–2020, also emphasizes the necessity of inward FDI in order to achieve a higher level of output and export targets (Planning Commission, 2015, p. 68). However, the actual FDI inflow is very low in Bangladesh, only 1.4 percent of GDP and 3.6 percent of gross capital formation. The poor business environment is considered to be the main barrier creating this low level of FDI. According to the World Bank's Ease of Doing Business Index, Bangladesh ranked 176 out of 190 countries in 2017. To improve the business environment, recently the government set a target to upgrade its position to be among the top 100 FDI host countries through various regulatory reforms (Independent, 2018).

The number of sectors hosting this low level of FDI in Bangladesh is very limited because of some sector-specific barriers to foreign investment (United Nations Conference on Trade and Development, 2013, p. 2). Around 20 percent of total FDI inflow is attracted by the textile and ready-made garments (RMG) industry. The RMG industry is the most important manufacturing sector in Bangladesh, accounting for 13 percent of GDP, 82 percent of total exports, and creating employment opportunities for four million workers (Bangladesh Bank, 2016; International Finance Corporation, 2016, p. 1). Although inward FDI is accepted in the RMG sector, the MNEs in this sector now produce only five percent of total RMG output (Kee, 2014, p. 39). Therefore, further expansion of the RMG sector by attracting more FDI is one of the major policy goals in Bangladesh.

Labor migration, another form of cross-border factor mobility, is also very important for Bangladesh in terms of foreign exchange earnings and poverty alleviation (Abrar and Billah, 2017, p. 148). Unlike the very low levels of FDI inflow, migrant workers' remittances are the second largest source of the country's foreign exchange earnings, which ranked Bangladesh the eighth among the top remittance-receiving countries in the world (Jawaid and Raza, 2014, p. 52). For the last two decades, remittances have helped Bangladesh to achieve high annual GDP growth rates, even in the years of the global recession. However, from 2013 to 2017, the upward trend in the country's remittance inflow turned into a downward trend because of the foreign labor market shock, particularly in the Middle East, which reduced the earnings of migrant workers. This reduction in remittances is considered to be a major risk factor for Bangladesh (International Monetary Fund, 2017, p. 6).

There are several factors behind the earnings loss of the migrant workers of Bangladesh. For example, the economic weakness in the Middle East, resulting from the oil price shocks, has reduced the job opportunities and wages of migrant workers; strict immigration policies in this region restricted the employment of undocumented migrants in formal sectors with higher wages; and high migration costs, as well as high costs of living relative to the wages of migrants in the Middle East have had a detrimental effect (Hussain, 2014). This earnings loss has induced the migrant workers to return, which makes the domestic labor market more vulnerable in terms of both wages and employment. Policy interventions are necessary to mitigate the negative impacts on the domestic economy, which could significantly vary among household groups.

Although the existing literature discusses various aspects of cross-border factor mobility, research gaps still exist, especially in the context of Bangladesh. Most of the recent studies on the effects of FDI in Bangladesh empirically analyzed their impact on economic growth, using aggregate FDI data with a reduced form model and found positive or ambiguous results as discussed in the literature survey in Chapter 2. Studies using sector-level FDI data and structural models, which might reveal a different outcome as Wang (2009) argued, are very rare in the Bangladesh perspective. Similarly, the studies on cross-border labor migration mainly use econometric techniques to investigate the causal link between remittances and economic growth or poverty, and generally found a positive impact of remittances on economic growth and poverty incidence in Bangladesh. None of the existing studies analyze the macroeconomic and/or distributional implications of cross-border factor mobility in the context of Bangladesh.

1.3. Objective

To fill the abovementioned research gap, this dissertation examines the impacts of cross-border factor mobility on household welfare in terms of both levels and distributional equity, and the macroeconomy. More specifically, in our first study, we address the following questions on international capital mobility: i) does an increased FDI inflow in the RMG sector, induced by the regulatory reforms for MNEs, enhance social welfare overall? ii) how are the benefits of FDI inflow transmitted and shared among households with different characteristics? and iii) what are the appropriate government policies to mitigate the adverse distributional problems, if any, created from the increased FDI in the RMG sector? In our second study, our research questions related to international labor migration are: i) how does a foreign labor market shock affect household welfare by changing wages and employment in the domestic labor markets of Bangladesh? and ii) what are the policy options to counteract the negative impacts on the domestic economy, if any, initiated by the foreign labor market shock? The main objective of this dissertation is to answer these questions.

1.4. Methodology

We develop both static and dynamic computable general equilibrium (CGE) models to examine both the short-run and long-run impacts, as well as their economic dynamism, of cross-border factor mobility in Bangladesh. We prefer CGE analysis over other types of methodological approaches, because it allows us to observe the economy-wide impacts in a general equilibrium framework that distinguishes a large number of sectors, factors, and households. In our first study, we analyze the long-run macro and

distributional impacts of FDI promotion in the RMG sector of Bangladesh and a few relevant policy interventions. We extend the standard CGE model by Hosoe *et al.* (2010) by incorporating two subsectors in the RMG sector based on capital ownership to encompass FDI in the model. We further distinguish eight different types of households based on their geographical location, occupation, levels of income, and education.

In our second study, we develop a recursive dynamic CGE model based on our static model to analyze both the short-run and long-run impacts of a foreign labor market shock and the effects of several policy interventions. We extend the model by elaborating labor supply by households, so that we can describe (voluntary) unemployment and endogenous allocation of the workforce between domestic and foreign labor markets in response to the foreign wage premium. This extension allows us to examine how a foreign labor market shock affects the migration decision and labor allocation between domestic and foreign labor markets. We simulate the foreign labor market shock as a migrant workers' wage decline. We also perform policy simulations with two counteractive measures: FDI promotion and human capital accumulation.

1.5. Contribution

This dissertation contributes to the existing literature in the following three ways. First, we conduct pioneering ex ante analyses of the cross-border factor mobility by developing both static and dynamic CGE models in the context of developing countries. Previous studies on both FDI and labor migration in developing countries are mostly ex post in nature and used either reduced-form econometric techniques or qualitative methods to predict the effects of remittances/FDI on some aggregate variables. A very

few studies used a structural CGE model, but with limited features of factor mobility within the model, to examine the impacts of cross-border factor mobility on developing economies. Raihan *et al.* (2009) is one of the very few papers that employed a structural CGE model to analyze the impacts of remittances in Bangladesh. However, it does not incorporate either a labor market for migrant workers or remittances shocks. Therefore, the dissertation contributes to the existing international economics literature by providing CGE analyses with more detailed cross-border factor mobility where we allow for interactions between capital mobility and labor mobility.

Second, we extend the standard CGE model by adding special features to analyze the impacts of sector-specific FDI and foreign labor market shocks. In the static CGE model in Chapter 3, we split the FDI hosting sector into two subsectors based on capital ownership. This extension allows us to examine the impacts of FDI in sectors of interest in developing countries. In our dynamic analysis in Chapter 4, we further extend the model by elaborating labor supply by household by incorporating (voluntary) unemployment and endogenous allocation of the workforce between domestic and foreign labor markets in response to the foreign wage premium. This feature enables us to predict the impacts of foreign labor market shocks on remittance-receiving countries. These methodological developments advance CGE analysis to new dimensions.

Third, the results of our analyses in Chapters 3 and 4 have important implications for contemporary policy issues in developing countries facing globalization. More specifically, the findings of Chapter 3 of this dissertation help the policy makers in developing countries to predict the possible macroeconomic and distributional implications of policies to attract FDI. The results of Chapter 4 show how an earnings

shock to migrants would adversely affect the domestic economy of a typical emigrant country, and how this may be managed using alternative policy measures. The findings of our studies support evidence-based policy making in developing countries, with more knowledge on both its intended and unintended outcomes and management. Applying these new models to real policy issues, we can demonstrate their validity empirically.

1.6. Organization of the Dissertation

The rest of the dissertation is organized as follows. Following this introduction, Chapter 2 reviews both the theoretical and empirical literature on this topic. We review the existing literature, including theoretical studies, cross-country studies, single-country studies, and studies focusing on Bangladesh. The chapter also critically reviews the main contributions and methodological aspects of the existing literature in order to identify research gaps for the dissertation topic.

Chapter 3 examines how the benefits of increased FDI in the RMG sector of Bangladesh are transmitted and shared among households with different characteristics, and the appropriate government policies to mitigate adverse distributional problems, if any, created from the increased FDI. For this purpose, we develop a static CGE model to analyze the macro and distributional implications of a sector-specific FDI. The main intension of this chapter is to examine the long-run impacts of the FDI promotion and counteractive policies using a static model. Our simulation results demonstrate that an increase in FDI promotes both output and exports in the RMG sector.

Chapter 4 investigates both the short-run and long-run impacts of a persistent foreign labor market shock and some counteractive policy measures to minimize the

negative impacts of this shock, using a recursive dynamic CGE model, which is an extension of the static model in Chapter 3. We need to develop a dynamic model and examine how the country can manage the dynamic adjustments to a foreign labor market shock by means of policy instruments. Our simulation results show that a foreign labor market shock would reduce household welfare by lowering wages and increasing unemployment, particularly for unskilled workers in the domestic labor market in Bangladesh. We conclude that FDI promotion in the RMG sector and a human capital accumulation program could manage the negative impacts of a foreign labor market shock. Both chapters examine the impacts of FDI promotion; however, in Chapter 4 we consider it as one of the counteractive policies to mitigate the negative impacts of the foreign labor market shock.

Chapter 5 summarizes the findings of Chapters 3 and 4 with comprehensive concluding remarks. In addition, this chapter provides some policy implications from our main findings and discusses some limitations and future extensions beyond this study.

1.7. Main Findings of the Dissertation

In this dissertation, two studies are conducted. In the first study in Chapter 3, we find that a positive 25 percent FDI shock in the RMG sector would increase both its output and exports. This would then lead to an overall welfare gain of BDT 180 million and a GDP increase of 0.05 percent. Although, these findings are rather straightforward, our study goes beyond them and further investigates the implications of the gains, and the channels through which the shock affects local firms and MNEs as well as different household groups. Our simulation results show that output expansion in the RMG sector

would not occur uniformly among local firms and MNEs. While local firms would expand significantly, MNEs would contract slightly. We also find that the benefits of FDI-induced growth would affect all household groups unevenly, but could be shared more equitably with skills development programs.

In our second study in Chapter 4, we find that a one percent wage rate fall in the foreign labor market of migrants would affect the migration decision of households. The returning migrants would lower the wage and increase the unemployment in the domestic labor market. The country's GDP would increase by 0.06 percent because of the increased availability of workers in the domestic market, while GNP would fall marginally by losing the foreign wage premium that they earned abroad. All household groups would suffer a loss of welfare. Our results also suggest that the counteractive policies of FDI promotion in the RMG sector and of a human-capital development program would minimize the negative impacts of foreign labor market shocks, while a combination of both policies is more equitable because of their synergetic effects.

Chapter 2: Literature Review

The effects of cross-border factor mobility have been widely discussed in both the theoretical and empirical literature. A vast majority of the literature concentrates on the developmental effects of foreign direct investment (FDI) and labor migration including remittances. This section reviews the main contributions of the recent literature to identify research gaps for this dissertation by categorizing it by methodology and research interest.

2.1. Economic Impacts of FDI

FDI is a cross-border investment made by a resident of one country (the home country) with the objective to acquire ownership of assets to establish a "lasting interest" in controlling the activities of a firm in another country (the host country) (Moosa, 2002, p. 1; Organisation for Economic Co-operation and Development, 2008, p. 17). From the perspective of the home (donor) country, Caves (1971) classified FDI into three categories: i) horizontal FDI – investment in similar productive activities abroad; ii) vertical FDI – investment to exploit raw materials or to be closer to the consumers; and iii) conglomerate FDI – investment to amalgamate with another company that produces an entirely unrelated product (Grimwade, 2000, p. 123). However, from the perspective of host countries, FDI is generally classified as i) import-substituting FDI – investment in import-competing industries to meet domestic demand; and ii) export-promoting FDI – investment in export-oriented industries. The effect of FDI on economic development, including its impacts on poverty and income inequality, has been investigated from many perspectives, generating different streams of literature. This section reviews both the

theoretical and empirical strands of the literature, focusing on the determinants of FDI and its economic impacts on a host country's economy.

2.1.1. Determinants of FDI

Considering the importance of FDI on a host country's economic development, a number of theories have identified the determinants of FDI. The differential rate of return hypothesis first explained international capital mobility, postulating that capital moves from low return countries to high return ones until their rates of return are equalized (Moosa, 2002, p. 24). This approach contains a business risk neutrality assumption, irrespective of investment location, *i.e.*, both home and foreign countries are perfectly substitutable. However, the differential return hypothesis is not consistent with some observed characteristics of cross-border capital movements. Two-way FDI flows between countries are often found. Moreover, capital moves in the opposite direction – from high return countries to low return ones. The empirical findings also suggest that international differences in the rate of return of capital are not sufficient to explain the cross-country variation in FDI flows, as surveyed by Agarwal (1980).

Following the theoretical foundation of Tobin (1958) and Markowitz (1959), the portfolio diversification hypothesis relaxed the risk neutrality assumption of the differential rates of return hypothesis and better explained cross-border capital movements. This hypothesis explains that capital flows to low return countries and thereby minimizes investment risks through diversification of investment destinations. Part of the excess profit earned from a high return country is attributable to the premium associated with the investment risk (Castro, 2000, p. 10). While the portfolio

diversification hypothesis partially explained the FDI flows, the market size hypothesis emerged which considered the host country's market size as a determinant of the attractiveness of FDI. While many empirical studies supporting this hypothesis concluded that market size was a significant determinant of FDI (Moore, 1993; Kalyoncu *et al.*, 2015; Boateng *et al.*, 2015; Santos *et al.*, 2017), a survey by A. T. Kearney, an American global management consulting firm, showed that the size of host countries' markets did not matter in attracting FDI (Moosa, 2002, p. 29).

The hypotheses discussed above postulate a perfect market assumption, but this assumption is often criticized for not being consistent with reality (Hymer, 1976; Kindleberger, 1969; Hufbauer, 1975). Consequently, the Hymer–Kindleberger hypothesis of industrial organization suggests that MNEs in the host country face disadvantages against local firms, which arise from the intercountry differences of firm regulations, culture, working environment, etc. Despite such disadvantages, the FDI flows occur mainly because of imperfect markets, where MNEs "internalize or supersede" this imperfection or market failure through direct investment (Hymer, 1976, p. 48). The internalization of a market refers to the replacement of market transactions with internal transactions. For example, if an RMG firm faces a problem in buying fabrics from the market, it may resolve this problem by buying a foreign textile firm – in the form of FDI.

The location hypothesis also explains a significant part of FDI flows. Some factors of production, particularly labor and natural resources, are immobile across countries, keeping the wages and prices of intermediate inputs low in some geographical locations. These cheap raw materials and cheap labor may attract more FDI in those countries. Many other hypotheses describe the determining factors of FDI, such as political stability,

government regulations, and trade openness in the host countries.[2] Political instability in the host country limits FDI by increasing the risks associated with the fiscal and legal frameworks. Government regulations can be attractive or restrictive depending on the host country's investment policy, while trade openness promotes FDI by providing greater market access to MNEs in both input and output markets.

2.1.2. FDI and Growth: Theoretical Views

A large number of theoretical studies have analyzed the effects of FDI on economic growth in host countries. The neoclassical growth model suggests that FDI accelerates economic growth by increasing the capital stock in developing countries, assuming that capital investment is one of the preconditions for economic growth (Adams, 2009, p. 940). However, this growth is achieved only in the short run as countries converge to the new steady state because of diminishing returns to capital (Iamsiraroj, 2016, p. 117). In contrast, the endogenous growth model shows that FDI can ensure long-run economic growth by transferring technologies, skill acquisition, knowledge spillover, and positive externalities in the production process (De Mello, 1997; Borensztein *et al.*, 1998; De Mello, 1999).

Opponents argue, however, that FDI may have negative impacts on the host country's economy because of the *Dutch disease* problem (Sy and Tabarraei, 2010; Alberto, 2015). According to the Dutch disease theory, a large amount of FDI inflow increases the demand for nontradable goods in the host country, pushing up the price of productive factors. The high factor prices and their mobility between the nontradable and

[2] For a more detailed survey of the literature on the driving forces of FDI, please see Moosa (2002).

tradable sectors increase the production costs in both sectors. The increase in production costs raises the prices in the nontradable sector, while the prices in the tradable sector in a small country are fixed in the international market. Therefore, the nontradable sector expands at the expense of the tradable sector, which causes the real exchange rate in the host country to appreciate. The high price of nontradable goods and imports ultimately reduces the welfare of the host country. Contrary to this theoretical prediction, Sy and Tabarraei (2010) empirically found very weak evidence of Dutch disease effects on financial inflows in developing countries.

2.1.3. Cross-Country Empirical Analysis

The empirical findings of the cross-country econometric analyses generally suggested positive impacts of FDI on the host country's economic growth, where the size of the effect depends on the level of economic development (Blomstrom *et al*., 1994), infrastructural development (Kinoshita and Lu, 2006), human capital accumulation (Borensztein *et al.*, 1998), financial market development (Alfaro *et al.*, 2004), and degree of trade openness (Balasubramanyam *et al.*, 1996) in the host countries. The cross-country studies have been widely criticized because of the country-specific heterogeneity of the effects of FDI, unobserved heterogeneity because of omitted variable bias, and the presence of reverse causality (Ericsson *et al.* 2001; Carkovic and Levine, 2005; Nair-Reichert and Weinhold, 2001).

In order to control for country-specific heterogeneity and endogeneity bias, and to test for Granger causality, several studies have used panel data. Their empirical findings on the effects of FDI on economic growth are mixed. Basu *et al.* (2003) used panel

cointegration and Granger causality tests to examine the relationship between FDI and economic growth in 23 developing countries for 1978–1996, and found bidirectional causality between these two variables. Using the same technique, Abbes *et al.* (2015) found unidirectional causality from FDI to GDP growth in 65 countries for 1980–2010. Iamsiraroj (2016) used a simultaneous system of equations approach to examine the effect of FDI on per capita income growth in 124 countries for 1971–2010, and found that FDI was associated with higher per capita income growth and vice versa. Many other studies using panel data estimators (Borensztein *et al.*, 1998; Nair-Reichert and Weinhold, 2001; Baharumshah and Thanoon, 2006; Basu and Guariglia, 2007; Azman-Saini *et al.*, 2010; Bengoa and Sanchez-Robles, 2003) found positive impacts of FDI on GDP growth. However, even after resolving endogeneity problems and controlling for the country-specific effects as well as joint growth determinants, the generalized method of moments (GMM) panel data estimator by Carkovic and Levine (2005) did not find a significant positive impact of FDI on GDP growth. Herzer *et al.* (2008) reexamined the FDI-led growth hypothesis for 28 developing countries using cointegration techniques on a country-by-country basis and found neither a long-term nor short-term effect of FDI on growth.

2.1.4. Single-Country Empirical Analysis

Similar to the cross-country studies, the empirical findings of the single-country analyses on the effects of FDI on economic growth are mixed. For example, Fedderke and Romm (2006) examined the FDI-led growth hypothesis using data for 1960–2003 and found a positive growth effect of FDI in South Africa. Yalta (2013) employed simulation-based inference to examine the causal relationship between aggregate FDI and

GDP in China and revealed that the growth effect of FDI was not observed at the aggregate level. Zhang (2001) examined the causal relationship between FDI and GDP growth in 11 East Asian and Latin American countries and found cointegration and Granger causality from FDI to GDP growth in only five countries. These studies suggest a need for a disaggregated analysis using industry-level FDI data. Aitken and Harrison (1999) used firm-level panel data on Venezuela for 1976–1989 and found a significant negative impact of FDI on the productivity of domestic firms. Similarly, Diankov and Hoekman (2000) found negative effects of FDI on domestic firms in the Czech Republic. Their findings suggest that MNEs established by FDI outperform the local competing firms, but do not expand the domestic market.

2.1.5. Ex Ante Computable General Equilibrium Analysis

While most of the existing studies used econometric techniques with ex post data, a few studies performed an ex ante analysis to predict the effects of FDI using a structural CGE model. Latorre and Hosoe (2016) developed a dynamic CGE model to predict the effects of a decrease in Japanese FDI outflow to China as a shock from the financial crisis in 2009. Their simulation exercise suggests that the decrease in FDI would negatively affect welfare, GDP, and wage rates in China. Arbenser (2004) developed a static CGE model for Ghana and found that liberalizing FDI and tariff regimes would be complementary policies and that both policies would be welfare enhancing for Ghana. Latorre (2016) employed a static CGE model to analyze the impacts of FDI liberalization and tariff reform on male and female wages in Tanzania. The simulation results of that study suggested that regulatory reform would increase the number of firms in Tanzania, increasing both male and female wages. However, the wage rise would be higher for male

workers because they dominate in the expanding sectors in Tanzania. Nana and Poot (1996) analyzed the impact of trade liberalization on factor mobility between Australia and New Zealand using a two-country multisectoral static CGE model and found that the removal of tariffs in Australia would increase FDI inflow.

2.1.6. Bangladesh-Specific Studies

The recent analyses on FDI in Bangladesh focused on its impact on economic growth. Ahmad (1990) estimated a two-gap model for Bangladesh and revealed that foreign capital stimulated its economic growth. Quader (2009) examined the determinants and impacts of FDI by applying an extreme bounds analysis approach for 1990–2005 and found a positive effect of FDI on GDP growth. Using time series econometric techniques, while Dutta *et al.* (2017) found a unidirectional causality running from FDI to growth in Bangladesh, others (Kabir, 2007; Shimul *et al.*, 2009; Islam and Meerza, 2013) found the relationship to be ambiguous.

While most of the above studies used aggregate FDI data, only a few studies attempted to use detailed sectoral data to examine the impacts of FDI in Bangladesh. Khatun and Ahmad (2015) used time series data for 1972–2010 to analyze the impacts of FDI on the energy and power sectors and found that FDI in the energy sector was associated with higher energy consumption and higher GDP growth. Investigating the determinants of FDI in the power sector, Mahbub and Jongwanich (2019) found that regulatory aspects were the most important factors. Kee (2014) analyzed the impacts of FDI in the RMG sector using firm-level data and confirmed a positive impact on firms'

total factor productivity but did not provide any macroeconomic or distributional implications.

2.2. Economic Impacts of Migration and Remittances

International migration is defined as the movement of one country's citizens to live in another country for at least one year (Nijkamp and Poot, 2012, p. 5). International labor migration can be voluntary (primarily for economic and social reasons) or involuntary or forced (mainly for political and environmental reasons). Based on the motives for migration, it can be temporary or permanent. Temporary migrants move to work for a limited period of time, keeping their family members at home. Permanent migrants move with their family to seek resident status in host countries. All types of migration have economic and sociocultural impacts on both the host and home (donor) countries. In this subsection, we discuss only the economic impacts of migration on the home (donor) country.

2.2.1. Determinants of Cross-border Labor Migration

Bodvarsson and den Berg (2013) classified recent theoretical studies on the determinants of migration into three distinct categories, viz. i) migrants as investors of human capital, ii) migrants as consumers, and iii) migrants as household producers. The first group of studies applied a "labor flow" model and argued that wage differentials across countries are the main driving force of migration. This hypothesis argues that the main motive of migrants is to maximize their utility by supplying labor in a foreign labor market that offers the highest real incomes in the world. However, it does not consider any sociopolitical factors, such as family reunions, climate change, religious differences,

or political asylum, which also affect the migration decision. As cross-border migration involves large moving costs and uncertainty, the proponents of this hypothesis view migration as an investment in human capital (Becker, 1975, p. 9). Most of the recent neoclassical analyses on the migration decision started from this basic hypothesis (Bodvarsson and den Berg, 2013, p. 32).

Contrary to expectation, many empirical findings failed to support the "migrant as investor of human capital" hypothesis, finding that wages and earnings differentials were not necessarily a significant factor in the migration decision. Consequently, an alternative view, "migrant as a consumer" evolved based on the idea of Rosen's (1974) hedonic prices and implicit markets (Bodvarsson and den Berg, 2013, p. 35). This argues that migration takes place to consume a desirable basket of goods and services (including public goods, weather, and natural resources) that are only available in another geographical location. Unlike differences in wages and incomes, this hypothesis focuses on differences in consumption goods. As households include their desirable goods and services in their utility function, they maximize utility by migrating and consuming those goods. One's desired consumption basket may change depending on the stage of one's lifecycle, economic growth in home and host countries, technological improvement, and so on.

Finally, the third view, "migrant as a household producer", argues that a household or its family members migrate to minimize their production costs. This hypothesis is somehow similar to that of the "migrant as an investor of human capital" hypothesis, because the higher real wages of migrants are consistent with the higher levels of output by migrants. Many other factors also influence the migration decision, such as a history

of past migration of the family and friends, which gives access to information for migration and reduces migration costs. Furthermore, many push and pull factors, such as poverty, unemployment, overpopulation, personal freedom, economic freedom, and the law and order situation in both the home and host countries also affects the migration decision. Therefore, earning differentials are not the only determinants of cross-border labor migration; many other economic and noneconomic factors significantly influence the migration decision of households.

2.2.2. Migration and Development: Theoretical Views

The debate over cross-border labor migration and development raises two separate theoretical views: optimistic and pessimistic. The neoclassical theory is optimistic about the impact of labor migration on economic development in home countries (Arango, 2000, p. 284). According to this theory, the main causes of international migration are demand–supply imbalances and wage differentials between developed and developing countries (Wickramasinghe and Wimalaratana, 2016, p. 22). Labor migration from poor to rich countries, because of stronger labor demand in the latter, contributes to optimal allocation of productive factors to improve the productivity of an economy (de Hass, 2007, p. 4). While the neoclassical theory of migration mainly discusses labor movements, migration from poor to rich countries also induces a capital flow including remittances in the opposite direction (Taylor, 1999, p. 65; Tolcha and Rao, 2016, p. 3). A developmental role of migration and remittances is realized through their contribution to poverty reduction and the relaxation of hard currency shortages.

A developmentalist also expresses an optimistic view about the possible impacts of migration in developing countries. One channel is that labor migration leads to transferring remittances from rich (host) to poor (donor) countries. Part of these remittances is used to accumulate investment capital that helps the poor countries to achieve higher economic growth by relaxing capital constraints. The returning migrants, with on-the-job training and skills acquired abroad, contribute to human capital accumulation in poor countries with abundant unskilled labor. The returning migrants are expected to invest a large portion of their remittances in small and medium enterprises, which creates job opportunities in the home country (de Hass, 2007, p. 3). However, this optimistic view has been thoroughly criticized by those with structuralist and dependency views.

The structuralist and dependency views are pessimistic regarding the possible impacts of migration, considering that increasingly the emigration of skilled workers involves "brain drain" and "brawn drain" (Penninx, 1982, p. 793) – movement of young workers, which undermines the basis of sustainable development. Migration is also seen to be detrimental to donor countries because large remittance income changes consumption patterns particularly in rural areas, increasing the demand for imported goods. This change adversely affects local economic activities and makes them more dependent on the global economy. The pessimists also argue that remittances are mainly spent on consumable goods, rather than investment (Lipton, 1980). The improvement of household welfare of migrants' families could be vulnerable, because remittances are often a temporary source of their income (de Hass, 2007, p. 5).

Recently, new economics of labor migration shifted the thinking on migration and development by explicitly linking the causes and consequences of migration, anticipating that both positive and negative impacts are possible. According to this approach, a household makes the migration decision to diversify its sources of income in order to minimize risks and secure livelihood (Stark and Levhari, 1982). Theoretically, this view explains the international labor migration between countries with similar income levels. As a livelihood strategy, migration creates opportunities as a potential source of investment capital, particularly in poor countries with imperfect credit and risk markets. This view is consistent with the empirical findings that remittances are countercyclical to the home country's business cycle (Ghosh, 2006, p. 35).

2.2.3. Cross-Country Empirical Analysis

The cross-country analyses on the effects of migration and remittances empirically analyze the impacts of remittances on economic growth and/or poverty. Remittances affect economic growth both directly and indirectly through its channels on macroeconomic volatility, real effective exchange rates, human and physical capital formation, financial development, etc. (Hassan, 2011, p. 8). Pradhan *et al.* (2008) used panel data of 39 developing countries for 1980–2004 and found that remittances had positive impacts on economic growth. This finding is consistent with those of many other cross-country studies (Fayissa and Nsiah, 2010; Mohamed, 2009; Ratha and Mohapatra, 2007; Garcia-Fuentes and Kennedy, 2009; Mchemwa, 2012). However, Chami *et al.* (2003) developed a model that linked the motivation for remittances with their effects on economic activities. The empirical results of this study found a significant negative impact of remittances on economic growth because of severe moral hazard problems. The

International Monetary Fund (2005) and Le (2009) examined the remittance–growth nexus using cross-country panel data and also found either insignificant or negative impact of remittances on economic growth.

Cross-country evidence of the effects of remittances on poverty generally conclude that remittances reduce poverty in developing countries (Adams and Page, 2005; International Monetary Fund, 2005; Jongwanich, 2007; Gupta *et al*., 2009; Anyanwu and Erhijakpor, 2010). Remittances enable the migrant workers' families to secure expenditures on consumption, housing, health, and child education, thus alleviating their poverty (Banga and Sahu, 2010, p. 5).

2.2.4. Single-Country Empirical Analysis

As with the cross-country analyses, the empirical results of single-country analyses on the role of remittances in economic growth and poverty are also mixed. A recent study by Jawaid and Raza (2016) examined the effects of remittances on economic growth in five South Asian countries using time series data for 1975–2009. Their cointegration analysis confirmed a significant positive long-run effect of remittances on economic growth in India, Bangladesh, Sri Lanka, and Nepal; but a significant negative effect in Pakistan. The paper argued that luxurious consumption and "brain drain" generated the negative impacts in Pakistan. However, using an autoregressive distributed lag (ADRL) approach, Qayyum *et al.* (2008) found a significant positive impact for Pakistan. Many other country-specific studies examining the causal relationship between remittances and economic growth found a positive relationship (Srivastava and Chaudhary, 2007; Majagaiya, 2009; Jayaraman *et al.*, 2012), while some other studies

found the relationship to be ambiguous (Jawaid and Raza, 2012; Karagoz, 2009; Waheed and Aleem, 2008).

2.2.5. Ex Ante Computable General Equilibrium Analysis

CGE models are frequently used to analyze not only trade liberalization programs but also cross-border labor migration issues. Walmsley and Winters (2005) employed a multi-country CGE model to analyzed the removal of restrictions on the temporary movement of natural persons under mode 4 of the General Agreement on Trade in Services (GATS). Not considering the actual bilateral migration flows, their modeling framework assumed a global pool of temporary migrants, collecting workers from their home countries. These migrant workers are allocated across regions based on demand for migrants in each region with a quota on their temporary moves that mimics restrictions on migration. Their simulation results showed that the removal of restrictions on both skilled and unskilled labor movements would increase welfare in all countries, with the donor countries gaining more. Using a dynamic CGE model with similar features, Walmsley *et al.* (2015) analyzed the impact of migration on GDP in East and Southeast Asian countries and found that an increase in the number of labor migrants would lead to larger GDP in both the host and home countries.

Holzman (2018) examined the potential economic effects of managed migration by simulating changes in remittances and/or labor force in a CGE model for Afghanistan. The results showed that a larger remittance receipt under managed migration would reduce GDP because of an increase in net imports induced by the exchange rate appreciation. The positive impact of managed migration on GDP would be achieved with

policies that increase literacy among the working population in Afghanistan. David and Marouani (2015) developed a dynamic CGE model, with an endogenous allocation of labor force between domestic and foreign labor markets, to examine how the migration channel affects the labor market in Tunisia during a crisis in the migrant-receiving countries. Their simulation results suggested that a crisis in the host countries would negatively affect GDP, wages, and employment in Tunisia. However, their study did not discuss the welfare and distributional implications of the crisis among different household groups.

2.2.6. Bangladesh-Specific Studies

The empirical literature on cross-border labor migration used mainly econometric techniques to analyze the determinants of remittances and their impact on economic growth and poverty incidence in Bangladesh. The studies identifying the determinants of remittances (Barua *et al.*, 2007; Hasan, 2008; Datta, 2014; Islam and Nasrin, 2015) found that income differentials between host and home countries, exchange rates, inflation, and petroleum price were the significant determinants of remittance inflows in Bangladesh. Most of these studies examined macroeconomic indicators of the home country (Bangladesh) but rarely examined factors in the host countries' economies and labor markets. The one exception is Rana (2015); the size of the labor force, consumer price index, exports, imports, government expenditure, and exchange rates of the host countries were found to be important.

The studies related to the impacts of remittances are focused mainly on their impact on economic growth and poverty incidence. Siddiqui *et al.* (2012) used time series

econometric techniques to investigate the causal links between remittances and economic growth and found a unidirectional positive effect from remittances to economic growth. Hassan and Shakur (2017) and Kumar *et al.* (2018) found a nonlinear U-shaped relationship between remittances and total factor productivity in Bangladesh. Raihan *et al.* (2009) used a static CGE model to analyze the role of remittances on poverty incidence in Bangladesh and found a positive impact. Many other time series econometric studies (Khan, 2008; Hatemi-J and Uddin, 2014; Raihan *et al.*, 2017) found that remittances reduce poverty.

2.3. Conclusion

This section reviews the recent theoretical and empirical literature focusing on the determinants, and more specifically the economic impacts, of cross-border factor mobility. Some of the determining factors, such as a high rate of return to capital, cheap labor, and greater market access for MNEs, have positive impacts on FDI inflows. However, factors such as investment regulations and their risks, act as impediments. Regarding the determinants of remittances in Bangladesh, almost all the studies examined only home countries' macroeconomic factors and overlooked factors related to the host countries and their labor markets.

There is also a lack of consensus in both the theoretical and empirical literature regarding the effects of FDI/labor migration on the host/home country's economy. These cross-country and single-country econometric analyses produced conflicting results, probably because of endogeneity problems, and omitted variable bias and reverse causality. In reduced-form analyses with aggregate FDI data, the heterogeneous effects

of FDI inflows among sectors are often offset to make the overall effects ambiguous. Although, some econometric and a few CGE analyses used sector-level FDI data and obtained clear-cut results, they did not consider any linkages between their sectoral impacts or the distributional implications among households, which are often important in the context of developing countries such as Bangladesh.

Similarly, these econometric studies on labor migration mainly examined the effects of remittances on aggregate macro variables and paid little attention to the equity issues. While a couple of CGE analyses distinguished labor markets of migrant workers from those of domestic markets to analyze the impacts of cross-border labor mobility, they employed representative household models and thus failed to discuss any equity issues caused by shocks to labor markets. It is worth mentioning that these studies did not examine the synergetic role of migration and FDI or explore policy measures that pursue growth and equity under these two types of factor mobility. These research gaps identified above have major policy concerns not only in Bangladesh but also in many developing countries. The dissertation tries to fill these research gaps by developing both static and dynamic CGE models with these two new features in the globalized world.

Chapter 3: Foreign Direct Investment in the Ready-Made Garments Sector of Bangladesh: Macro and Distributional Implications

3.1. Introduction

Foreign direct investment (FDI) is a major component of cross-border factor mobility in the current globalized world and is anticipated to accelerate economic growth by relaxing a capital constraint that is particularly serious in developing countries. This anticipation has been reflected in recent policies in Bangladesh to establish a business-friendly market environment for foreign investors. Bangladesh, being a labor-abundant country, is expected to benefit from FDI as it is considered to be a supplement to domestic investment. The country has been adopting policies to liberalize its investment regime through various incentive measures to attract foreign investors in its major industries.

The ready-made garments (RMG) industry is the most important manufacturing sector in Bangladesh. It accounted for 82 percent of total exports and 13 percent of gross domestic product (GDP) in 2016. Around four million workers are employed in this sector; among them, 50 percent are from rural areas. More than 20 million people in Bangladesh are dependent on this sector for their livelihood (International Finance Corporation, 2016, p. 1). The RMG sector, by creating many employment opportunities, especially for unskilled workers, has contributed to a reduction in poverty and inequality in the country. The backward linkages of this sector are also strengthening the textile, power, accessories, and spare-parts industries. Considering its large contribution, further expansion of the RMG sector by attracting FDI and the acceleration of its ongoing development has received enormous attention in Bangladesh. That large RMG sector, however, cannot fully utilize the abundant labor force. The surplus labor emigrates abroad

and sends a large amount of remittances. The remittance amounts to 6.1 percent of GDP, comparable with 36.7 percent of total export, in 2016 to alleviate domestic poverty and hard currency shortage under a growing trade deficit.

While the RMG sector is currently dominated by local firms, it was initially established by joint venture agreements with multinational enterprises (MNEs) in the 1980s. Under those agreements, technological know-how and the marketing networks of the MNEs were combined with abundant cheap domestic labor to help Bangladesh obtain market access in western countries (Alam and Natsuda, 2016, p. 320). The number of MNEs in the industry has decreased in recent decades, and domestic firms now produce around 95 percent of RMG output in Bangladesh (Kee, 2014, p. 39). This decline in the number of MNEs can be attributed to restrictive government policies that created an unfavorable business environment. The World Bank's ease of doing business index ranks Bangladesh very low.

In the absence of any effective laws to regulate FDI, several complex rules have been enforced by various authorities with overlapping administrative procedures. Sector-specific investment regulations have restricted FDI in high-growth industries such as garments, pharmaceuticals, and telecommunications (United Nations Conference on Trade and Development, 2013, p. 2). MNEs have to satisfy at least seven procedures in registering businesses and experience frequent inspection (on average 17 a year) by regulatory agencies after starting a business, and thus organizations incur sizable monetary and time costs. The National Board of Revenue frequently reopens decade-old complex tax cases, targeting MNEs that filed applications for profit repatriation. The repatriation process can be ongoing until the settlement of the tax dispute (US Trade

Representative, 2017, p. 45). An electricity connection and access to land are also very costly and time consuming for MNEs. The country now has sufficient electricity generation capacity, but a poor transmission and distribution system often interrupts the power supply to manufacturing plants. Land ownership barriers include "lack of coherence, outdated laws, a poor land registry and frequent court disputes related to land titles" (United Nations Conference on Trade and Development, 2014, p. 7)[3]

The government has taken several measures to improve this business-unfriendly environment and attract FDI. The establishment of export processing zones (EPZs) in 1983 was a milestone. A substantial amount of FDI in Bangladesh has taken place in EPZs because of various tax incentives and facilities offered to investors, therefore, it has partially achieved its objective of creating more job opportunities by promoting exports (Kathuria *et al.*, 2016, p. 256). From 2006 onward, FDI became permitted outside the EPZs, which had been restricted previously. Another milestone was the establishment of the Bangladesh Economic Zone Authority in 2010.[4] It is scheduled to create 100 economic zones within 15 years to facilitate investment and create new job opportunities.

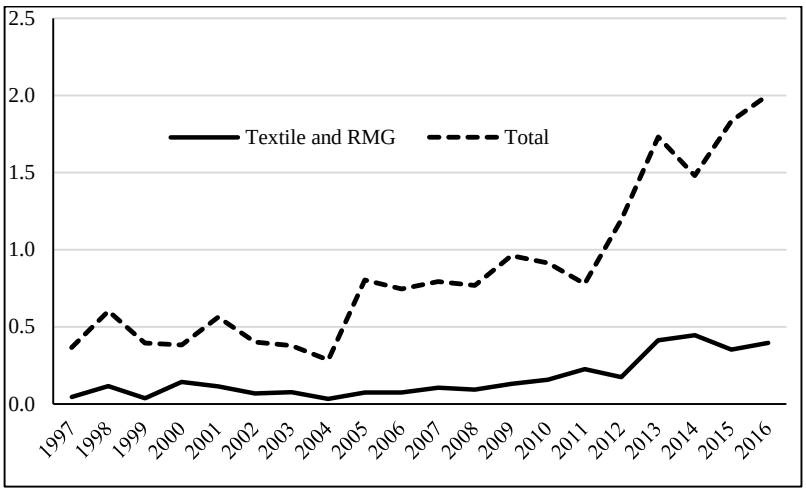
Despite these liberalizing measures to attract FDI during the last two decades, the total FDI inflow has been historically very low at 3.6 percent of the country's gross capital formation in 2016 (United Nations Conference on Trade and Development, 2017, Annex Table 5) (Figure 3.1). The average FDI-GDP ratio in 2011–2015 shows that Bangladesh

[3] Both MNEs and citizens of the US filed cases complaining about the fraudulent sale of land in Bangladesh (US Trade Representative 2017, p. 46).

[4] Besides several tax exemptions, the main nonfiscal incentives include permission for 100 percent foreign ownership; no ceiling on foreign investment; issuance of work permits to foreigners up to five percent of total employees of an industrial unit; 50-year land lease period with a possibility of extension; 20 percent sale to domestic tariff areas; provision of transfer of shares of foreign shareholders to local shareholders and investors; etc.

is ranked 149 among 179 countries. The FDI-GDP ratio of Bangladesh is 1.4 percent, whereas most Southeast Asian countries have a ratio well above two percent (Raihan and Ashraf, 2016, p. 2).

Figure 3.1: Net FDI Inflow in Bangladesh (1997–2016) [Unit: Billion USD]



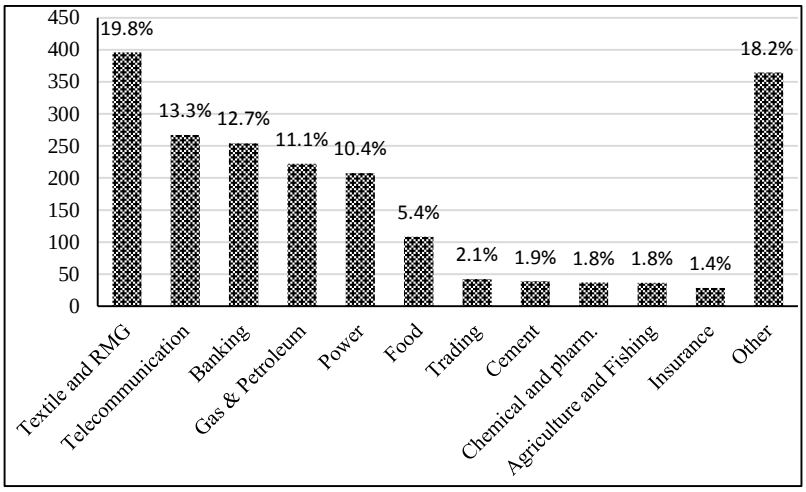
Source: Based on Bangladesh Bank (2016)

Among this low level of FDI inflow, the largest share, around 20 percent of the total inflow in 2016, is attracted by the textile and RMG sector in Bangladesh (Figure 3.2). In recent years, service sectors, such as telecommunication and banking, attracted considerable FDI because of their privatization policy. While the high growth achieved in the RMG sector is mainly from indigenous investment, there is substantial scope for further expansion of the RMG sector by increasing exports through FDI mainly from the current major FDI donors, such as South Korea and Hong Kong as well as the UK.[5] As the FDI in the RMG sector requires unskilled workers, poor households are expected to be the main beneficiaries of FDI. However, the reemergence of RMG MNEs may have

[5] The significance of Hong Kong might need careful examination considering the possibility that it serves as a way station for FDI (from mainland China), as argued by Blanchard and Acalin (2016) for Hungary's FDI to the US.

some negative impacts on domestic RMG firms because they compete with each other for cheap labor and export markets. While there is a consensus among policy makers, academia, and civil society regarding policies to attract FDI, the impact of FDI on the domestic economy—especially, trade-offs between competition among domestic firms and MNEs in the RMG sector and on the distributional outcome among firms and households—is not self-evident in the Bangladesh context.

Figure 3.2: Net FDI Inflow in Bangladesh by Major Sector in 2016 [Unit: Million USD]



Source: Based on Bangladesh Bank (2016)

Recent literature on FDI in Bangladesh mainly analyzed its impact on GDP growth and found it to be positive (Ahmad 1990; Dutta *et al.*, 2017), but also often ambiguous (Kabir, 2007; Shimul *et al.*, 2009; Islam and Meerza, 2013). Most of these studies use aggregate FDI data and reduced-form models; sector-level FDI data and structural models are rarely used. As Wang (2009) argued, an examination with aggregate FDI data, which the previous studies used, might blur the effects of FDI and lead to ambiguous results. Thus, Wang (2009) used sector-level FDI data for 12 Asian countries,

including Bangladesh, and found that the growth effects depend on the sectors hosting the FDI. The growth effects are found to be strong for manufacturing FDI, compared with nonmanufacturing FDI. More detailed sector-specific FDI studies are scant. Khatun and Ahmad (2015) found that FDI in the energy sector was associated with higher energy consumption and higher GDP growth in Bangladesh. Kee (2014) analyzed the impacts of FDI in the RMG sector using firm-level data for Bangladesh and confirmed a positive impact on firms' total factor productivity but did not provide any macroeconomic or distributional implications.

The above backdrop raises some pertinent questions for Bangladesh. Does an increased FDI inflow in the RMG sector, which could result from regulatory reforms for MNEs, enhance social welfare overall? How are the benefits of FDI inflow transmitted and shared among households with different characteristics (rural–urban, rich–poor, landowner–landless, highly educated–poorly educated)? In the context of Bangladesh with abundant labor force, what are the appropriate government policies to mitigate the adverse distributional problems, if any, created from the increased FDI in the RMG sector? To answer these questions, we need a comprehensive macroeconomic framework that can be used to examine the above-mentioned dilemmas in Bangladesh. We develop a computable general equilibrium (CGE) model for Bangladesh that describes competition between local firms and MNEs in the RMG sector and the distributional impacts among households and then simulate an FDI increase. Using counterfactual experiments, we find an overall welfare gain through a rise of wages but detect that a certain household group is negatively affected by the FDI increase. We subsequently

explore policy interventions targeted at this social group to achieve a more equitable distribution of gains.

The remainder of the chapter is organized as follows. Section 3.2 describes the methodological approach, data, and simulation scenarios. The simulation results are presented in Section 3.3, while Section 3.4 provides concluding comments.

3.2. Methodology and Data

3.2.1. The Model

To overcome the existing controversies, we simulate an FDI increase in the RMG sector to predict the possible macro impacts on output and household welfare by using a static CGE model, developed based on the standard CGE model by Hosoe *et al.* (2010), which computationally implements the theoretical framework of Arrow−Debreu's general equilibrium model. This model allows us to examine the economy-wide impacts with details of sectoral inputs and outputs, and income and expenditure of social groups of interest. It enables us to identify how the FDI in the RMG sector affects these macro and micro variables and who ultimately receives the benefits. We extend this standard model in two ways. Following Latorre and Hosoe (2016), we include two subsectors of the RMG sector. One subsector hosts MNEs, whose capital is provided by the foreign owner. The other subsector hosts only local RMG firms, whose capital owners are domestic households. This extension linking the FDI incidence in the RMG sector to the macroeconomic outcome in the structural model is an important extension over previous studies that either use reduced form econometric techniques or focus on aggregate macro variables. We distinguish eight different types of households (rural–urban, rich–poor,

landowner–landless). This allows us precisely to depict the mechanism through which FDI affects the RMG sector, and how its impact is propagated in the macroeconomy and shared among different social groups. As the RMG sector is large in Bangladesh, resource constraints, especially factor markets, and the distribution of gains/losses among households, are explicitly considered in our general equilibrium model.

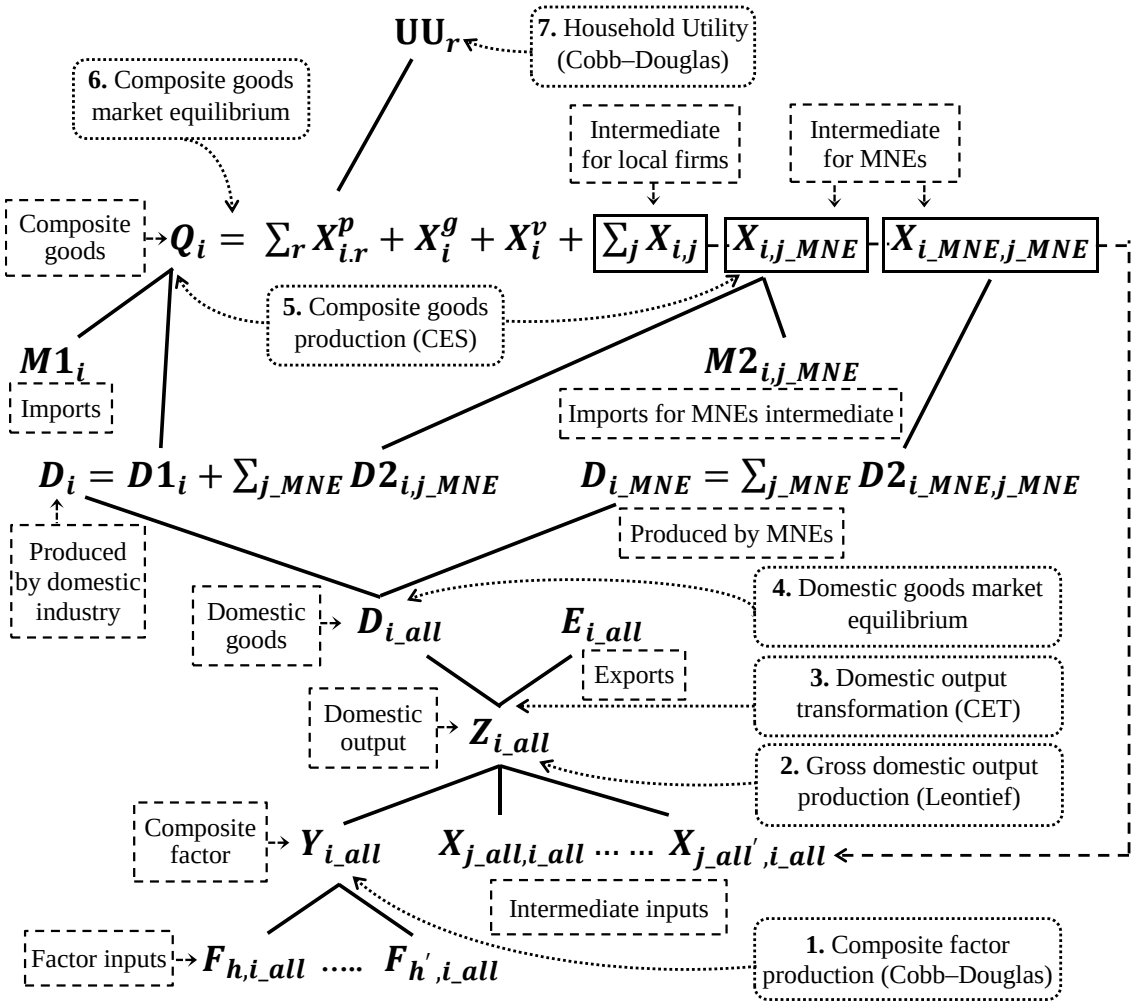
3.2.1.1 The Structure of the Bangladesh CGE Model

The basic structure of the model is presented in Figure 3.3. The bottom part (label 1) of the figure shows that in the *i_all*-th sector a composite factor (Y_{i_all}) is produced by employing all factors of production (F_{h,i_all}) using a Cobb–Douglas-type production function.[6] Domestic output (Z_{i_all}) is produced using the composite factor and *j_all*-th intermediate inputs (X_{j_all,i_all}). A Leontief-type production function is assumed for the production function (label 2). A constant elasticity of transformation (CET) function is assumed to describe the transformation of domestic output into exports (E_{i_all}) and domestic goods (D_{i_all}), shown by label 3. Domestic goods are supplied to the *i*-th domestic firms (left part) and *i_MNE*-th MNEs (right part) (label 4).[7] The domestic goods produced by domestic industries (D_i) are used for two purposes. A large portion of these goods ($D1_i$) is combined with imports by local firms of intermediate and final goods ($M1_i$) to produce Armington composite goods (Q_i) using a constant elasticity of substitution (CES) production function. For the RMG sector only, the other portion of

[6] The *i_all*-th (or *j_all*-th) sector includes local firms and MNEs. The *i*-th (or *j*-th) sector includes only the former; the *i_MNE* (or *j_MNE*) sector includes the latter.
[7] The MNEs and FDI are considered only for the RMG sector.

domestic goods ($D2_{i,j\_MNE}$) is combined with imports ($M2_{i,j\_MNE}$) for the production of composite intermediate inputs for the *j_MNE*-th MNEs, using a CES function (label 5).

Figure 3.3: Structure of the Bangladesh CGE Model



As, according to the Bangladesh data (discussed later), the RMG MNEs are 100 percent export oriented and do not supply for domestic consumption, the domestic goods produced by MNEs (D_{i_MNE}) are only used for self-intermediate uses (X_{i_MNE,j_MNE}). The Armington composite goods are used as intermediate inputs by domestic industries ($X_{i,j}$), consumed by the *r*-th household ($X_{i,r}^p$), consumed by the government (X_i^g), and used for

investment (X_i^v) as shown by label 6. Household utility (UU_r) depends on the consumption of ($X_{i,r}^p$) (label 7).

In our model, household incomes are generated from factor incomes, government transfers, and foreign remittances. We distinguish 15 industrial sectors and five factors (local and foreign capital, skilled and unskilled labor, and land). We assume that factors are fully employed while factor prices (rate of return on capital, wage rates, and rental rate for land) are flexibly adjusted to achieve factor market equilibrium. All the factors are assumed to be mobile across sectors. We assume that MNEs use foreign capital but no local capital; the local firms use only local capital for simplicity.[8]

The government generates its revenue from direct income taxes, production taxes, and import tariffs, whose tax rates are exogenous. The government proportionately allocates its revenue among consumption, household transfers, subsidies, and savings. The foreign sector receives payments from net imports and the remuneration of foreign capital. The foreign exchange rate is flexibly adjusted to ensure the current account deficit is unchanged in USD terms. As a small country assumption, we set world prices of exports and imports to be exogenous in USD terms.

3.2.1.2 Expected Impacts of FDI

An increase in FDI in the RMG sector, which is presumed to be induced by a better business environment, would expand the production capacity of the RMG sector. This leads to more competition between the MNEs and local firms in output and labor

[8] As the foreign capital is used only by the MNEs in the RMG sector, this factor is sector-specific and cannot move to other sectors.

markets. Local firms would lose their sales in the output market. Local firms are also harmed in the labor market as the increased labor demand by the MNEs increases wage rates. As the increase in the MNEs' output and exports is likely to exceed the contraction in the output and exports of local firms, aggregate RMG output and exports would increase. This would relax the balance of payment constraint and allow more imports of goods and services, leading to an expansion of the attainable consumption set for domestic households in general.

The aggregate gains from the FDI increase are captured by households through factor income and thus may be unevenly shared among households. As the composition of factor income varies among households, there may be a household worse-off from the adverse change in factor prices on their major income source, under the injection of foreign capital.

3.2.2. Model Estimation and Splitting the RMG Sector

The model is calibrated to the Bangladesh social accounting matrix (SAM) for 2012 with Armington elasticities of substitution and transformation provided by the GTAP version 9 database (Hertel, 1997). The Bangladesh SAM for 2012 was constructed by the Planning Commission of Bangladesh on the basis of input–output tables for 2012, SAM coefficients for 2006–07, Household Income and Expenditure Survey, and Economic Survey of Bangladesh (Policy Research Institute, 2012, p. 3). This SAM has 86 sectors and is aggregated into 15 sectors for our FDI simulation.[9]

[9] The Section I.1 of Appendix I shows the mapping of the original and aggregated SAMs.

The RMG sector in the SAM is further divided into two subsectors: one for domestic firms and the other for MNEs established with FDI. This split is a key feature of our CGE modeling exercise focusing on the FDI incidence. To split the RMG sector, sales and sourcing patterns of MNEs obtained from Kee (2014) are used as weights for estimation of the MNEs' inputs and outputs in the RMG sector. We assume that the share of sales and exports of MNEs are 5.5 and 5.6 percent of total sales and exports of the RMG sector, respectively. The share of imported inputs in total intermediate inputs for the MNEs in the RMG sector is estimated to be 87 percent according to the survey by Kee (2014). The MNEs' input coefficients, which determine their backward linkages, are assumed to be similar to those of local firms. As all the MNEs in the RMG sector are 100 percent export oriented and have no forward linkages, our SAM describes only self-intermediate uses and exports by MNEs.

In our CGE model, we distinguish eight household categories reported in the original Bangladesh SAM 2012 (Table 3.1). Rural households are divided into six categories based on income class, land ownership, and occupation, whereas urban households are divided into two categories by household head education. The income of these households is generated from factor income, government transfers, and foreign remittances. Figure 3.4 shows the share of income generating factors in total household income, which accurately represent these household characteristics. Among these eight household groups, urban highly educated households generate most of their income from skilled labor wages, while urban poorly educated households do so from unskilled labor wage. Rural nonagricultural rich households depend heavily on capital income. Rural

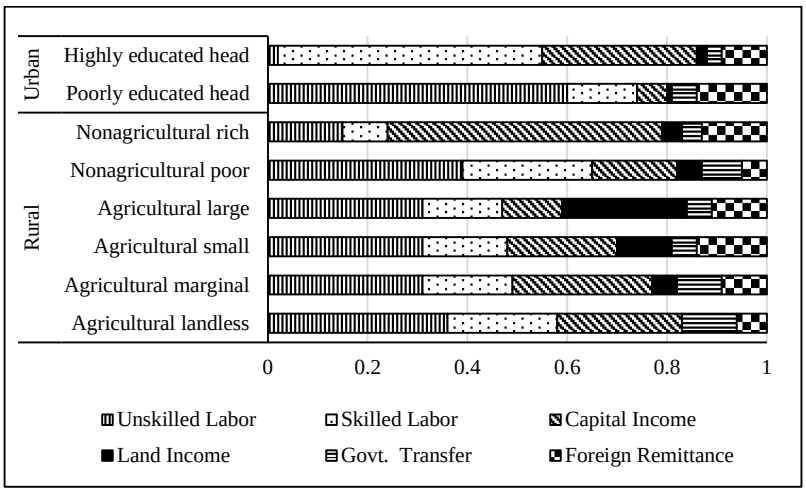
agricultural large households generate considerable amounts of income from land. Other households generate most of their income from unskilled labor wages.[10]

Table 3.1: Definition of Household Types

Household type	Description
Urban	
Highly educated	Head has more than 8 years of schooling
Poorly educated	Head has 1–8 years of schooling
Rural	
Nonagricultural rich	Not engaged in agricultural activities and owns more than 0.5 acres of land
Nonagricultural poor	Not engaged in agricultural activities and owns fewer than 0.5 acres of land
Agricultural large	Agricultural households who own more than 2.49 acres of land
Agricultural small	Agricultural households who own 0.5–2.49 acres of land
Agricultural marginal	Agricultural households who own up to 0.49 acres of land
Agricultural landless	Agricultural households who have no land

Source: Bangladesh Bureau of Statistics (2011) and Policy Research Institute (2012)

Figure 3.4: Share of Income Generating Factors in Total Household Income



Source: Bangladesh SAM 2012

[10] Our SAM also shows different consumption patterns among households, but the differences are not large.

We finalize the SAM by correcting an apparent statistical error in the original SAM data. The original SAM records an unreasonably large level of RMG exports, compared with actual export data reported in Export Receipt Statistics (Bangladesh Bank, 2016). To balance the SAM, we use the latter RMG export data and adjust the RMG inventory change data, which report a large negative value because of the above-mentioned export data error.

3.2.3. Simulation Scenarios

We set three simulation scenarios to analyze the macro and distributional impacts of FDI in the RMG sector of Bangladesh. In simulation 1, we assume an increase of the FDI stock in the RMG sector by 25 percent. Simulation 2 uses the assumption in simulation 1 plus a skill development program that equips unskilled labor of rural nonagricultural rich households with skills equivalent to those that skilled labor possesses. Simulation 3 uses the assumption in simulation 1 plus a foreign-worker training program that makes the unskilled labor of the same household emigrate abroad for higher wages. Details of these scenarios are provided below.

3.2.3.1 FDI Increase

In scenario 1, we assume an FDI stock increase in the RMG sector of 25 percent, which is comparable to a 0.035 percent increase in base run GDP, induced by regulatory reforms that attract FDI. Future regulatory reforms taken by the government cannot be predicted. Hence, we take an alternative approach by using a government-set policy goal that makes the country as attractive as other Asian countries in terms of being an FDI destination.

Attractiveness as an FDI destination is often measured by the World Bank's ease of doing business index. The country's current rank is very low at 176 out of 190 countries in 2017 (Table 3.2).[11] The overall rank is calculated using a range of country-specific factors. For instance, Bangladesh's rank in access to electricity, which is vital for modern industries, is 187 out of 190 countries. This is very poor compared with India (rank 26), Vietnam (rank 96), Malaysia (rank 8), and Indonesia (rank 49). The factors used in the electricity rank are "procedures, time and cost to get connected to the electricity grid, the reliability of the electricity supply and the transparency of tariffs" (World Bank, 2017, p. 14). The time required to get a permanent electricity connection is 429 days in Bangladesh, compared with only 46 days in India and Vietnam, 31 days in Malaysia, and 59 days in Indonesia (World Bank World Development Indicators). This reflects the very poor energy infrastructure in Bangladesh, which is one of the main impediments to attracting FDI. Another constraint to FDI inflow in Bangladesh is access to land to start up a new business, particularly when investing in the manufacturing sector. The time required to register a property in Bangladesh is 244 days, whereas it takes only 47, 51, and 25 days in India, Sri Lanka, and Indonesia, respectively. The difficulties with the land transfer and land administration systems in Bangladesh have resulted in a rank of 185.

[11] This index is constructed by considering government regulations on 10 factors affecting business life and investment decisions in a country. These factors are starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting minority investors, paying taxes, trading across borders, enforcing contracts, and resolving insolvency (World Bank, 2017, p. 1).

Table 3.2: World Bank's Ease of Doing Business Ranking 2017

	Bangladesh	Vietnam	Malaysia	Indonesia	Sri Lanka	India
Overall rank	176	82	23	91	110	130
Area-specific rank:						
Starting a business	*122*	*121*	*112*	*151*	*74*	*155*
Dealing with construction permits	*138*	*24*	*13*	*116*	*88*	*185*
Getting electricity	*187*	*96*	*8*	*49*	*86*	*26*
Registering property	*185*	*59*	*40*	*118*	*155*	*138*
Getting credit	*157*	*32*	*20*	*62*	*118*	*44*
Protecting minority investors	*70*	*87*	*3*	*70*	*42*	*13*
Paying taxes	*151*	*167*	*61*	*104*	*158*	*172*
Trading across borders	*173*	*93*	*60*	*108*	*90*	*143*
Enforcing contracts	*189*	*69*	*42*	*166*	*163*	*172*
Resolving insolvency	*151*	*125*	*46*	*76*	*75*	*136*

Source: World Bank Doing Business Database

In our experiment, we assume that the Bangladesh government implements reforms in these areas so that the country can improve its rank to 126, which is comparable to the ranks of countries such as Vietnam, Sri Lanka, and India. Given this target, we estimate the magnitude of FDI increase achieved in the improved business environment. Several studies (Wei, 2000; Aizenman and Spiegel, 2006; Jayasuriya, 2011; Zhang, 2012; Duval and Utoktham, 2014; Corcoran and Gillanders, 2015) estimated the marginal effect of host country's deregulations and found a significant positive impact on FDI. For instance, Corcoran and Gillanders (2015) used average FDI stock data for the period 2004–2009 and found that the business environment, represented by the World Bank's ease of doing business rank, affected the FDI inflow stock and that an increase in the rank by one position was associated with an increase in the FDI inflow stock by 0.56 percent.

Based on their estimate, our policy goal will increase the FDI stock by around 25 percent. This is the rationale for our assumption of a 25 percent increase in the FDI stock in the RMG sector in simulation 1. In our model, the remuneration of foreign capital is transferred to the foreign owners, not captured by domestic households.[12]

3.2.3.2 Human Resource Development Programs

As discussed below, the results of simulation 1 show that rural nonagricultural rich households would be adversely affected by the FDI increase. To mitigate this adverse impact, we consider two hypothetical skill development programs for households. In the first program, 4,000 unskilled workers are assumed to be given technical and vocational training to become skilled workers and earn the skill premium. The skill premium is estimated to be 148 percent, which is 10,206 Bangladeshi taka (BDT) per month per worker, based on the Bangladesh labor force survey and the SAM.[13] This premium estimate implies an increase in skilled labor wages of 821 million BDT (or 0.4 percent of the skilled labor endowment) at the sacrifice of unskilled labor wages of 332 million BDT (or 0.1 percent of the unskilled labor endowment) for rural nonagricultural rich households in total. Simulation 2 incorporates these endowment changes along with the 25 percent increase in the FDI stock in the RMG sector assumed in simulation 1.

[12] It should be noted that we assume the policy outcome (indicated by the ranking) but not any specific policies that could achieve this goal. The feasibility, effectiveness, and implementation costs of the policies should be examined separately.

[13] To compute the changes in endowment income resulting from the proposed program, the share of skilled and unskilled labor in Bangladesh is calculated based on the World Bank (2013). These are 28.5 percent and 71.5 percent, respectively. Using the data of the working labor force from the Ministry of Finance (2015) and total skilled and unskilled labor wages from the Bangladesh SAM 2012, the average skill premium is calculated as 10,206 BDT per month per worker.

In the second human resource development program, the same number of unskilled workers are assumed to be given training to emigrate and work abroad for a migration premium that is estimated to be 187 percent or 12,956 BDT per month per migrant worker. Based on our assumed migration premium, by getting jobs in international labor markets, the remittance earnings of these workers would increase by 954 million BDT (or 0.09 percent of total remittances) at the sacrifice of the same amount of unskilled labor wages.[14] Simulation 3 incorporates these endowment change and remittance receipts, which is exogenous in BDT, in addition to the FDI stock increase assumed in simulation 1.

We ignore costs of these programs. While this assumption may seem too simple, it could be found permissible considering the following simulation context. First, the assumed number of trainees is only 0.6 percent of total enrollments of formal training programs in Bangladesh (Asian Development Bank, 2016, p.2). Second, many of those training programs are provided as part of various skill development projects financed by development partners, such as the World Bank and the Asian Development Bank. Therefore, we do not expect our simplifying assumption could affect our macroeconomic simulation results seriously.

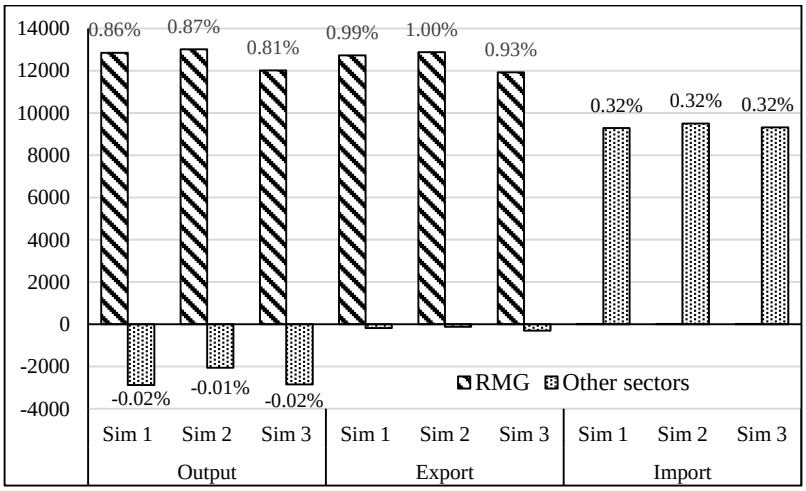
[14] Siddiqui (2016) reported that remittances per male migrant are around 200,000 BDT a year in Bangladesh, mainly from Saudi Arabia, United Arab Emirates, the United States of America, Malaysia, Kuwait, and Oman. Based on Siddiqui (2016) and our interview with Bangladeshi government officials, we estimate the remittances to be 238,478 BDT per year per migrant in Bangladesh. To verify the robustness of our simulation results with these two human resource development programs, we conducted a sensitivity analysis. The results are reported in the Section I.2 of Appendix I.

3.3. Simulation Results

3.3.1. Sectoral Impact of FDI Increase

The 25 percent FDI stock increase (simulation 1) would expand total production of the RMG sector by 0.9 percent from the base quantity (Figure 3.5). Because the RMG sector is highly export oriented, its output increase almost entirely is exported. The expansion of the RMG sector can occur by mobilizing resources, especially labor, from other sectors, and thus leads to a contraction of output in the other sectors by 0.02 percent. The decrease in domestic production of these other sectors is compensated for by increased imports of 0.3 percent, which are made possible by the increase in RMG exports and the induced appreciation of the BDT.

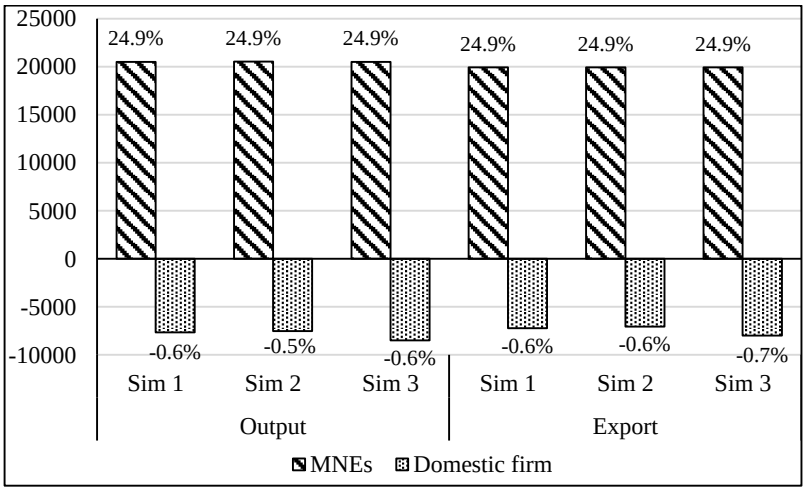
Figure 3.5: Impacts on Output and Trade [Unit: Million BDT and Percentage Change from the Base]



Note: Sectors other than the RMG sector are aggregated into "Other sectors" in this figure but reported in detail in Figure 3.7.

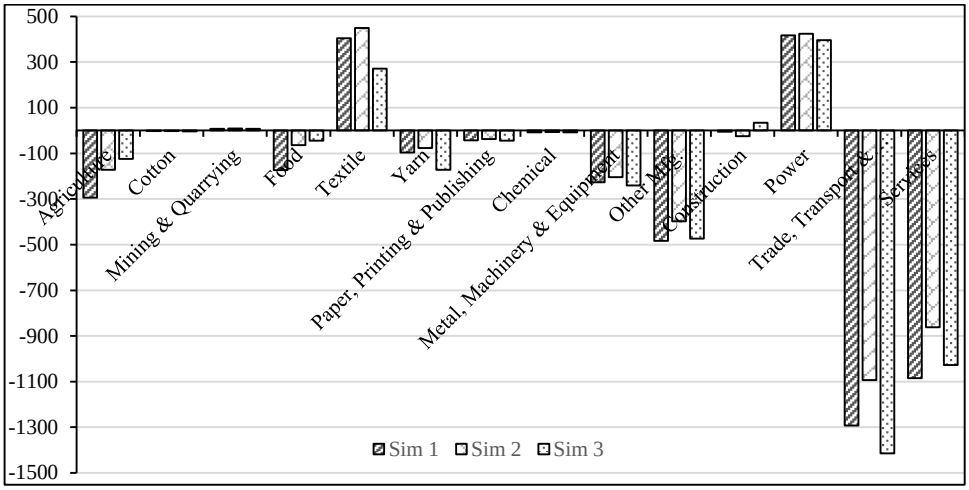
The output and export expansion in the RMG sector would not occur uniformly between MNEs and domestic firms (Figure 3.6). While MNE output and exports would increase significantly, by as much as the magnitude of the FDI increase, domestic firms would experience a slight contraction. This happens because the increase in FDI makes MNEs more aggressive both in the factor and output markets, and captures some of the market share of the domestic firms. However, the gains by MNEs dominate the losses by domestic firms, so that overall RMG output would expand as shown in Figure 3.5.

Figure 3.6: Changes in Output and Exports by MNEs vs. Domestic Firms in the RMG Sector [Unit: Million BDT and Percentage Change from the Base]



The increase in the FDI stock in the RMG sector also affects the output of the other 14 sectors in different ways (Figure 3.7). While output in many sectors would decline, the textile and power sectors would experience an output gain through backward linkages with the RMG sector. Besides the backward linkages, differences in factor intensity also explain the variation of the output changes among sectors. As the FDI stock increase would make labor less readily available, labor-intensive sectors, especially service sectors, would contract significantly.

Figure 3.7: Change of Output in the Other Sectors [Unit: Million BDT]

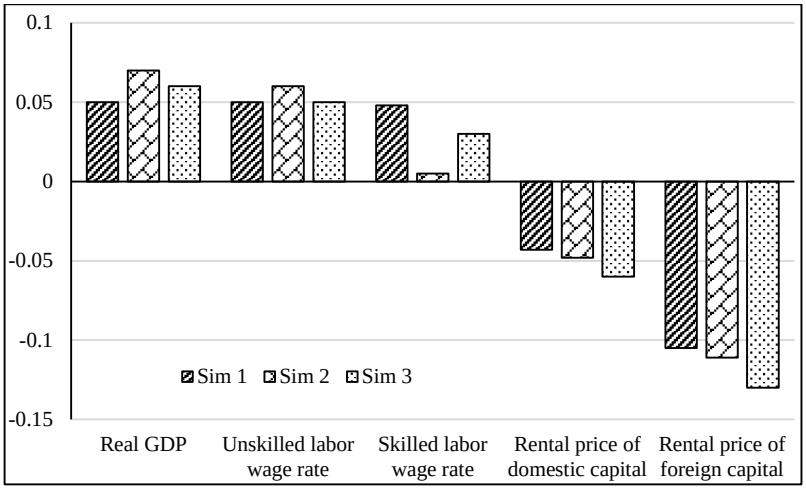


3.3.2. Macro Impact of FDI Increase

In simulation 1, the increase of the foreign capital stock in the RMG sector by 25 percent would increase the country's real GDP by 0.05 percent (Figure 3.8). The impact of FDI promotion on the changes of GDP might seems small because of the low initial FDI level in absolute terms.[15] Behind the GDP gains, skilled and unskilled wage rates would rise, reflecting demand increases in the RMG MNEs. While the rental price of foreign capital falls sharply because of the assumed FDI increase, the rental price of domestic capital also falls, though marginally. This is because the increase in production by the RMG MNEs associated with the FDI increase caused declines in the other sectors, especially the domestic RMG firms, which employ a large amount of domestic capital.

[15] Although the 25 percent FDI increase seems large in percentage term, the absolute value is small because the initial level of FDI inflow is 2.1 percent of GDP and 3.4 percent of country's gross capital formation.

Figure 3.8: Impact on Real GDP and Factor Prices [Unit: Percentage Change from the Base]

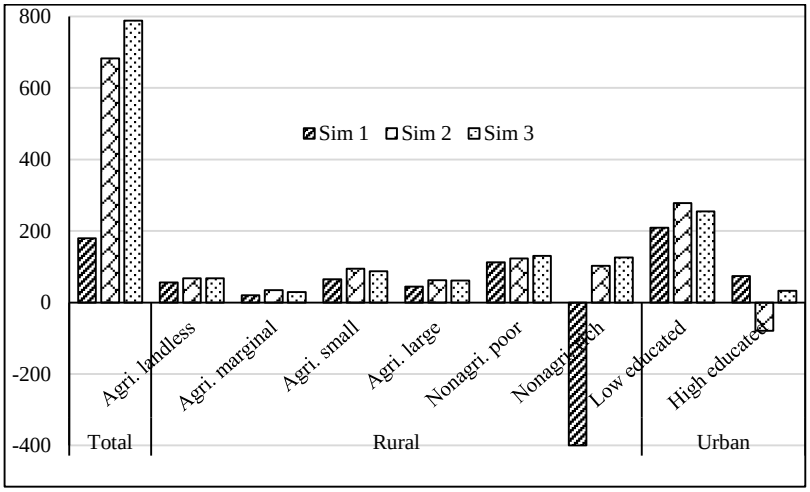


Note: As land is chosen as a numeraire, its price is not shown

3.3.3. Impact on Household Welfare and Distribution

The FDI stock increase in the RMG sector (simulation 1) would improve aggregate household welfare by 180 million BDT, measured by Hicksian equivalent variations (EVs) (Figure 3.9). This welfare impact can be broken down into that for eight individual household groups. The breakdown shows that all the household groups would experience a positive welfare gain, except the rural nonagricultural rich households, which suffer a welfare loss of 400 million BDT. This household is highly dependent on domestic capital income (55 percent of total income) (Figure 3.4), whose return is predicted to fall by around 0.04 percent in simulation 1 (Figure 3.8).

Figure 3.9: Changes in Household Welfare [Unit: EV in Million BDT]



Note: The household types are explained in detail in Table 3.1.

3.3.4. Human Capital Development Programs

From the viewpoint of distributional equity of gains from the FDI increase, the outcome of simulation 1 may be unacceptable for the government and/or households left behind. We thus further investigate distribution policies as remedies for this equity issue.[16] Although the rural nonagricultural rich household is just relatively richer in rural areas where poverty incidence is high, it still needs support to manage the negative welfare impacts. In simulations 2 and 3, we assume two skill development programs targeted at the rural nonagricultural rich household to alleviate the above-mentioned adverse impact on them. The results show that these human capital development programs enable these households to earn wage premiums in the skilled and foreign labor markets. In simulation 2, rural nonagricultural rich households would become net welfare gainers

[16] The new allocation demonstrated in simulation 1, which harms rural nonagricultural rich household, would be rejected by Pareto's criteria if the original allocation is accepted as a fair allocation by the society. To the contrary, if the society finds the original allocation is too favorable for these households because they are now relatively rich in rural areas, the new allocation would be accepted without amendments such as in simulations 2 and 3.

(Figure 3.9). Aggregate household welfare would also improve further, and urban highly educated households would experience a slight welfare loss, by facing more severe competition from the newly transformed skilled labor supplied by rural nonagricultural rich households. As shown in Figure 3.8, the gain in the skilled labor wage rate would almost disappear.

When training is provided for foreign labor markets (simulation 3), such a negative side-effect on the skilled wage rate is not experienced by urban highly educated households (Figure 3.8). The human capital development program for foreign labor markets ensures an equitable distribution of gains in society (Figure 3.9). While urban highly educated households experience a positive gain, the other seven household groups would enjoy a gain comparable with that in simulation 2.[17] Needless to say, instead of the training programs, a cash transfer program from the gainers to the losers can be an alternative and efficient solution, if available.

In terms of sectoral output (Figures 3.7 and 3.8), the skill upgrading assumed in simulation 2 would improve output in all the sectors compared with their sectoral output in simulation 1. In contrast, the outcome of simulation 3 appears controversial. Compared with the outcome of simulation 2, the sectoral output would decrease in many sectors. Furthermore, RMG exports would be lower than that in simulation 2 (Figure 3.5). This is partly because the emigration promoted by the skill development program reduces the

[17] The welfare estimates for the urban highly educated households depend on our assumptions about skill premiums. When we assume a higher/lower skill premium in simulation 2, a larger/smaller welfare deterioration would be realized for these households. However, our assumption about the migration premium would not substantially affect the welfare estimates of these households in simulation 3. See Section I.2 of Appendix I for details of the sensitivity analysis.

domestic endowment of unskilled workers and partly because the program increases remittances, which leads to an appreciation of the BDT, which thus reduces RMG exports.

3.4. Conclusion

This chapter attempted to measure quantitatively the impacts of an FDI increase in the RMG sector on the macroeconomy in Bangladesh and welfare of households, which are heterogeneous especially in income sources, using a general equilibrium framework. Our simulations demonstrated that the FDI stock increase in the RMG sector would increase both its output and exports. This would then lead to an overall welfare gain of 180 million BDT and a modest GDP increase of 0.05 percent. What is important, however, are the distributional implications of gains, tradeoff between losers and gainers, and channels on how shocks affect local firms and MNEs as well as different household groups. Because of the competition between MNEs and domestic firms, the output of domestic firms would fall slightly. By examining the welfare effects of the household groups, we found that the benefits of FDI-induced growth would not be transmitted to all household groups equally. One out of the eight household groups would experience a welfare loss, mainly because of a deterioration of its (domestic) capital income.

To ensure an equitable distribution of the benefits among household groups, we considered two skill-development programs that improve the human capital of the adversely affected household group. One program, converting unskilled labor to skilled labor in the domestic market, would benefit the households adversely affected by the FDI increase but, at the same time, would harm other households that largely depend on skilled wage income. The other program, to train emigrant workers, would not create any losing

households but may achieve a smaller domestic production gain, because the program allows the labor force to go abroad in exchange for remittances.

The study in this chapter has certain limitations. First, we used a static model with full employment, whereas Bangladesh suffers structural deficiencies in its labor markets. When we model unemployment explicitly, the FDI increase would not be constrained by the labor endowment and therefore, might intensify its positive welfare effect. In this sense, our aggregate welfare-impact estimates are lower bound estimates. However, welfare estimates for individual household groups would not be self-evident because the increase in labor income depends on the reduction of unemployment in each household, not the changes in wage rates. Nevertheless, our full employment assumption provided us with a benchmark for any extension with unemployment. Second, we assumed that the skill development programs were costless, other than the opportunity costs of the transformed unskilled labor, given our simulation context that only a small fraction of labor force enrolls. The costs needs to be considered explicitly when this type of policy intervention becomes large scaled. Third, the static nature of our model could not capture the effects of physical and human capital accumulation and productivity changes in the long run. Training and education may need a substantial amount of time; emigrants may return home as the domestic economy develops after several years. Our analysis can be further extended to a dynamic analysis to examine the short-run and long-run effects of factor mobility.

Chapter 4: Welfare and Equity Impacts of Cross-Border Factor Mobility in Bangladesh: A General Equilibrium Analysis

4.1. Introduction

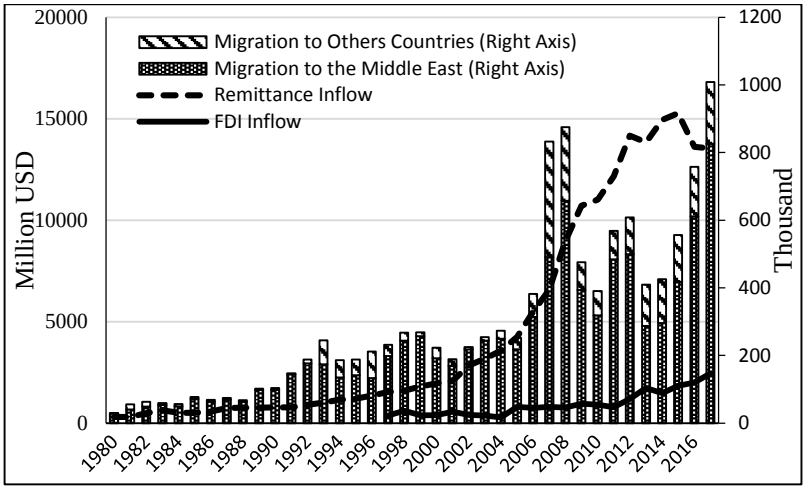
Recent decades have witnessed a considerable intensification of global economic integration. Cross-border trade in goods and services has increased substantially through bilateral and multilateral free trade agreements (FTAs), leading to higher economic growth and improved welfare, particularly in the member countries. FTAs used to cover mainly cross-border movement of goods and services, but now also involve factor mobility, typically in the forms of labor migration and foreign direct investment (FDI). As traditional trade theories have viewed that the abundance of factors determines trade patterns (Heckscher–Ohlin model), cross-border factor mobility also matters in the recently globalizing world, as labor migrates from poor to rich countries, and capital moves from rich to poor countries.

Inbound labor migration to rich countries can relax labor supply constraints on growth and increase economic mass to exploit economies of scale. Poor countries can use remittance income to reduce poverty among households, earn foreign currency, and acquire skills through returning migrants (ILO/OECD/World Bank, 2015, p. 10). Similarly, as a supplement to domestic investment, FDI can relax the capital-availability constraint in the host countries (Mallick and Moore, 2008, p. 114). The donor countries can benefit from the availability of cheap labor and intermediate inputs, and by enjoying greater market access of their products. However, problems can also arise. Continued emigration can undermine sustainable development. Rich countries exploit the services

of relatively skilled workers that were educated and trained by developing countries using their limited budgets (Beine *et al.*, 2001, p. 276; Hanson, 2009, p. 180). Furthermore, FDI inflows can create severe competition between local firms and multinational enterprises (MNEs) in both output and labor markets in the host countries. Growth of MNEs increases the wages of employees working in export processing zones where most MNEs are located, whereas the wages of workers employed by local firms may be stagnant.

While outward migration can increase the welfare of poor households in the short run, many unskilled migrants miss the opportunities for training and education, which hinders human capital accumulation in the long run. As MNEs are technology and knowledge intensive and thus tend to hire skilled workers, human capital accumulation can create a synergy effect with FDI/MNEs. Human capital development to meet the demand for highly skilled workers makes part of the labor force temporarily unavailable, worsening poverty incidence in the short run. In the long run, a wage increase can reduce poverty and improve income equality. The above-mentioned dilemmas relating to factor mobility and human capital accumulation create two tradeoffs in a poor country: a tradeoff between short-run poverty alleviation with remittances and long-run growth with human capital accumulation, and a tradeoff between competition among local firms and MNEs with the presence of FDI. These tradeoffs are serious in Bangladesh, which faces many constraints: employment opportunities, foreign exchange earnings by remittances, poverty incidence, and human capital quality and availability.

Figure 4.1: Migration, Remittances and FDI in Bangladesh (1980–2017) [Unit: Million USD and Thousands of Workers]



Source: Bureau of Manpower, Employment and Training Database; Bangladesh Bank (2017)

Bangladesh is one of the largest remittance recipient countries in the world. Remittances are the second largest source of foreign exchange earnings in Bangladesh, after exports of ready-made garments (RMG), which is the most important manufacturing sector in Bangladesh. From 2007 to 2017, remittances accounted for eight percent of gross domestic product (GDP) and 47 percent of total exports, and funded 34 percent of the country's total import payments (World Bank World Development Indicators). The remittance receipts (Figure 4.1) enabled Bangladesh to maintain a balance of payments surplus despite facing a continuously growing trade deficit (Abrar and Billah, 2017, p. 148). Remittances contributed significantly to improving household welfare and reducing headcount poverty (World Bank, 2006, p. 120; Raihan *et al.*, 2009, p. 17). However, in recent years, remittance inflows have declined steadily because of real income reductions

among migrants working in the Middle East (Figure 4.1).[18] This is a major risk factor for Bangladesh (International Monetary Fund, 2017, p. 6).

These income reductions have resulted in an increase in the number of returning migrants, which makes domestic employment in Bangladesh less secure. Given this external labor market shock, policy interventions are necessary to mitigate its negative impact on the domestic economy. For example, more job opportunities need to be created by encouraging more FDI. However, inward FDI in Bangladesh is very small at present, less than two percent of GDP (Figure 4.1). The poor business environment is the main barrier as indicated by the World Bank's *Ease of Doing Business Index*, in which Bangladesh ranked 176 out of 190 countries in 2017. The returning migrants are most commonly unskilled workers and are therefore more of a threat to the job security of domestic unskilled workers than skilled ones. While the transformation of unskilled workers to skilled ones through human capital development programs is a solution, this skill transformation creates another tradeoff between short-run wage loss and long-run wage increase.

The studies on factor mobility in Bangladesh mainly examined the impacts of remittances and FDI on economic growth and/or poverty. Siddique *et al.* (2012) found a causal link from remittances to economic growth in Bangladesh. Studies, such as Khan (2008), Raihan *et al.* (2009), Hatemi-J and Uddin (2014), and Raihan *et al.* (2017), found

[18] Several factors can explain the real income reduction among migrant workers in the Middle East. First, the economic weakness in the Middle East, resulting from the oil price shocks, has reduced the job opportunities and wages of migrant workers. Second, strict immigration policies in this region restricted the employment of undocumented migrants in formal sectors with higher wages. Third, high migration costs, as well as the high cost of living relative to the wages of migrants in the Middle East, reduced migrants' average propensity to save and consequently average propensity to remit money out of their savings (Hussain, 2014).

that remittances reduced the poverty of Bangladeshi households. Studies on FDI in Bangladesh mainly analyzed its impact on GDP growth and found it to be positive (Dutta *et al.*, 2017), but also often ambiguous (Kabir, 2007; Shimul *et al.*, 2009; Islam and Meerza, 2013). As FDI affects the whole macroeconomy, interactions among various macro variables make the total outcome complex. A similar macroeconomic modelling issue also arises in the remittance studies. Hassan *et al*. (2017) and Kumar *et al.* (2018) found a negative impact of remittances on total factor productivity only when the remittance inflow was small and that this effect became positive when remittances flows were large (i.e., a U-shaped curve). Although these studies indicated some inefficiency because of liquidity constraints, the mechanism cannot be explained by their macro aggregate models without detailed modeling of the economic structure.

A general equilibrium approach is required to predict the economy-wide impacts of these shocks in a comprehensive manner. Stahl and Habib (1989) used an input–output model to investigate the impacts of remittances on the expansion of indigenous industries, but shed no light on the distributional implications among households. In Raihan *et al.* (2009), a static computable general equilibrium (CGE) model was developed to describe how a negative remittance shock affects different types of households in goods and factor markets and through international trade. However, the remittances were described simply as international transfers, although it is a payment to workers abroad, who can work at home if they stay. They did not consider any impacts on the domestic labor market caused by the return of migrant workers, which was induced by the reduction in remittances. Hossain and Hosoe (2017) also used a static CGE model to analyze the impacts of FDI promotion in the RMG sector and immigration, where human capital was assumed to be

improved by a policy intervention to earn a wage premium abroad. However, physical and human capital accumulation is a dynamic phenomenon. Investment is sluggish; education and training incur opportunity costs of employment at home and abroad. It takes time for policy interventions in these factor markets to take effect in the macroeconomy. The statistic model approach does not allow us to examine the short-run and long-run impacts of shocks to factor markets and the effects of policy interventions.

In this chapter, we develop a recursive dynamic CGE model that captures the abovementioned missing features of the existing general equilibrium analyses in Bangladesh. Using our model we examine the impacts of cross-border factor mobility and human capital accumulation on welfare level and equity among households, and the macroeconomy. Our simulation exercises show that a foreign labor market shock reduces household welfare by inevitably lowering wages and increasing unemployment, particularly for unskilled workers in the domestic labor market. To counteract this negative impact, we consider two policy options. In the first option, we examine the impacts of FDI increases in the RMG sector. In the second option, we analyze the impacts of a human capital development program that transforms unskilled workers to skilled, to help them combat the domestic wage fall. Based on our simulation results, we conclude that the former policy minimizes the negative impacts of returning migrants on the domestic labor market and consequently on household welfare, while a combination of both policies is more equitable and favorable toward poor households.

The reminder of the chapter is organized as follows. Section 4.2 describes the methodological approach, data, and simulation scenarios. The results of the simulations are discussed in Section 4.3, while Section 4.4 draws conclusions.

4.2. Methodology and Data

4.2.1. The Model

We develop a recursive dynamic CGE model for Bangladesh based on the static model of Hossain and Hosoe (2017). Our model distinguishes 15 sectors, including two subsectors in the RMG sector (Table 4.1), eight household groups (Table 4.2), and three factors of production: unskilled labor, skilled labor, and capital. Their production technology is represented by constant-returns-to-scale production functions. Markets are assumed to be perfectly competitive for the sake of simplicity.

The income of these households is generated from factor income, government transfers, and foreign remittances, which reflects these households' characteristics (Figure 4.2). Among these eight household groups, urban highly educated household generates most of their income from skilled labor wages, while the urban poorly educated household does so from unskilled labor wage. The rural nonagricultural rich household depends heavily on capital income. The rural agricultural large household generates considerable amounts of income from land.[19] Other households generate most of their income from their unskilled labor wages.[20]

[19] In the following simulation analysis, we combine land with capital.
[20] There are only minor differences in consumption patterns among households.

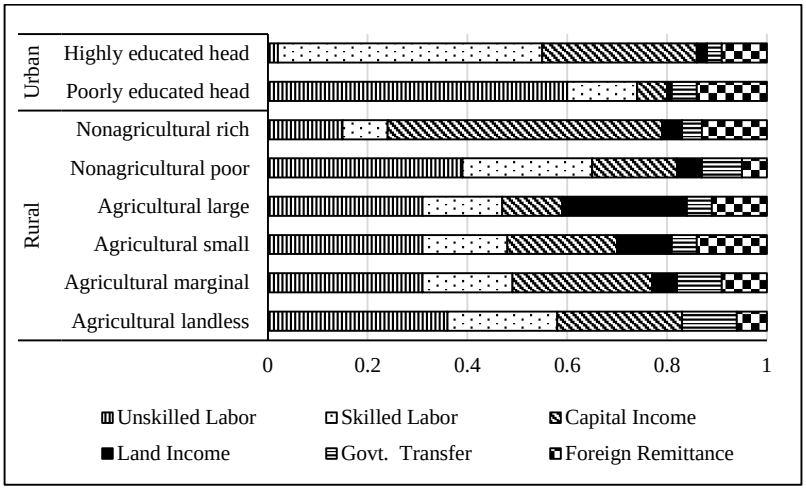
Table 4.1: Sectoral Aggregation

Sector	Abbreviation
Agriculture	AGR
Cotton cultivation	COT
Mining & quarrying	MIN
Food products	FOD
Textile	TEX
Ready-made garments hosting local firms	Local-RMG
Ready-made garments hosting MNEs	MNE-RMG
Yarn industry	YRN
Paper, printing & publishing	PPP
Basic chemical	CHM
Metal, machinery & equipment	MME
Other manufacturing	OMC
Construction	CON
Power	POW
Trade, transport & communications	TTC
Services	SVC

Table 4.2: Definition of Household Types

Household type	Description
Urban	
Highly educated	Head has more than 8 years of schooling
Poorly educated	Head has 1–8 years of schooling
Rural	
Nonagricultural rich	Not engaged in agricultural activities and owns more than 0.5 acres of land
Nonagricultural poor	Not engaged in agricultural activities and owns fewer than 0.5 acres of land
Agricultural large	Agricultural households who own more than 2.49 acres of land
Agricultural small	Agricultural households who own 0.5–2.49 acres of land
Agricultural marginal	Agricultural households who own up to 0.49 acres of land
Agricultural landless	Agricultural households who have no land

Figure 4.2: Share of Income Generating Factors in Total Household Income



The model is extended in the following three ways. First, the RMG sector is split into two subsectors, local firms and MNEs, based on the capital ownership. This feature enables us to analyze the impacts of international capital mobility in the form of FDI. Second, we elaborate labor supply by household by incorporating (voluntary) unemployment and endogenous allocation of the workforce between domestic and foreign labor markets in response to the foreign wage premium. This extension allows us to examine how a reduction in migrant workers' earnings in the foreign labor market affects their migration decision and domestic labor supply. Finally, we extend it to a dynamic model to examine the tradeoffs between physical and human capital accumulation in the short run and long run in the presence of FDI inflows and international labor mobility, which cannot be analyzed with a static model.

For the second extension, we assume that a household obtains utility by consuming a composite good, composed of various goods and services, and by enjoying leisure (Figure 4.3). The substitution between these two endogenously determines labor supply by each household. Compared with other approaches, such as full employment

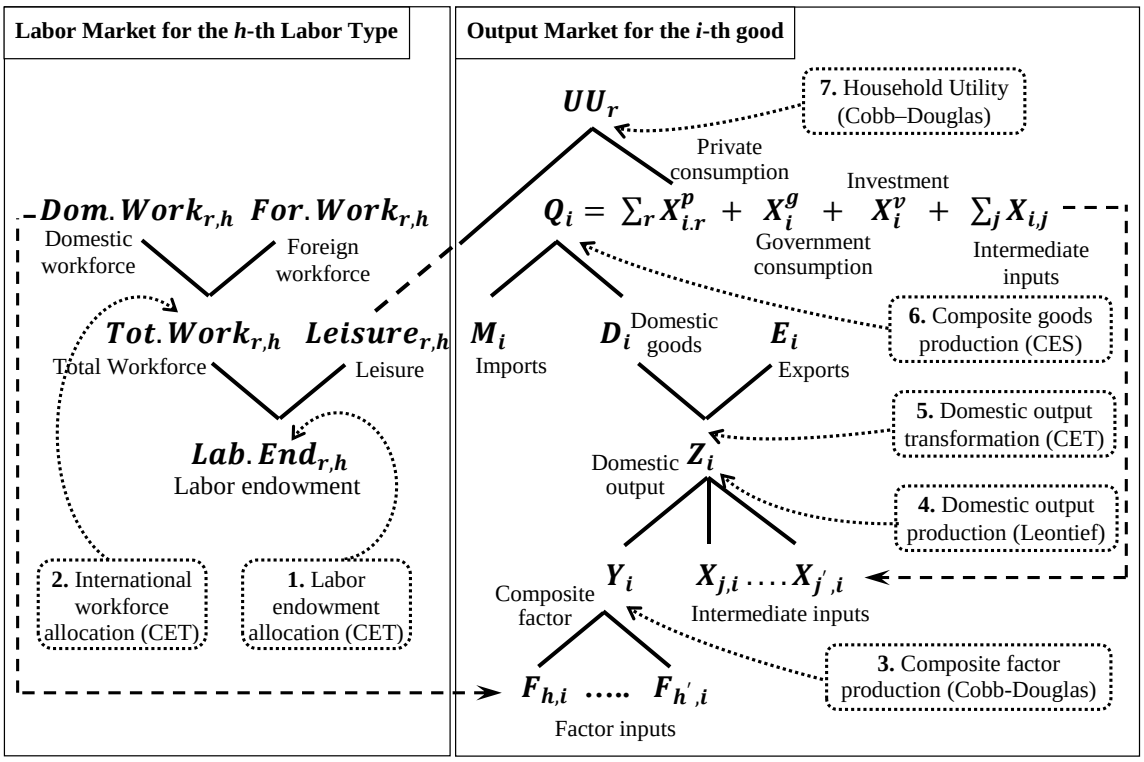
with a flexible wage rate (neoclassical model) and an institutionally fixed wage rate with unlimited supply of labor (structuralist model), this voluntary unemployment approach allows us to describe the labor market in Bangladesh more flexibly, where many people are jobless even with open job opportunities offering low wages. Voluntary unemployment also explains the relatively high unemployment rate of skilled workers compared with unskilled workers in Bangladesh (Asadullah, 2014). We next describe both the static and dynamic features of our model.

4.2.1.1 Structure of the CGE Model within a Period

The within-period structure of our CGE model is described in Figure 4.3. In the labor market for the h-th labor type (left panel), the r-th household makes the decision to supply its skilled and unskilled labor endowments ($Lab.End_{r,h}$) either to work ($Tot.Work_{r,h}$) or consume its own leisure ($Leisure_{r,h}$), taking into account the labor wage (label 1 in Figure 4.3). A constant elasticity of transformation (CET) function is employed to allocate the labor endowments between total workforce and leisure. The h-th total workforce ($Tot.Work_{r,h}$) is then allocated between domestic workforce ($Dom.Work_{r,h}$) and foreign workforce ($For.Work_{r,h}$) with a CET function (label 2). The h-th domestic workforce ($Dom.Work_{r,h}$) is employed in all sectors (both local and MNE sectors). Both skilled and unskilled workers are fully mobile across sectors; domestic capital is used only in the local firm sectors not in the MNE sector. The external sector supplies capital to their affiliates in the MNE-RMG sector in the form of FDI. In the output market for the i-th good (right panel), the composite factor (Y_i) is produced by using capital and skilled and unskilled labor with a Cobb–Douglas type production function (label 3). The structure after the composite factor production is similar to the

standard CGE model, which describes the economic activities with nested constant elasticity of substitution and transformation (CES and CET) functions. These functions describe the production of gross domestic output (Z_i) (label 4), transformation of gross domestic output into domestic goods (D_i) and exports (E_i) (label 5), and production of Armington composite goods (Q_i) (label 6). As mentioned above, household utility depends on the consumption of composite goods ($X_{i,r}^p$) and own leisure ($Leisure_{r,h}$) from the h-th labor endowment (label 7).

Figure 4.3: Intratemporal Structure of the CGE Model



As Hossain and Hosoe (2017) assumed, the difference between the local-RMG and MNE-RMG sectors lies in the ownership of the capital they use. We assume that the MNE-RMG sector is 100 percent export-oriented in final demand and that foreign capital

is not substitutable with domestic capital. Their production technology, such as capital–labor ratio and intermediate input coefficients, is assumed to be common.

4.2.1.2 Dynamic Structure

We modify the static model of Hossain and Hosoe (2017), by adding recursive dynamics. Government consumption is set as exogenous within a period, but growing at the rate of population growth rate (pop). The government generates its revenue from various indirect taxes and a lump-sum direct tax on household income. Total tax revenue is proportionately used for government consumption, subsidies, transfers to households, and savings. Government fiscal balance is achieved through the lump-sum direct taxes. Household income depends on labor wages, returns to capital, government transfers, and remittances.

The h-th labor endowment is given at the beginning of each period but grows at the population growth rate pop, $Lab.End_{r,h,t+1} = (1 + pop).Lab.End_{r,h,t}$. Both skilled and unskilled workers are fully mobile across sectors. The private savings by the r-th household ($S^p_{r,t}$) and government savings (S^g_t) are generated with constant propensities to save ($ss^p_r \; and \; ss^g$), but foreign savings (S^f_t) are assumed to be exogenous and growing at the population growth rate. The foreign exchange rate (ε_t) is endogenously determined to keep the current account balance unchanged. Savings are used to purchase various investment goods ($X^v_{i,t}$), which are used to produce composite investment goods that are allocated across sectors. Sectoral investment in the j-th sector ($II_{j,t}$) is determined by expected returns to capital under myopic expectations, à la Hosoe (2014).

Unlike the local firm sectors, investment in the MNE sector ($II_{j\_MNE,t}$) is financed by the external sector and is exogenous. The return to foreign capital from the MNE sector is captured by the external sector, not by any of the domestic agents. Capital is accumulated with new investment after its depreciation with a rate of dep as: $KK_{j,t+1} = (1 - dep).KK_{j,t} + II_{j,t}$. Capital is a putty-clay type and sector specific after its installation.

4.2.2. Model Estimation

Our model is calibrated to the Bangladesh Social Accounting Matrix (SAM) for 2012 with Armington elasticities of substitution and transformation (σ_{i_all} and ψ_{i_all}) provided by the Global Trade Analysis Project (GTAP) version 9 database. The elasticity of transformation for international labor allocation ($\chi_{r,h2}$) is assumed to be 1.2, following David and Marouani (2015).[21] In our model, the exogenous variables, such as labor endowment ($LF_{r,h,t}$), government consumption ($X_{i,t}^{g}$), foreign savings (S_t^f), and foreign direct investment ($II_{j\_MNE,t}$), are assumed to grow at the population growth rate so that the model can generate a balanced growth path for the business-as-usual (BAU) path. The population growth rate is assumed to be 1.1 percent, considering the population growth in Bangladesh in 2016 (World Bank World Development Indicators). We assume the rate of return to capital, $ror = 5$ percent; capital depreciation rate, $dep = 4$ percent; and the elasticity parameter in the investment function, $\zeta = 1$, following Hosoe (2014).[22] We

[21] The elasticity of transformation for international labor allocation was dynamically calibrated by David and Marouani (2015), with a starting point of one unity following Constant and Zimmermann (2013) by capturing individual preferences, migration costs, and opportunities.

[22] To check the robustness of our simulation results with respect to these assumed parameters we conduct sensitivity analyses, which are shown in Section II.1 of Appendix II. The details of the investment function and its parameters are explained in Section II.2 of Appendix II.

adjust the investment and government consumption data for the above-mentioned BAU growth path, as the investment reported in the original SAM is not necessarily consistent with the required investment to generate the BAU growth path.

The Bangladesh SAM reports wages, but not leisure consumption or unemployment for the eight household groups. Assuming common unemployment rates among rural and urban household groups, we estimate the unemployed labor endowment of each household group using the unemployment rates reported in a survey by the Bangladesh Bureau of Statistics (2017). According to this survey, the unemployment rates in rural areas are 7.88 and 2.74 percent for skilled and unskilled workers, respectively, whereas in urban areas these rates are 6.91 and 2.80 percent, respectively. These figures may be quite small compared with unemployment rates commonly observed in developing countries. An alternative estimate of the graduate unemployment rate of 47 percent is provided in an economist intelligence report (British Council, 2014, p. 10). The difference between these two estimates can be attributed largely to the differences in the samples and definition of unemployment incidence. As there is no other official unemployment data with a wide coverage, we use the Bangladesh Bureau of Statistics (2017) estimate to construct our model.

4.2.3. Simulation Scenarios

We set three scenarios of cross-border factor mobility and human capital accumulation for Bangladesh. Simulation 1 assumes a one percent wage decline for migrant workers in the foreign labor market. This is an exogenous shock that Bangladesh may face. To counteract this, we consider two policy measures in our scenarios.

Simulation 2 assumes a 25 percent yearly increase of FDI inflow into the MNE-RMG sector, in addition to the shock assumed in simulation 1. Simulation 3 assumes a hypothetical human resource development program, provided to 25,000 unskilled workers to transform them into skilled workers so that they can earn a skill premium, in addition to the shocks assumed in simulation 2. We run our model with these shocks for 10 consecutive periods. Their backgrounds are discussed below.

4.2.3.1 Migrant Workers' Wage Decline

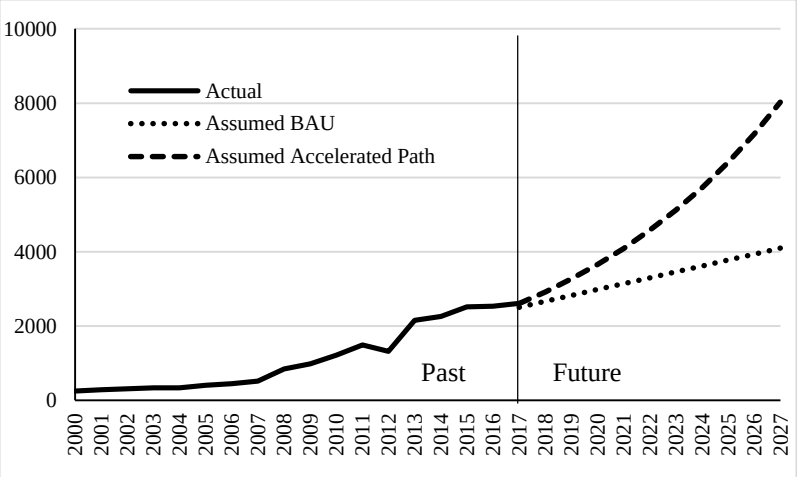
From 2013 to 2017, overall remittances flowing into Bangladesh fell, on average, by 0.7 percent per year (Figure 4.1). This was partly because of increased unemployment and the declining wages of undocumented low-skilled migrants in the Middle East (Hussain, 2014), and partly because of deteriorating nonmonetary benefits for migrant workers (*i.e.,* food and accommodation, free air tickets to work and to visit family members during holidays, free visa extension arrangements). For example, migration costs to Saudi Arabia rose, on average, from 200,000 Bangladeshi taka (BDT) in 2000 to 600,000 BDT in 2016 (Palma, 2016). These changes reduced migrants' earnings and ability to remit. Based on the trend in Figure 4.1, we assume a one percent decline in migrants' wages throughout the simulation period.

4.2.3.2 Increase in FDI Inflow

In simulation 2, we assume that the FDI stock in the MNE-RMG sector is doubled in Bangladesh in 10 years (Figure 4.4). This target can be contextualized with the recent policy reforms to attract FDI. The government is aiming to improve the country's attractiveness as an FDI destination in order to become a top 100 FDI host country (The

Independent, 2018). To measure attractiveness, the World Bank's Ease of Doing Business Index is often used. Several empirical studies (Wei, 2000; Aizenman and Spiegel, 2006; Jayasuriya, 2011; Zhang, 2012; Duval and Utoktham, 2014; Corcoran and Gillanders, 2015) identified a positive association between this index and the amount of FDI inflow. Corcoran and Gillanders (2015) found that a one place improvement in rank is associated with a 0.56 percent FDI stock increase, on average. This implies that achieving the target rank of 100 in Bangladesh would increase the FDI stock by around 43 percent. As Zhang (2012) found, this relationship between the index and FDI is much stronger for poorly ranked countries such as Bangladesh, which was ranked 176 out of 190 countries in 2017. We investigate to what extent this increase in FDI could vitalize Bangladesh's economy and offset the negative shock in remittances.

Figure 4.4: FDI Stock in the Textile and RMG Sectors [Unit: Million USD]



Note: Bangladesh Bank (2017) for the actual FDI stock data.). The BAU and accelerated FDI growth paths are constructed using the authors' assumptions.

To double the FDI stock in 10 years, Bangladesh must increase the FDI (stock)-GDP ratio from the current ratio of 5.8 percent (United Nations Conference on Trade and Development, 2018/World Bank World Development Indicators) to 11.6 percent. This

10-year target is reasonable considering the current FDI stock in the RMG sector, where MNEs produce only five percent of total RMG output (Kee, 2014, p. 39). The target is also consistent with the experiences of other South and Southeast Asian countries, although they have achieved higher positions in the FDI host ranking and the World Bank's Ease of Doing Business Index. For example, the FDI (stock)-GDP ratios of Vietnam (rank 82), Malaysia (rank 23), Indonesia (rank 91), and India (rank 130) are 57.8 percent, 44.4 percent, 24.5 percent, and 14.5 percent, respectively.[23] This is the rationale of our assumption of a doubling in the FDI stock in the RMG sector over 10 years. This translates into a 25 percent annual increase in FDI in our simulation period.

4.2.3.3 Human Capital Accumulation

A three-year-long hypothetical education and training program is assumed to upgrade unskilled workers to skilled ones. Each year, this program accepts 25,000 unskilled workers among the eight household groups. The trainees are selected based on their unskilled labor endowment.[24] The unskilled workers assigned to the program leave the labor markets for three years and are transformed into skilled workers, who can earn a skill premium of 148 percent over the unskilled workers, equivalent to 10,206 BDT per worker per month.[25] Such an education and training program involves pecuniary costs, other than the opportunity cost of wage losses. For this, we use the per-student cost of public universities in Bangladesh, which is estimated to be 45,605 BDT per year based

[23] Calculated based on data from United Nations Conference on Trade and Development (2018) and the World Bank's World Development Indicators.
[24] This class size is chosen arbitrarily. This represents about 0.11 percent of the total labor force.
[25] To compute the changes in endowment income resulting from the proposed program, the share of skilled and unskilled labor in Bangladesh is calculated based on World Bank (2013). These shares are 28.5 percent and 71.5 percent, respectively. Using the data of the working labor force from the Ministry of Finance (2015) and total skilled and unskilled labor wages from the Bangladesh SAM 2012, the average skill premium is calculated as 10,206 BDT per month per worker.

on the data reported in the Annual Report of University Grant Commission (University Grant Commission 2015, pp. 96–129) of Bangladesh. The estimated annual cost for each batch of trainees amounts to 2,280 million BDT and is assumed to be covered by an additional tax proportional to household income.[26]

4.3. Simulation Results

4.3.1. Simulation 1: Impact of Migrant Workers' Wage Fall

The one percent wage rate fall in the foreign labor market for Bangladeshi migrants would affect the domestic economy through the channel of labor market effect and remittance effect. The labor market effect would be realized when households change their migration decision and labor allocation between the domestic and foreign markets. The returning migrants would make labor more readily available in the domestic market, and therefore, would expand the output in many sectors (Figure 4.5). The RMG sectors, which are the most export-oriented, would experience substantial output increases because of abundant labor supply, along with export growth from the currency depreciation following the remittance loss from the returning migrants. The percentage change in output in the MNE-RMG sector is slightly below that of the local-RMG sector as MNEs' production is constrained by the FDI, which is exogenously determined by the external sector. Trade, transport, and communications, other manufacturing, textiles, and yarn industries would expand significantly because of their backward linkage to the RMG sectors and their high labor intensity, by which they can benefit from the increased labor supply of the returning migrants (Figure 4.5).

[26] This additional tax is only as large as 0.02 percent of household income. Therefore, this assumption is not critical in our simulation analysis.

Figure 4.5: Output [Deviation from BAU, Billion BDT]

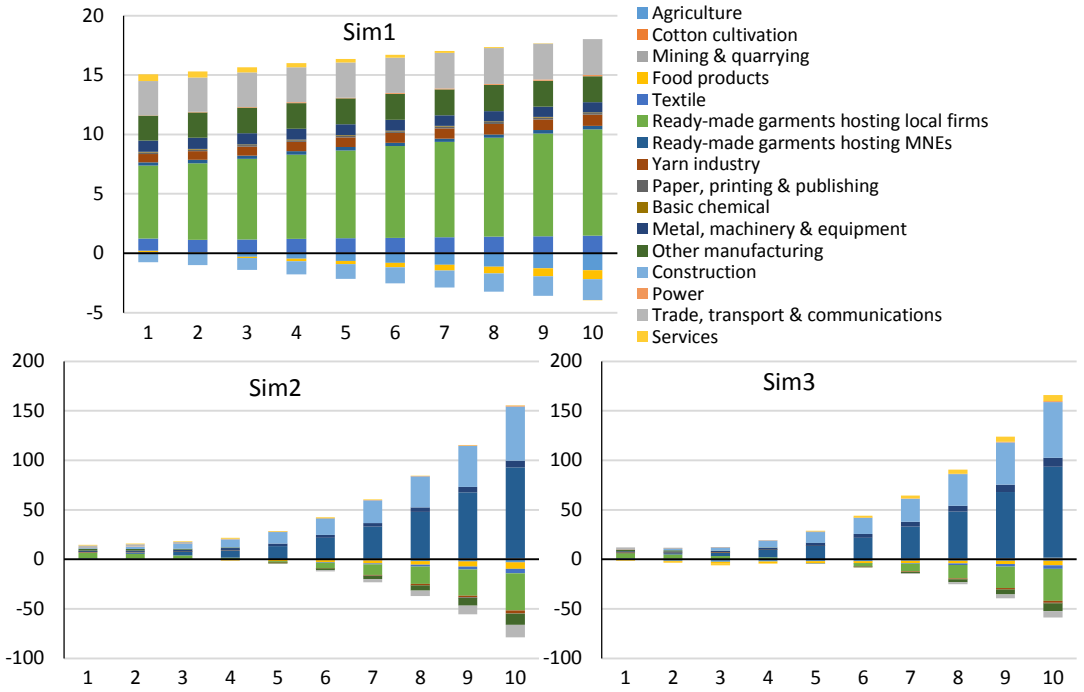


Figure 4.6: Domestic and Foreign Employment, and Leisure of Unskilled Workers [% Change from BAU Total Endowment]

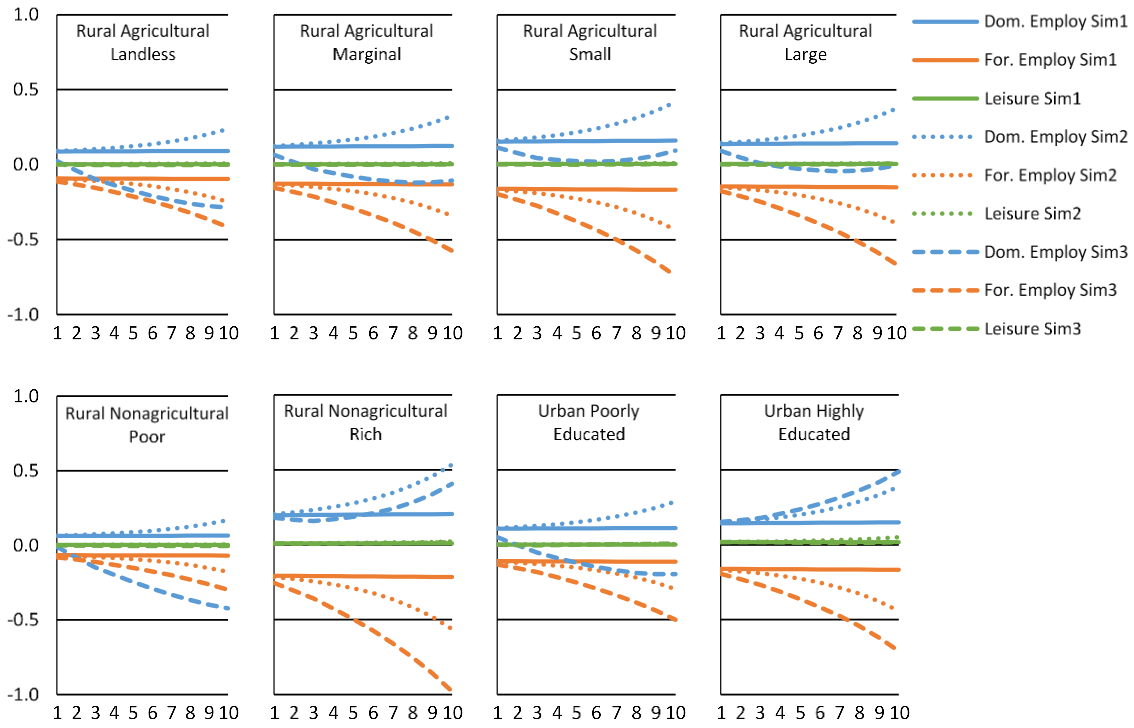
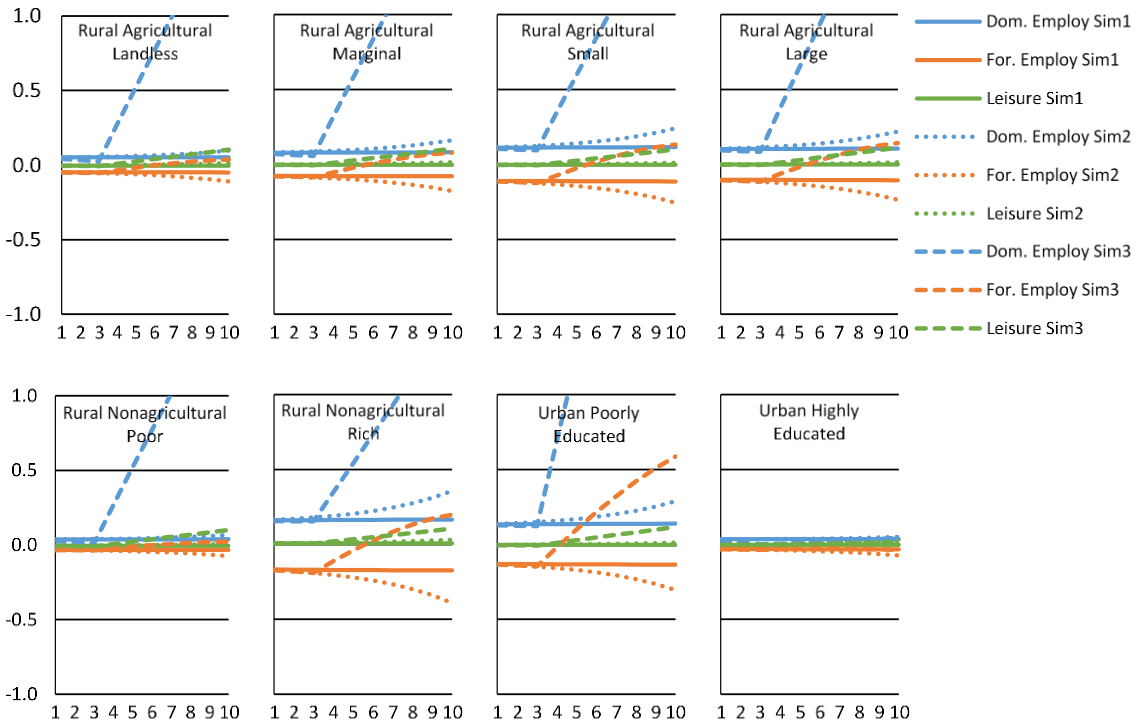


Figure 4.7: Domestic and Foreign Employment, and Leisure of Skilled Workers [% Change from BAU Total Endowment]



The fall in the foreign wage of migrants would lower the employment in the foreign labor market and increase that in the domestic labor market, for both unskilled and skilled workers (Figures 4.6 & 4.7). Most, but not all, of the returning migrant workers would be employed in the domestic labor market, for all household groups. The differences in the foreign labor endowment by household group determine the amount of unemployment in each group. As most of the out-migrants are unskilled, their domestic return would lower the wage rate in the domestic unskilled labor market by around 0.2 percent (Figure 4.8). In contrast, skilled workers would be affected only marginally.

Figure 4.8: Changes in Domestic Labor Wage [Deviation from BAU, % Change]

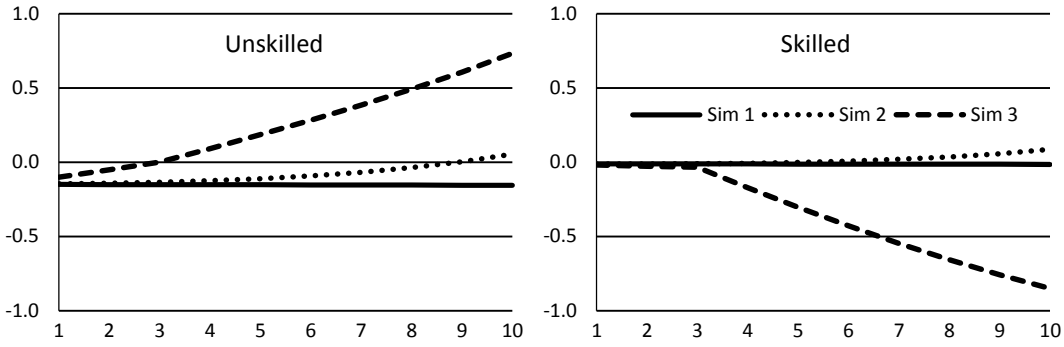
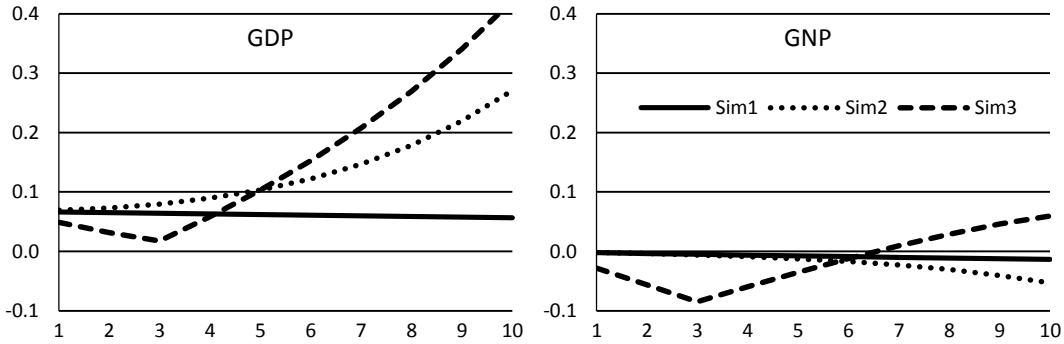
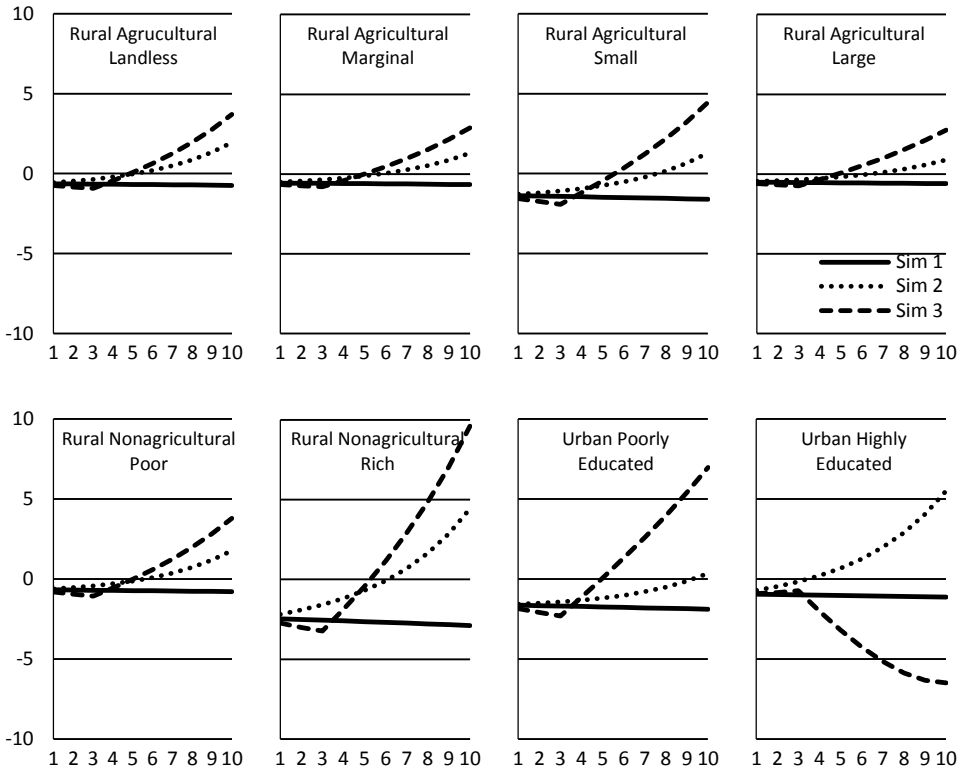


Figure 4.9: GDP and GNP [Deviation from BAU, % Change]



In simulation 1, the country's GDP would increase by around 0.06 percent because of the returning migrants (Figure 4.9). However, GNP is predicted to fall slightly by around 0.01 percent because of the loss of the foreign wage premium. Because of the remittance effect of foreign labor market shock, all household groups would suffer from a reduction in welfare, measured using equivalent variation (taking account of both composite good consumption and leisure consumption) (Figure 4.10). Their dependence on remittance income determines the magnitude of the welfare loss. For example, as the rural nonagricultural rich and the urban less-educated households are dependent heavily on remittance income, they suffer most seriously among the eight household groups from the shock.

Figure 4.10: Household Welfare [EV in Billion BDT]



4.3.2. Simulation 2: Effect of FDI Promotion

In Simulation 2, we examine a policy to promote FDI in order to offset the negative impacts of the foreign labor market shock on the domestic economy. The increase in FDI would affect output in the local-RMG and MNE-RMG sectors in opposite ways. While production by MNEs would expand significantly, local firms would experience a contraction by facing competition with MNEs in output and labor markets (Figure 4.5). Total RMG production by local firms and MNEs would increase substantially, making the labor market tighter.

The increased FDI creates more domestic job opportunities (Figures 4.6 & 4.7), especially for unskilled workers. This would raise the domestic wages in both the

unskilled and skilled labor markets. The effects of the fall in wages of unskilled labor, caused by the foreign labor market shock (simulation 1), would be gradually offset and finally disappear in period 10 (Figure 4.8). Employment in the foreign labor market would fall further (Figures 4.6 & 4.7) because the rise in the domestic wage rates induces more migrant workers to return home. This wage increase enables households to consume more composite goods and leisure (voluntary unemployment) (Figures 4.6 & 4.7).

In simulation 2, both GDP and GNP would be affected, but in different ways (Figure 4.9). While the increase in GDP is attributable to the injection of capital through the assumed increase in FDI, GNP would further decrease, although marginally. This is because of the return of more migrant workers. As mentioned above, some of them leave the labor market, and thus do not contribute to GNP. In terms of welfare, the negative impact of the foreign labor market shock would disappear following FDI promotion (Figure 4.10). However, this takes several periods. Among the eight types of households, urban highly educated household would reach the BAU level quickly in period 4, whereas the urban less educated household would at the very end of our simulation period. Others would reach the BAU level by period 7. The distribution of gains from the FDI promotion favors the richest rural and urban household groups in terms of both speed and level. Next, we investigate another policy intervention aimed at accelerating the recovery and more equitable welfare allocation.

4.3.3. Simulation 3: Impact of Human Capital Accumulation

From a distributional perspective, the policy intervention in simulation 2 favors the richest household groups; therefore, a more equitable policy option is required. As the

poor household groups depend mainly on the unskilled labor wage, the policy should be targeted toward them to ensure an equitable distribution of gains. In simulation 3, we consider a human resource development program that transforms unskilled workers into skilled workers. Our results show that this intervention would reduce output marginally in the short run until period 3 (Figure 4.5), because it makes part of the unskilled labor endowment unavailable during the training period. This unskilled labor shortage causes an increase in the unskilled wage (Figure 4.8). When the transformed skilled workers reenter the job market from period 4, the skilled labor market would experience a sharp fall in the wage rate.

The increase in the unskilled labor wage rate would again induce a return of unskilled migrants (Figure 4.6). The seven households, which were originally endowed with rich unskilled labor, would benefit from the skill development program significantly (Figure 4.8). In period 10, the domestic employment of skilled workers would increase by around two percent, which is larger than the skilled wage rate fall about one percent. Thus, the wage income from skilled workers would increase. Incidentally, the domestic skilled wage rate fall would also increase outward migration of skilled workers in a long run (Figure 4.7).

In simulation 3, GDP and GNP would fall in the short run until period 4 as part of the labor force is unavailable, but increase in the long run because of the human capital accumulation (Figure 4.9). The GDP and GNP gains in simulation 3 are larger than those in simulation 2 in and after period 6 and period 7, respectively. All but the urban highly educated household would be worse off in simulation 3 than in simulation 2 in the short run, but better off in the long run (Figure 4.10). Thanks to the intervention, their recovery

from the foreign labor market shock would be accelerated by period five. Notably, the distribution of welfare would be more favorable toward poorer household groups. The urban highly educated household would, however, suffer from the sharp fall in the skilled wage of around 0.8 percent (Figure 4.8).

As the gains in seven types of households are achieved at the expense of the one household, we need to evaluate carefully the overall impact of the human capital development program. In Bangladesh, the income share of the richest five percent group has reached 24.6 percent (Ministry of Finance, 2015, p. 200). This is consistent with the urban highly educated household earning 24.4 percent of total household income as reported in the SAM that we used for our CGE model development. The second richest group's income is 13.4 percent smaller than that of the richest (Ministry of Finance, 2015, p. 199). Therefore, the richest group, the urban highly educated household, suffers but its income level would remain larger than those of the second richest group.

4.4. Conclusion

This chapter studies the impacts of cross-border factor mobility and human capital accumulation on the macroeconomy and household welfare in terms of levels and equitability in Bangladesh. Our simulation results suggest that a one percent wage fall in the foreign labor market causes a movement of workers from foreign to domestic labor markets by affecting the migration decision of households. The returning migrants would lower the unskilled labor wage by around 0.2 percent. The skilled labor wage would also fall, although marginally. The availability of workers in the domestic market would raise the country's GDP by 0.06 percent. However, GNP would fall by around 0.01 percent

because of the loss of the foreign wage premium that they earned abroad. All household groups would suffer a welfare deterioration. The more heavily they depend on remittance income, the more they would suffer.

To minimize these negative impacts of the foreign labor market shock, we examine the effectiveness of two counteractive policy options. In the first policy, we examine the impacts of FDI promotion in the MNE-RMG sector. Our results show that increased FDI would further raise domestic wages for both unskilled and skilled labor and would increase the number of returning migrants. While GDP would increase with FDI promotion, GNP would remain relatively stable, because of the return of more migrant workers, who benefit from the domestic wage rise. The negative welfare impact of the foreign labor market shock would gradually disappear with FDI promotion. However, the distribution of gains from the FDI promotion favors the richest household groups. To ensure an equitable distribution of gains, we consider a human resource development program in the second policy option. Transforming unskilled workers into skilled workers accelerates the recovery from the negative foreign labor market shock and achieves a more favorable distribution toward poor household groups.

Our study in this chapter has certain limitations. First, we do not assume that migrants provide their own capital but that their labor service is exported from households at home. We do not consider any processes of job search or human capital investment, either. They are omitted because of the lack of data and for modeling simplicity. A microsimulation approach may be an option to elaborate the analysis in this way. Second, we consider only voluntary unemployment, even though involuntary unemployment exists in Bangladesh, mainly in the areas with low levels of economic activity. These

unemployed people in the economically disadvantaged areas are not mobile and generally unwilling to migrate to the economic zones that offer greater job opportunities. They also suffer from a lack of labor market information. As we examine factor mobility in the form of labor migration and FDI promotion, which mainly affects employment in the economic zones, involuntary unemployment is largely unaffected. Third, we increase FDI inflow into the RMG sector exogenously, assuming a target level of the FDI stock, in one of our alternative policy experiments. Adding endogenous FDI determination with response to some policy variables of regulatory reform could be an interesting extension of this chapter. Fourth, we examine the impacts of FDI only in the RMG sector because of data availability constraints for the other sectors in Bangladesh. An effective survey on sales and sourcing patterns of MNEs in other capital thrust sectors in Bangladesh would allow replication of our modeling framework to examine the impacts of FDI in those sectors. This type of extension is necessary to identify potential emerging sectors in Bangladesh.

Chapter 5: Conclusions and Policy Implications

This dissertation conducted a pioneering ex ante structural macroeconomic analysis of cross-border factor mobility by developing both static and dynamic computable general equilibrium (CGE) models. Two studies of cross-border factor mobility in Bangladesh were conducted using CGE models. The first study in Chapter 3 involved an impact analysis of FDI using a static CGE model. We identified the channels through which individual households would be affected by changes in wage rates and the rental rate of capital. Notably, in our static model analysis, the model structure was fully described so that the welfare and distributional impacts could be attributed to changes in the sector-specific FDI inflows.

We then extended our static model to a dynamic one in Chapter 4 to examine the impacts of a persistent decline of migrants' wages. The unique feature of our dynamic model is that it analyzes the welfare and equity impacts of a foreign labor market shock, describing its synergetic role and the dynamic adjustments in response to various exogenous shocks and counteractive policy measures against them. In both studies, relevant counteractive measures to manage the adverse impacts of shocks were considered in policy experiments. The simulation results identified the effects of factor mobility and shocks on factor markets.

In Section 5.1, we summarize the findings of our studies focusing on Bangladesh. As we used Bangladeshi data and models, the results apply only to Bangladesh. However, many developing countries share similar economic and institutional constraints and face

unexpected shocks. Thus, in Section 5.2 we discuss the policy implications of our study by generalizing the findings.

5.1. Summary of Studies

In Chapter 3, we examined the impacts of an increase in FDI in the ready-made garments (RMG) sector, which is the most important manufacturing sector, on the macroeconomy and distributional equality in Bangladesh. The simulation results suggested that a 25 percent FDI stock increase in the RMG sector would be associated with higher output and exports in this sector, as well as a larger GDP. The expansion of the RMG sector would lead to an overall welfare gain of 180 million Bangladeshi taka (BDT). Scrutinizing the welfare effects among household groups, we found that the benefits of the FDI-induced growth would affect household groups unevenly. One of the eight household groups would be adversely affected by the factor price fall on its major income source, under the injection of foreign capital.

From the viewpoint of distributional equity of gains from the FDI increase, this outcome may not be acceptable for households left behind. We thus further investigated redistribution policies that improve the human capital of the adversely affected household group as remedies for this equity issue. The first policy, converting unskilled labor to skilled labor in the domestic market, would benefit these left-behind households but, at the same time, would harm other households that largely depend on a skilled wage income. The second policy, to train emigrant workers, would not create any losing households but may achieve a smaller domestic production gain overall, because the program allows the labor force to go abroad in exchange for remittances.

In Chapter 4, we used a recursive dynamic CGE model to examine the impacts of a foreign labor market shock to migrants on the macroeconomy and household welfare in terms of levels and equitability in Bangladesh. Our simulation results showed that a one percent wage rate fall in the foreign labor market of Bangladeshi migrants would affect the migration decision and labor allocation between domestic and foreign markets. The shock incentivizes migrants to return and increases their labor supply in the domestic labor market for all household groups. As most of the out-migrants are unskilled, their domestic return would lower the wage rate in the domestic unskilled labor market by around 0.2 percent. The country's GDP would increase by around 0.06 percent because of the returning migrants. However, its GNP is predicted to fall slightly by around 0.01 percent because of the loss of the foreign wage premium. Consequently, all household groups would suffer a welfare deterioration from the shock. The more heavily a household depends on remittance income, the more it would suffer.

We examined two counteractive policies to offset the negative impacts of the foreign labor market shock on the domestic economy by means of FDI promotion in the RMG sector and of a human capital development program. In the first policy, an FDI increase would raise the domestic labor wage by creating more domestic job opportunities. The negative impacts of the foreign labor market shock would gradually disappear as FDI stocks accumulated. However, from the distributional perspective, the gains from the FDI promotion favor only the richest household groups. To ensure an equitable distribution of gains, we consider a human resource development program in addition to the FDI promotion in the second policy experiment. Our simulation results suggested that a combination of both policies would accelerate the recovery from the negative foreign

labor market shock and achieve a more favorable distribution toward poor household groups.

5.2. Policy Implications

In the increasingly globalized world, ex ante assessments are mandatory for effective policy design. This is because qualitative predictions do not provide clear-cut implications and also partly because there are many different stakeholders affected by the shock and policies. Moreover, economic variables affect each other. Other than the expected impacts, there are unexpected outcomes. To manage the tradeoffs among stakeholders, we need a framework that makes a policy work. In our simulation study context, prediction of the unintended negative outcomes of cross-border factor mobility can help to develop ideas and make the government better prepared to manage these negative outcomes. Similarly, tradeoffs can be more serious if vulnerable or sensitive groups are impacted severely, which then requires alternative policy measures.

The impacts of cross-border factor mobility, in the form of FDI and labor migration, using a structural macroeconomic framework have not been discussed well in the existing literature. The static and dynamic CGE models developed in this dissertation are demonstrated to be powerful tools for predicting the impacts of multiple shocks and outcomes of policy interventions against those shocks in developing countries that face globalization not only in goods trade but also factor mobility. The findings based on our static and dynamic CGE analyses in Chapters 3 and 4 consider how these shocks would affect the economy, and how the detrimental effects of these shocks would be managed. Some policy implications and recommendations can be drawn as discussed below.

The findings of Chapter 3 quantitatively predicted how the increase in FDI in the RMG sector would affect the macroeconomy and aggregate household welfare in Bangladesh. Decomposing the welfare effects among household groups, we found that the benefits of increased FDI would affect the household groups unevenly, affecting one type of household adversely. While the existing studies only discussed the impacts of FDI on some aggregate macro variables without any distributional implications, our findings for Bangladesh, as a typical example, have some important policy implications for developing countries. Both the Government of Bangladesh and governments of other developing countries that face similar constraints can become better prepared in formulating policies for these new types of globalization modes and their unintended consequences. The beneficiaries of FDI policies and those who are left behind, as well as the corrective measures for equitable distribution of gains, are now more visible to policy makers.

Furthermore, our CGE modeling framework that we developed in Chapter 3 is applicable for predicting the effects of FDI inflows in other sectors. Because detailed or sector-specific FDI studies are scant in general, our model extension will help policy makers in developing countries to conduct their own FDI analysis for sectors of their interest. For example, Figure 3.2 shows that some service sectors, such as telecommunications and banking, have attracted FDI increasingly in accordance with information-technology-based industrialization in Bangladesh. Our CGE-model-based approach is applicable for analyzing the impacts of FDI inflows in service sectors as well, contrasting the effects of manufacturing and nonmanufacturing FDI to show their relative importance as sectors hosting FDI.

Our findings in Chapter 4 showed how a foreign labor market shock to Bangladeshi migrants would negatively affect the welfare of the households by changing wages and employment in the domestic labor market. Our investigation of counteractive policies to offset the negative impacts suggested two measures with different distributional impacts on households, and their synergetic roles in the macroeconomy. A foreign labor market shock is a serious risk factor in many remittance-receiving countries. Existing studies with an explicit quantitative prediction of such a foreign labor market shock are rare and/or analyze little about welfare and equity effects, as well as the effectiveness of counteractive measures. Therefore, our study will help policy makers in emigration countries by providing insights about the channels through which shocks hit the economy and what policy alternatives are available.

In recent years, labor markets have been integrated rapidly. However, boosting labor mobility is always a sensitive policy goal, not only internationally but also domestically. Policy concerns about labor mobility become more aggravated in the case of forced migration. Bangladesh has been facing one of the worst forced migration crises in its history because of a large influx of *Rohingya* refugees from Myanmar. As of August 2017, more than 836,000 Rohingya refugees have fled to Bangladesh as forced migrants (Martin, 2017, p. 4). The Government of Bangladesh has been allocating its limited budget to hosting them. As the country will be facing this problem for a long time, questions may arise: whether their (partial) integration in the domestic labor market could be a good alternative or not, and how this integration would affect the welfare of Bangladeshi nationals by changing wages and employment. Our ex ante dynamic CGE

model can be used to analyze the Rohingya's integration as well as other counteractive measures to minimize the negative impacts, if any, created by this crisis.

5.3. Limitations of the Dissertation

This dissertation has certain limitations. First, we developed single-country static and dynamic CGE models that can examine the impacts of cross-border factor mobility in only one country of our interest. For example, we can only predict the impacts of FDI promotion on the host country, ignoring its possible impacts on the home country. Similarly, we cannot predict the outcome of a labor mobility shock on the host country. A policy change or shock to international factor mobility also affects counterpart partner countries. When we ignore the possible outcomes on the partner countries, policies could be less effective. Further extension of our single-country models to world trade multi-country models can overcome this limitation.

Second, in our static model we assumed full employment, whereas developing countries suffer from structural deficiencies in their labor markets. This assumption was relaxed in our dynamic model, which incorporated (voluntary) unemployment and endogenous allocation of the workforce between domestic and foreign labor markets. We considered only voluntary unemployment, even though involuntary unemployment exists in developing countries, mainly in those areas with low levels of economic activity. These unemployed people in the economically disadvantaged areas are not mobile and are generally unwilling to migrate to the economic zones that offer greater job opportunities. Thus, their unemployment incidence is observed there. They also suffer from a lack of labor market information. As we examined factor mobility in the form of labor migration

and FDI promotion, which mainly affects employment in the economic zones, involuntary unemployment was found to be little affected.

Third, in one of our simulation scenarios in Chapter 3, we assumed an exogenous increase in FDI in the RMG in light of a target level of FDI stock set by the government. FDI attraction policies involve some costs but they were not taken into account in our simulation scenarios. Adding a mechanism that describes endogenous FDI determination could be an interesting extension for evaluating the effectiveness of FDI policies and regulatory reforms. In our human capital development program simulation in Chapter 4, we assumed that skill transformation was driven by policies, not by endogenous human capital investment, whose intensity could differ by industry. In reality, industries replace unskilled workers with skilled ones using human capital accumulation. Modeling their private human capital accumulation, we can investigate policies that can accelerate growth through this channel.

Fourth, we examined the impacts of FDI only in the RMG sector because of data availability constraints in other sectors. Survey data on sales and sourcing patterns of MNEs and local firms that cover a wider range of industries would allow us to examine the impacts of sector-specific FDI more intensely. Finally, as we used data for Bangladesh, the policy implications for other developing countries based on our results might not be as strong as they are for Bangladesh. However, for better prediction, countries with different economic characteristics can replicate our analyses using their own data or the global trade analysis project (GTAP) database, which is widely used in CGE-based policy analyses (Hertel, 1999).

References

Abbes, S. M., B. Mostéfa, G. M. Seghir, and G. Y Zakarya (2015), "Causal Interactions between FDI, and Economic Growth: Evidence form Dynamic Panel Co-Integration", *Procedia Economics and Finance,* vol. 23, pp. 276–290.

Abrar, C. R., and M. Billah (2017), "Challenges of Labour Recruitment for Overseas Employment: The Bangladesh Experience", in S. I. Rajan (ed.), *South Asia Migration Report 2017: Recruitment, Remittances and Reintegration,* London and New York: Routledge, pp. 147–163.

Adams, R. H., and J. Page (2005), "Do International Migration and Remittances Reduce Poverty in Developing Countries?", *World Development,* vol. 33, no. 10, pp. 1645–1669.

Adams, S. (2009), "Foreign Direct Investment, Domestic Investment and Economic Growth in Sub-Saharan Africa", *Journal of Policy Modeling,* vol. 32, no. 6, pp. 339–349.

Agarwal, J. P. (1980), "Determinants of Foreign Direct Investment: A Survey", *Weltwirtschaftliches Archiv,* vol. 116, pp. 739–773.

Ahmad, S. (1990), "Foreign Capital Inflow and Economic Growth: A Two Gap Model for the Bangladesh Economy", *Bangladesh Journal of Development Studies,* vol. 18, no. 1, pp. 55–78.

Aitken, B. J., and A. E. Harrison (1999), "Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela", *American Economic Review,* vol. 89, no. 3, pp. 605–618.

Aizenman, J., and M. M. Spiegel (2006), "Institutional Efficiency, Monitoring Costs, and the Investment Share of FDI", *Review of International Economics*, vol. 14, no. 4, pp. 683–697.

Alam, M. S., and K. Natsuda (2016), "The Competitive Factors of the Bangladeshi Garment Industry in the Post-MFA Era", *Canadian Journal of Development Studies*, vol. 37, no. 3, pp. 316–336.

Alberto, B. (2015), "The Macroeconomics of a Financial Dutch Disease", *Working Paper No. 850*, New York: Levy Economics Institute of Bard College.

Alfaro, L. A., A. Chanda, S. Kalmli-Ozcan, and S. Sayek (2004), "FDI and Economic Growth: The Role of Local Financial Markets", *Journal of International Economics*, vol. 64, no. 1, pp. 89–112.

Anyanwu, J. C., and A. E. O. Erhijakpor (2010), "Do International Remittances Affect Poverty in Africa?", *African Development Review*, vol. 22, no. 1, pp. 51–91.

Arango, J. (2000), "Explaining Migration: A Critical View", *International Social Science Journal*, vol. 52, no.165, pp. 283–296.

Arbenser, L. (2004), "A General Equilibrium Analysis of the Impact of Inward FDI on Ghana: The Role of Complementary Policies", *Working Paper No. 69/2004*, Berlin: Humboldt University of Berlin.

Asadullah, M. N. (2014), "Is Graduate Unemployment Rate Really 47%", *Daily Star*, May 01, available: https://www.thedailystar.net/is-graduate-unemployment-rate-really-47-22302, accessed: December 15, 2018.

Asian Development Bank (2016), "Skill Development in Bangladesh", *ADB Briefs*, no. 67, Manila.

Azman-Saini, W. N. W., A. Z. Baharumshah, and S. H. Law (2010), "Foreign Direct Investment, Economic Freedom and Economic Growth: International Evidence", *Economic Modelling*, vol. 27, no. 5, pp. 1079–1089.

Baharumshah, A. Z., and M. A–M. Thanoon (2006), "Foreign Capital Flows and Economic Growth in East Asian Countries", *China Economic Review*, vol. 17, no. 1, pp. 70–83.

Balasubramanyam, V., N. Salisu, and D. Sapsford (1996), "Foreign Direct Investment and Growth in EP and IS Countries", *Economic Journal*, vol. 106, no. 434, pp. 92–105.

Banga, R., and P. K. Sahu (2010), "Impact of Remittances on Poverty in Developing Countries", *Working Paper id: 2872*, eSocialSciences, available: https://ideas.repec.org/p/ess/wpaper/id3100.html, accessed: February 27, 2019.

Bangladesh Bank (2016), *Foreign Direct Investment (FDI) in Bangladesh: Survey Report January-June 2016*, Dhaka.

Bangladesh Bank (2017), *Foreign Direct Investment (FDI) in Bangladesh: Survey Report January-June 2017*, Dhaka.

Bangladesh Bureau of Statistics (2011), *Report of the Household Income and Expenditure Survey 2010*, Dhaka: Ministry of Planning, Government of Bangladesh.

Bangladesh Bureau of Statistics (2017), *Quarterly Labor Force Survey Bangladesh 2015–16*, Dhaka: Ministry of Planning, Government of Bangladesh.

Barua, S., M. A. Majumder, and M. Akhtaruzzaman (2007), "Determinants of Workers' Remittances in Bangladesh: An Empirical Study", *Working Paper Series: WP 0713*, Dhaka: Policy Analysis Unit, Bangladesh Bank.

Basu, B. (2009), "International Factor Mobility", in P. M. Sgro (ed.): *International Economics, Finance and Trade*, United Kingdom: Eolss Publishers/UNESCO, pp. 94–114.

Basu, P., and A. Guariglia (2007), "Foreign Direct Investment, Inequality, and Growth", *Journal of Macroeconomics*, vol. 29, no. 4, pp. 824–839.

Basu, P., C. Chakraborty, and D. Reagle (2003), "Liberalisation, FDI, and Growth in Developing Countries: A Panel Cointegration Approach", *Economic Inquiry*, vol. 41, no. 3, pp. 510–516.Becker, G. (1975), *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*, Second Edition, Chicago: Chicago University Press.

Beine, M., F. Docquier, and H. Rapoport (2001), "Brain Drain and Economic Growth: Theory and Evidence", *Journal of Development Economics*, vol. 64, no. 1, pp. 275–289.

Bengoa, M., and B. Sanchez-Robles (2003), "Foreign Direct Investment, Economic Freedom and Growth: New Evidence from Latin America", *European Journal of Political Economy*, vol. 19, no. 3, pp. 529–545.

Blanchard, O., and J. Acalin (2016), "What Does Measured FDI Actually Measure?", *Policy Brief, PB 16-17*, Washington DC: Peterson Institute for International Economics.

Blomstrom, M., R. E. Lipsey, and M. Zejan (1994), "What Explains Growth in Developing Countries", *NBER Discussion Paper no. 1924*.

Boateng, A., X. Hua, S. Nisar, and J. Wu (2015) "Examining the Determinants of Inward FDI: Evidence from Norway", *Economic Modelling*, vol. 47, pp. 118–127.

Bodvarsson, O. B., and H. V. den Berg (2013), *The Economics of Immigrations: Theory and Policy*, Second Edition, New York: Springer.

Borensztein, E., J. De Gregorio, and J. W. Lee (1998), "How Does Foreign Direct Investment Affect Growth?", *Journal of International Economics*, vol. 45, no. 1, pp. 115–135.

British Council (2014), *High University Enrolment, Low Graduate Employment: Analysing the Paradox in Afghanistan, Bangladesh, India, Nepal Pakistan and Sri Lanka*, An Economist Intelligence Unit Report for the British Council, available: https://www.britishcouncil.in/sites/default/files/british_council_report_2014_jan.pdf, accessed: October 01, 2018.

Bureau of Manpower, Employment and Training Database, Dhaka: Ministry of Expatriates' Welfare and Overseas Employment, Government of the People's Republic of Bangladesh, available at: http://www.bmet.gov.bd/BMET/stattisticalDataAction, accessed: January 01, 2018.

Campbell, D. (2013), "The Labour Market in Developing Countries", in S. Cazes and S. Verick (eds.), *Perspectives on Labour Economics for Development*, Geneva: International Labor Organization, pp. 7–38.

Carkovic, M., and R. Levine (2005), "Does Foreign Direct Investment Accelerate Economic growth?", in H. Moran, and E. M. Graham (eds.), *Does Foreign Direct Investment Promote Development?*, Washington DC: Institute for International Economics.

Castro, F. B. (2000), *Foreign Direct Investment in the European Periphery: The Competitiveness of Portugal*, unpublished PhD thesis, Leeds: University of Leeds.

Caves, R. E. (1971), "International Corporations: The Industrial Economics of Foreign Investment", *Economica*, vol. 38, no. 149, pp. 1–27.

Chami, R.., C. Fullenkamp, and S. Jahjah (2003), "Are Immigrant Remittance Flows a Source of Capital for Development?", *IMF Working Paper on WP/02/189*, Washington DC: The International Monetary Fund.

Constant, A. F., and K. F. Zimmerman (2013), *International Handbook on the Economics of Migration*, Cheltenham: Edward Elgar.

Corcoran, A., and R. Gillanders (2015), "Foreign Direct Investment and the Ease of Doing Business", *Review of World Economics*, vol. 151, no. 1, pp. 103–126.

David, A., and M. A. Marouani (2015), "Migration and Employment Interactions in a Crisis Context: The Case of Tunisia", *Economics of Transition*, vol. 23, no. 3, pp. 517–564.

de Hass, H. (2007), "Remittances, Migration and Social Development: A Conceptual Review of the Literature", *Social Policy and Development Programme Paper Number 34*, Geneva: The United Nations Research Institute for Social Development.

De Mello, L. R. (1997), "Foreign Direct Investment in Developing Countries and Growth: A Selective Survey", *Journal of Development Studies*, vol. 34, no. 1, pp. 1–34.

De Mello, L. R. (1999), "Foreign Direct Investment-led Growth: Evidence from Time Series and Panel Data" *Oxford Economic Papers*, vol. 51, no.1, pp. 133–151.

Dhaka Tribune (2018a), "Government Needs to Attract New Investments for Economic Growth", June 04, 2018, available: https://www.dhakatribune.com/business/economy/2018/06/04/government-needs-to-attract-new-investments-for-economic-growth, accessed: April 29, 2019

Dhaka Tribune (2018b), "Bangladesh Ready for Massive Foreign Investment", September 05, 2018, available: https://www.dhakatribune.com/business/2018/09/05/bangladesh-ready-for-massive-foreign-investment, accessed: April 29, 2019.

Diankov, S., and B. Hoekman (2000), "Foreign Investment and Productivity Growth in Czech Enterprises", *World Bank Economic Review*, vol. 14, no. 1, pp. 49–64.

Doytch, N., and M. Uctum (2011), "Does the Worldwide Shift of FDI from Manufacturing to Servces Accelerate Economic Growth? A GMM Estimation Study", *Journal of International Money and Finance*, vol. 30, no. 3, pp. 410–427.

Dutta, C. B., M. Z. Haider, and D. K. Das (2017), "Dynamics of Economic Growth, Investment and Trade Openness: Evidence from Bangladesh", *South Asia Journal of Macroeconomics and Public Finance*, vol. 6, no. 1, pp. 82–104.

Duval, Y., and C. Utoktham (2014), "Impact of Trade Facilitation on Foreign Direct Investment", *TID Working Paper*, no. 04/14, Bangkok: ESCAP Trade and Investment Division.

Ericsson, N. R., J. S. Irons, and R. W. Tryon (2001), "Output and Inflation in the Long-Run", *Journal of Applied Econometrics*, vol. 16, no. 3, pp. 241–253.

Fayissa, B., and C. Nsiah (2010), "The Impact of Remittances on Economic Growth and Development in Africa", *American Economist*, vol. 55, no. 2, pp. 92–103.

Fedderke, J. W., and A. T. Romm (2006), "Growth Impact and Determinants of Foreign Direct Investment into South Africa, 1956–2003", *Economic Modelling*, vol. 23, pp. 738–760.

Garcia-Fuentes, P. A., and P. L. Kennedy (2009), "Remittances and Economic Growth in Latin America and the Caribbean: The Impact of Human Capital Development",

Paper presented at the Southern Agricultural Economics Association Annual Meeting, Atlanta, Georgia, January 31–February 3, 2009.

Ghosh, B. (2006), *Migrants' Remittances and Development: Myths, Rhetoric and Realities*, Geneva: International Organization for Migration.

Grimwade, N. (2000), *International Trade: New Patterns of Trade, Production and Investment*, Second Edition, London and New York: Routledge.

Gupta, S., C. A. Pattillo, and S. Wagh (2009), "Effects of Remittances on Poverty and Financial development in Sub-Saharan Africa" *World Development*, vol. 37, no. 1, pp. 104–115.

Hanson, G. H. (2009), "The Economic Consequences of the International Migration of Labor", *Annual Review of Economics*, vol. 1, pp. 179–208.

Harrison, A., and A. Rodríguez-Clare (2010), "Trade Foreign Investment, and Industrial Policy for Developing Countries", in D. Rodrik, and M. Rosenzweig (eds.), *Handbook of Development Economics*, North-Holland, vol. 5, pp. 4039–4214.

Hasan, M. (2008), "The Macroeconomic Determinants of Remittances in Bangladesh", *MPRA Paper No. 27744*, available: http://mpra.ub.uni-muenchen.de/27744/, accessed: March 26, 2018.

Hassan, G. M. (2011), "Growth Effects of Remittances: Cross-Country Analysis", Unpublished PhD Dissertation, Sydney: University of Western Sydney.

Hassan, G. M., and S. Shakur (2017), "Nonlinear Effects of Remittances on Per Capita GDP Growth in Bangladesh", *Economies*, vol. 5, no. 3, pp. 1–11.

Hatemi-J, A., and G. S. Uddin (2014), "On the Causal Nexus of Remittances and Poverty Reduction in Bangladesh", *Applied Economics*, vol. 46, no. 4, pp. 374–382.

Hertel, T. W. (1997), *Global Trade Analysis: Modeling and Applications*, New York: Cambridge University Press.

Herzer, D., S. Klasen, and F. Nowak-Lehmann D. (2008), "In Search of FDI-led Growth in Developing Countries: The Way Forward", *Economic Modelling*, vol. 25, pp. 793–810.

Holzman, R. (2018), *Managed Labor Migration in Afghanistan: Exploring Employment and Growth Opportunities for Afghanistan*, Summary Policy Report to the World Bank Project on "Afghanistan: Managed International Labor Mobility as Contribution to Economic Development and Growth", Washington DC: The World Bank.

Hosoe, N. (2014), "Japanese Manufacturing Facing Post-Fukushima Power Crisis: A Dynamic Computable General Equilibrium Analysis with Foreign Direct Investment", *Applied Economic*, vol. 46, no. 17, pp. 2010–2020.

Hosoe, N., K. Gasawa, and H. Hashimoto (2010), *Textbook of Computable General Equilibrium Modelling: Programming and Simulations*, New York: Palgrave Macmillan.

Hossain, S. M., and N. Hosoe (2017) "Foreign Direct Investment in the Ready-Made Garments Sector of Bangladesh: Macro and Distributional Implications", *GRIPS Discussion Paper 17-10*, Tokyo: National Graduate Institute for Policy Studies.

Hufbauer, G. C. (1975), "The Multinational Corporation and Direct Investment", in P. B. Kenen (ed.), *International Trade and Finance: Frontiers for Research*, Cambridge: Cambridge University Press, pp. 253–319.

Hussain, Z. (2014) “Explaining the Recent Decline in Remittances in Bangladesh” available: http://blogs.worldbank.org/endpovertyinsouthasia/explaining-recent-decline-remittances-bangladesh, accessed: December 22, 2017.

Hymer, S. H. (1976), *The International Operations of National Firms: A Study of Direct Foreign Investment*, Cambridge: MIT Press.

Iamsiraroj, S. (2016), “The Foreign Direct Investment-Economic Growth Nexus”, *International Review of Economics and Finance*, vol. 42, pp. 116–133.

ILO/OECD/World Bank (2015), “The Contribution of Labour Mobility to Economic Growth”, Joint paper for G20 Labour and Employment Ministers’ Meeting Ankara, Turkey, 3–4 September.

Independent (2018), “BIDA Policy to Make Bangladesh a Top Investment Destination”, January 23, available: http://www.theindependentbd.com/arcprint/details/77613/2017-01-23, accessed: December 20, 2018.

International Finance Corporation (2016), *Transforming Bangladesh’s Garments Sector: At a Glance*, IFC Issue Brief, World Bank Group, available: https://www.ifc.org/wps/wcm/connect/2a915f804a103b7c9ff2bfe54d141794/Bangladesh.pdf?MOD=AJPERES, accessed: February 2, 2017.

International Monetary Fund (2005), *World Economic Outlook: Global Economic Outlook and External Imbalances*, Washington DC.

International Monetary Fund (2017), “Bangladesh: 2017 Article IV Consultation-Press Release; Staff Report”, *IMF Country Report*, no. 17/147, Washington DC.

Islam, M. S., and S. I. A. Meerza (2013), "Trade, Foreign Direct Investment and Economic Growth Linkages in Selected South Asian Countries", in S. Ahmed (ed.), *Foreign Direct Investment, Trade and Economic Growth: Exploring Challenges and Opportunities*, New Delhi: Routledge, pp. 101–112.

Jawaid, S.T., and S. A. Raza (2012), "Workers' Remittances and Economic Growth in China and Korea: An Empirical Analysis", *Journal of Chinese Economic and Foreign Trade Studies*, vol. 5, no. 3, pp. 85–193.

Jawaid, S. T., and S. A. Raza (2016), "Effects of Workers' Remittances and its Volatility on Economic Growth in South Asia", *International Migration,* vol. 54, no. 2, pp. 50–68.

Jayaraman, T. K., C. K. Choong, and R. R. Kumar (2012), "Role of Remittances in India's Economic Growth", *Global Business and Economics Review*, vol. 14, no. 3, pp. 159–177.

Jayasuriya, D. (2011), "Improvements in the World Bank's Ease of Doing Business Rankings: Do they Translate into Greater Foreign Direct Investment Inflow?", *Policy Research Working Paper*, no. 5767, Washington DC: The World Bank.

Jongwanich, J. (2007), "Remittances, Economic Growth and Poverty in Developing Asia and the Pacific Countries", *UNESCAP Working Paper*, no. WP/07/01, Bangkok: United Nations Economic and Social Commission for Asia and the Pacific.

Kabir, M. (2007), "Is Foreign Direct Investment Growth-Enhancing in Bangladesh?", *BIISS Journal*, vol. 28, no. 2, pp. 101–119.

Kalyoncu, H., N. Tuluce, and Z. O. Yaprak (2015), "Determinants of Foreign Direct Investment: An Empirical Analysis for Turkey", *Journal of Economic and Social Studies*, vol. 5, no. 2, pp. 41–56.

Karagoz, K. (2009), "Workers' Remittances and Economic Growth: Evidence from Turkey", *Journal of Yasar University*, vol. 4, no. 13, pp. 1891–1908.

Kathuria, S., M. M. Malouche, P. Kausek, and N. Rizwan (2016), "Attracting Foreign Direct Investment" in S. Kathuria, and M. M. Malouche (eds.), *Strengthening Competitiveness in Bangladesh–Thematic Assessment*, Dhaka: The World Bank and the Government of the People's Republic of Bangladesh, pp. 237–269.

Kee, H. L. (2014), "Local Intermediate Inputs and the Shared Supplier Spillovers of Foreign Direct Investment", *Policy Research Working Paper*, no. 7050, Washington DC: The World Bank.

Khan, M. W. R. (2008), *The Micro Level Impact of Foreign Remittances on Incomes in Bangladesh: A Measurement Approach Using the Propensity Score*, Dhaka: Centre for Policy Dialogue.

Khatri, S. K. (2010), "Labor Migration, Employment, and Poverty Alleviation in South Asia", in S. Ahmed, S. Kelegama, and E. Ghani (eds.), *Promoting Economic Cooperation in South Asia: Beyond SAFTA*, Washington DC: The World Bank, pp. 231–258.

Khatun, F., and M. Ahmad (2015), "Foreign Direct Investment in the Energy and Power Sector in Bangladesh: Implications for Economic Growth", *Renewable and Sustainable Energy Reviews*, vol. 52, pp. 1367–1377.

Kindleberger, C. P. (1969), "The Theory of Direct Investment", in C. P. Kindleberger (ed.), *American Business Abroad: Six Lectures on Direct Investment*, New Haven: Yale University Press.

Kinoshita, Y., and C. Lu (2006), "On the Role of Absorptive Capacity: FDI Matters to Growth", *William Davidson Institute Working Paper*, no. 845, Ann Arbor: The University of Michigan.

Kumar, R. R., P. J. Stauvermann, N. N. Kumar, and S. J. H. Shahzad (2018), "Revisiting the Threshold Effect of Remittances on Total Factor Productivity Growth in South Asia: A Study of Bangladesh and India", *Applied Economics*, vol. 50, no. 26, pp. 2860–2877.

Latorre, M. C. (2016), "A CGE Analysis of the Impact of Foreign Direct Investment and Tariff Reform on Female and Male Workers in Tanzania", *World Development*, vol. 77, pp. 346–366.

Latorre, M. C., and N. Hosoe (2016), "The Role of Japanese FDI in China", *Journal of Policy Modeling*, vol. 38, no. 2, pp. 226–241.

Le, T. (2009), "Trade, Remittances, Institutions, and Economic Growth", *International Economic Journal*, vol. 23, no. 3, pp. 391–408.

Lipton, M. (1980), "Migration from the Rural Areas of Poor Countries: The Impact on Rural Productivity and Income Distribution", *World Development*, vol. 8, no. 1, pp. 1–24.

Mahbub, T., and J. Jongwanich (2019), "Determinants of Foreign Direct Investment (FDI) in the Power Sector: A Case Study of Bangladesh", *Energy Strategy Reviews*, vol. 24, pp. 178–192.

Majagaiya, K. P. (2009), "Foreign Direct Investment, Grant, Remittances and Pension; Case of Nepal", *Journal of Applied Sciences Research*, vol. 5, no. 7, pp. 876–879.

Mallick, S., and T. Moore (2008), "Foreign Capita in a Growth Model", *Review of Development Economics*, vol. 12, no. 1, pp. 143–159.

Markowitz, H. M. (1959), *Portfolio Selection: Efficient Diversification of Investment*, New York: John Wiley.

Martin, W. (2017), *Strategic Recommendations for Shelter Upgrade in Response to the Rohingya Humanitarian Crisis: Findings and Results of the Emergency Market Mapping Analysis (EMMA) on Bamboo and Timber Market Chains in Cox's Bazar District, Bangladesh*, Dhaka: Humanitarian Aid and Civil Protection, European Union.

Mchemwa, L. (2012), "The Effects of Remittances on Economic Growth in Sub-Saharan Africa", Master's Dissertation, Johannesburg: Department of Economics and Econometrics, The University of Johannesburg.

Ministry of Finance (2015), *Bangladesh Economic Review 2014*, Dhaka: The Government of the People's Republic of Bangladesh.

Mohamed, S. E. (2009), "Workers' Remittances and Growth in MENA Labor Exporting Countries", *International Network for Economic Research Working Paper*, no. 2009.1B0, available: http://www.infer-research.net/files_publications/wp2009-10.pdf, accessed: December 24, 2017.

Moore, M. O. (1993), "Determinants of German Manufacturing Direct Investment in Manufacturing Industries", *Weltwirtschaftliches Archiv*, vol. 129, pp. 120–137.

Moosa, I. A. (2002), *Foreign Direct Investment: Theory, Evidence and Practice*, New York: Palgrave Macmillan.

Mundell, R. A. (1957), "International Trade and Factor Mobility", *American Economic Review*, vol. 47, no. 3, pp. 321–335.

Nair-Reichert, U., and D. Weinhold (2001), "Causality Tests for Cross-Country Panels: a New Look at FDI and Economic Growth in Developing Countries", *Oxford Bulletin of Economics and Statistics*, vol. 63, no. 2, pp. 153–171.

Nana, G., and J. Poot (1996), "A Study of Trade Liberalisation and Factor Mobility with a CGE Model of Australia and New Zealand", *Studies in Regional Science*, vol. 26, no. 2, pp. 27–52.

Nijkamp, P., and J. Poot (2012), "Migration Impact Assessment: A State of Art", in P. Nijkamp, J. Poot, and M. Sahin (eds.), *Migration Impact Assessment: New Horizons*, Cheltenham: Edward Elgar, pp. 3–62.

Organisation for Economic Co-operation and Development (2008), *OECD Benchmark Definition of Foreign Direct Investment*, Fourth Edition, Parish.

Palma, P. (2016), "Migration Cost Goes Up, Wages Not So", *Daily Star*, December 09, https://www.thedailystar.net/frontpage/migration-cost-goes-wages-not-so-1327447, accessed June 18, 2018.

Penninx, R. (1982), "A Critical Review of Theory and Practice: The Case of Turkey", *International Migration Review*, vol. 16, no. 4, pp. 781–818.

Planning Commission (2015), *Seventh Five Year Plan FY 2016-FY 2020: Accelerating Growth, Empowering Citizens*, Dhaka: General Economic Division, Planning Commission, Government of the People's Republic of Bangladesh.

Policy Research Institute (2012), "Social Accounting Matrix for Bangladesh, 2012: Methodology and Result", *SPM Manual Series*, no. 5, Dhaka.

Pradhan, G., M Upadhyay, and K. Upadhyaya (2008), "Remittances and Economic Growth in Developing Countries", *European Journal of Development Research*, vol. 20, no. 3, pp. 497–506.

Qayyum, A., M. Javid, and U. Arif (2008), "Impact of Remittances on Economic Growth and Poverty: Evidence from Pakistan", *MPRA Paper No 22941*, Munich Personal RePEc Archive.

Quader, M. (2009), "Foreign Direct Investment in Bangladesh: An Empirical Analysis on its Determinants and Impacts", *MPRA Paper No 26134*, Munich Personal RePEc Archive.

Raihan, S., B. H. Khondker, G. Sugiyarto, and S. Jha (2009), "Remittance and Household Welfare: A Case Study of Bangladesh", *ADB Economics Working Paper*, no 189, Manila: Asian Development Bank.

Raihan, S., and F. Ashraf (2016), "What Factors Matter in Attracting FDI?", *Thinking Aloud*, vol. 3, no. 7, p. 2.

Raihan, S., T Siddiqui, and R. A. Mahmood (2017), "Estimating the Impact of International Remittance on Household Expenditure in Bangladesh", in S. I. Rajan (ed.), *South Asia Migration Report 2017: Recruitment, Remittances and Reintegration*, London and New York: Routledge, pp. 190–208.

Rana, R. H. (2015), "The Determinants of Workers Remittance in Terms of Foreign Factors: The Case of Bangladesh", *Studies in Business and Economics*, vol. 10, no. 3, pp. 81–93.

Ratha, D., and S. Mohapatra (2007), "Increasing the Macroeconomic Impact of Remittances on Development", Development Prospects Group, Washington DC: The World Bank, available: http://www.dilipratha.com/index_files/G8Berlin.pdf, accessed: December 22, 2018.

Rosen, S. (1974), "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition", *Journal of Political Economy*, vol. 82, no. 1, pp. 34–55.

Santos, H. C. Z. A., C. da Silva, T. A. A. de Souza, and E. C. de Araújo (2017), "Empirical Analysis on the Determinants of FDI in Brazil for the Period of the Post 1990", *Transnational Corporations Review,* vol. 9, no. 3, pp. 218–231.

Sarkar, B., and K. Datta (2014), "Determinants of Remittances to Bangladesh: A Regression Analysis" *IUP Journal of Bank Management*, vol. 13, no. 3, pp. 48–56.

Shimul, S. N., S. M. Abdullah, and S. Siddiqua (2009), "An Examination of FDI and Growth Nexus in Bangladesh: Engle Granger and Bound Testing Cointegration Approach", *BRAC University Journal,* vol. 6, no. 1, pp. 69–76.

Siddique, A., E. A. Selvanathan, and S. Selvanathan (2012), "Remittances and Economic Growth: Empirical Evidence from Bangladesh, India and Sri Lanka", *Journal of Development Studies,* vol. 48, no. 8, pp. 1045–1062.

Siddiqui, T. (2016), "International Labour Migration", *Daily Star*, 25th Anniversary Special, February 05, 2016.

Srivastava, N.L., and S.K. Chaudhary (2007), "Role of Remittance in Economic Development of Nepal", *Journal of Nepalese Business Studies,* vol. 4, no. 1 pp. 28–37.

Stahl, C. W., and A. Habib, (1989), "The Impact of Overseas Workers' Remittances on Indigenous Industries: Evidence from Bangladesh", *Developing Economies,* vol. 27, no. 3, pp. 269–285.

Stark, O., and D. Levhari (1982), "On migration and risk in LDCs", *Economic Development and Cultural Change,* vol. 31, no. 1, pp. 191–196.

Sy, M., and H. Tabarraei (2010), "Capital Inflows and Exchange Rate in LDCs: The Dutch Disease Problem Revisited", *PSE Working Paper No 2009-26*, Parish: Parish School of Economic.

Taylor, J. E. (1999), "The New Economics of Labour Migration and the Role of Remittances in the Migration Process", *International Migration*, vol. 37, no. 1, pp. 63–88.

Tobin, J. (1958), "Liquidity Preference as Behavior Towards Risk", *The Review of Economic Studies*, vol. 25, no. 2, pp. 65–86.

Tolcha, T. D., and P. N. Rao (2016), "The Impact of Remittances on Economic Growth in Ethiopia", *Indian Journal of Commerce and Management Studies*, vol. 7, no. 2, pp. 1–15.

Ullah, M. S. (2017), "FDI Policies of Developing Countries in South and Southeast Asia: A Comparative Analysis", *Ritsumeikan Economic Review*, vol. 65, no. 4, pp. 498–519.

United Nations Conference on Trade and Development (2013), *Investment Policy Review: Bangladesh*, Geneva: United Nations Conference on Trade and Development.

United Nations Conference on Trade and Development (2014), "Investment Policy Review of Bangladesh: Speaking Point", Geneva, available: http://unctad.org/meetings/en/Presentation/cii2014_Zhan03_en.pdf, accessed: September 26, 2017.

United Nations Conference on Trade and Development (2017), *World Investment Report 2017: Investment and the Digital Economy*, Geneva.

United Nations Conference on Trade and Development (2018), *World Investment Report 2018: Investment and New Industrial Policies,* Geneva.

University Grant Commission (2015), *41st Annual Report* (In Bengali), Dhaka.

US Trade Representative (2017), "2017 National Trade Estimate Report on Foreign Trade Barriers", Washington DC, available: https://ustr.gov/sites/default/files/files/reports/2017/NTE/2017%20NTE.pdf, accessed: September 24, 2017.

Waheed, A., and A. Aleem (2008), "Workers' Remittances and Economic Growth: Empirical Evidence from Pakistan", *Journal of Social Science and Humanities*, vo. 47, no. 1, pp. 1–12.

Walmsley, T., A. Aguiar, and S. A. Ahmed (2015), "Labour Migration and Economic Growth in East and South-East Asia", *World Economy*, vol. 40, no. 1, pp. 116–139.

Walmsley, T. L., and L. A. Winters (2005), "Relaxing the Restrictions on the Temporary Movement of Natural Persons: A Simulation Analysis", *Journal of Economic Integration,* vol. 20, no. 4, pp. 688–726.

Wang, M. (2009), "Manufacturing FDI and Economic Growth: Evidence from Asian Economies", *Applied Economics*, vol. 41, no. 8, pp. 991–1002.

Wei, S. J. (2000), "How Taxing is Corruption on International Investors?", *Review of Economics and Statistics,* vol. 82, no. 1, pp. 1–11.

Wickramasinghe, A. A. I. N., and W. Wimalaratana (2016), "International Migration and Migration Theories", *Social Affairs: A Journal for the Social Sciences*, vol.1, no. 5, pp. 13–32.

World Bank (2006), *Global Economic Prospects 2006: Economic Implications of Remittances and Migration*, Washington DC.

World Bank (2013), "An Assessment of Skills in the Formal Sector Labor Market in Bangladesh: A Technical Report on the Enterprise-Based Skills Survey 2012", *Discussion Paper Series*, no. 64, Washington DC.

World Bank (2017), *Doing Business 2017: Equal Opportunity for All*, Washington DC.

World Bank, Doing Business Database, Washington DC, available: http://www.doingbusiness.org/rankings, accessed: February 15, 2017.

World Bank, *World Development Indicators*, Washington DC, available: http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators, accessed: December 18, 2017.

Yalta, A. Y. (2013), "Revisiting the FDI-led Growth Hypothesis: The Case of China", *Economic Modelling*, vol. 31, pp. 335–343.

Zhang, H. (2012), "How do Business Regulations Affect Foreign Direct Investment?", *Transnational Corporations Review*, vol. 4, no. 2, pp. 97–119.

Zhang, K. H. (2001), "Does Foreign Direct Investment Promote Economic Growth? Evidence from East Asia and Latin America", *Contemporary Economic Policy*, vol. 19, no. 2, pp. 175–185.

Appendix I: Appendix for Chapter 3

I.1. Aggregation of Social Accounting Matrix

Table I.1: Bangladesh 2012 SAM Accounts

Sectors (no. of original sectors and institutions)	Description of Elements
Industrial Sectors (86)	
Agriculture (20)	Paddy Cultivation, Wheat Cultivation, Other Grain Cultivation, Jute Cultivation, Sugarcane Cultivation, Potato Cultivation, Vegetable Cultivation, Pulses Cultivation, Oilseed Cultivation, Fruit Cultivation, Cotton Cultivation, Tobacco Cultivation, Tea Cultivation, Spice Cultivation, Other Crop Cultivation, Livestock Rearing, Poultry Rearing, Shrimp Farming, Fishing, Forestry
Mining & Quarrying (1)	Mining and Quarrying
Manufacturing (39)	Rice Milling, Grain Milling, Fish Process, Oil Industry, Sweetener Industry, Tea Product, Salt Refining, Food Process, Tanning and Finishing, Leather Industry, Baling, Jute Fabrication, Yarn Industry, Cloth Milling, Handloom Cloth, Dyeing and Bleaching, Woven, Knitting, Toiletries, Cigarette Industry, Bidi Industry, Wood and Cork Product, Furniture Industry, Paper Industry, Printing and Publishing, Pharmaceuticals, Fertiliser Industry, Basic Chemical, Petroleum Refinery, Earth ware Industry, Plastic Products, Glass Industry, Clay Industry, Cement, Basic Metal, Metal, Machinery and Equipments, Transport Equipments, Miscellaneous Industry
Construction (04)	Building, Kutcha House, Agriculture Construction and Other Construction
Electricity, Gas and Water Supply (3)	Electricity, Water Generation, Gas Extraction and Distribution
Trade, and Transport (7)	Wholesale Trade, Retail Trade, Air Transport, Water Transport, Land Transport, Railway Transport, Other Transport,
Services (12)	Housing and Real Estate Service, Health Service, Education Service, Public Administration and Defense, Bank and other Financial Services, Insurance, Professional Service, Entertainment, Hotel and Restaurant, Communication, Other Services, ICT
Factors of Production (4)	
Labor (2)	Labour Unskilled, and Labour Skilled
Capital (2)	Capital and Land
Current Institutions (11)	
Households (8)	Rural: landless, Agricultural marginal, Agricultural small, Agricultural large, Non-farm poor and Non-farm non poor Urban: Low educated heads, and High educated heads
Others (3)	Government, Corporation and Rest of the World
Capital Institution (1)	Investment

Source: Policy Research Institute, 2012, pp. 2-3

Table I.2: Aggregated Social Accounting Matrix of Bangladesh [Unit: Million BDT]

	AGR	COT	MIN	FOD	TEX	RMG	YRN	PPP	CHM	MME	OMC	CON	POW	TTC	SVC	ULB	SLB	CAP
AGR	611580	2	0	1121659	580	0	34	1586	1	85	57103	122000	659	0	88132	0	0	0
COT	0	4	0	0	64	122	27640	4	0	0	2	0	0	0	12			
MIN	4367	0	0	3900	4	0	0	0	15	34559	10469	76053	8931	0	138			
FOD	47369	0	0	42745	0	0	0	522	0	0	48890	0	0	0	31542	0	0	0
TEX	0	0	0	0	430	224452	1085	63	0	101	4256	0	0	308	9137			
RMG	0	0	0	0	0	3181	0	0	0	0	0	0	0	0	0	0	0	0
YRN	638	0	0	0	35652	182141	16710	15	0	5	8999	0	0	0	0			
PPP	18	0	269	6984	24	4798	121	6244	0	2229	15650	0	18	15028	56994	0	0	0
CHM	325	0	2212	6157	0	2435	40	1699	208	4928	35462	34185	1371	10397	5046			
MME	54109	6	24503	7454	363	23204	444	1520	16	250138	8479	355274	14448	20426	44957	0	0	0
OMC	178085	61	1774	6405	7810	32061	2259	4849	380	1717	165981	226417	5490	115141	94830	0	0	0
CON	0	0	0	397	19	1090	50	64	0	55	609	3342	0	25421	21497	0	0	0
POW	2504	0	3448	776	74	54374	78	422	24	719	2431	4327	293	3816	23190	0	0	0
TTC	739074	756	5632	401195	46460	262816	39169	29306	7876	258964	556747	0	0	144681	94059	0	0	0
SVC	72632	6	36855	13145	1008	135639	3443	3980	470	28055	82768	276353	10667	389095	732622	0	0	0
ULB	465068	208	2098	96508	20286	162806	8370	6800	479	32752	65734	210042	2533	486258	683349			
SLB	205054	61	10754	72995	20233	165091	8348	7147	503	34424	66841	99749	12983	748791	760581			
CAP	422789	0	44263	187242	19698	235249	8116	14197	985	69459	169034	424151	95326	919062	1062079			
LND	515523	656	0	0	0	0	0	0	0	0	0	0	0	0	0			
RLL	0			0		0		0		0	0	0	0	0	0	215894	136456	155247
RMR	0			0		0		0		0	0	0	0	0	0	175478	100734	161467
RSM	0			0		0		0		0	0	0	0	0	0	339675	188934	237137
RLR	0			0		0		0		0	0	0	0	0	0	210411	105694	83101
RNFP	0			0		0		0		0	0	0	0	0	0	292241	185945	124509
RNFNP	0			0		0		0		0	0	0	0	0	0	348251	215888	1323397
ULED	0			0		0		0		0	0	0	0	0	0	612616	142071	62737
UHED	0			0		0		0		0	0	0	0	0	0	48725	1137832	659585
CRP	0			0		0		0		0	0	0	0	0	0			864467
IDT	126	0	94	9191	0	59	322	1383	757	5733	153253	32475	26508	30177	85615			
TRF	10044	2	1410	41817	2874	2678	2855	6584	11827	83678	149911	0	0	0	0			
PRT	-40227	-15	0	-3486	-11918	0	0	0	0	0	-1903	0	-80	-5	0			
XSB	-1698	0	-47	-1370	-3051	-39165	-411	-72	-89	-1189	-6649	-70	0	-1047	-2663			
GOV	0			0		0		0		0	0	0	0	0	0			
ROW	104662	26100	5239	571690	252862	3053	137130	35786	76699	493324	1123877	756	0	56309	61738			
INV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	3392042	27847	138505	2585403	393470	1456084	255801	122101	100153	1299735	2717946	1865055	179148	2963857	3852855	2243291	2213554	3671648

Table I.2: Aggregated Social Accounting Matrix of Bangladesh [Continued]

	LND	RLL	RMR	RSM	RLR	RNFP	RNFNP	ULED	UHED	CRP	IDT	TRF	PRT	XSB	GOV	ROW	INV	Total
AGR	0	94464	86281	171260	83633	112851	395694	119206	223802	0	0	0	0	0	0	55564	45866	3392042
COT		0	0	0	0	0	0	0	0						0	0	0	27847
MIN		187	236	178	390	214	411	212	1048						0	1539	-4345	138505
FOD	0	191012	181684	336324	163212	220911	777070	206974	300099	0	0	0	0	0	0	44833	-7784	2585403
TEX		6134	952	6629	4070	5144	15315	9026	8806						0	99871	-2308	393470
RMG	0	3377	2654	4162	1655	3383	9616	4155	4958	0	0	0	0	0	7481	1281863	129598	1456084
YRN		0	0	0	0	0	0	0	0						0	13464	-1822	255801
PPP	0	285	237	348	121	287	804	408	434	0	0	0	0	0	0	2341	8457	122101
CHM		0	0	0	0	0	0	0	0						0	2897	-7208	100153
MME	0	487	283	703	191	598	1625	1332	1402	0	0	0	0	0	0	38924	448848	1299735
OMC	0	130390	92660	165935	69911	122738	383389	163153	193211	0	0	0	0	0	0	217620	335678	2717946
CON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2285	1810225	1865055
POW	0	5146	4002	5773	1971	4210	13339	19725	28506	0	0	0	0	0	0	0	0	179148
TTC	0	28741	22742	46328	16122	27199	107041	39915	54775	0	0	0	0	0	0	34258	0	2963857
SVC	0	130154	96085	173600	59588	124013	401100	223330	258192	0	0	0	0	0	512895	87161	0	3852855
ULB																	0	2243291
SLB																	0	2213554
CAP																	0	3671648
LND																	0	516179
RLL	0														65823	39040	0	612460
RMR	30213														49294	49755	0	566940
RSM	124453														60788	148736	0	1099723
RLR	170732														34702	75066	0	679706
RNFP	34484														54536	34616	0	726331
RNFNP	92219														97160	323337	0	2400253
ULED	15044														50293	141434	0	1024196
UHED	49035														56939	203850	0	2155966
CRP																	0	864467
IDT																	0	345693
TRF																	0	313681
PRT																	0	-57634
XSB																	0	-57519
GOV		0	0	0	0	0	0	17797	123458	337231	345693	313681	-57634	-57519			0	1022707
ROW																	0	2949225
INV	0	22084	79124	188483	278842	104782	294848	218963	957274	527237	0	0	0	0	32796	50771	73451	2828654
Total	516179	612460	566940	1099723	679706	726331	2400253	1024196	2155966	864467	345693	313681	-57634	-57519	1022707	2949225	2828654	

Source: Planning Commission, General Economic Division, Government of the People's Republic of Bangladesh.

Table I.3: Mapping between Disaggregated SAM and Aggregated SAM

	Sector	Abbreviation	Comprising Original SAM Sectors
1	Agriculture	AGR	Paddy Cultivation, Wheat Cultivation, Other Grain Cultivation, Jute Cultivation, Sugarcane Cultivation, Potato Cultivation, Vegetable Cultivation, Pulses Cultivation, Oilseed Cultivation, Fruit Cultivation, Tobacco Cultivation, Tea Cultivation, Spice Cultivation, Other Crop Cultivation, Livestock Rearing, Poultry Rearing, Shrimp Farming, Fishing, Forestry
2	Cotton Cultivation	COT	Cotton Cultivation
3	Mining and Quarrying	MIN	Mining and Quarrying
4	Food Products	FOD	Rice Milling, Grain Milling, Fish Process, Oil Industry, Sweetener Industry, Tea Product, Salt Refining, Food Process
5	Textile	TEX	Cloth Milling
6	Ready-Made Garments	RMG	Woven, Knitting
7	Ready-Made Garments hosting MNEs	RMG2	
8	Yarn Industry	YRN	Yarn Industry
9	Paper, Printing and Publishing	PPP	Paper Industry, Printing and Publishing
10	Basic Chemical	CHM	Basic Chemical
11	Metal, Machinery and Equipment	MME	Basic Metal, Metal, Machinery and Equipments
12	Other Manufacturing	OMC	Tanning and Finishing, Leather Industry, Baling, Jute Fabrication, Handloom Cloth, Dyeing and Bleaching, Toiletries, Cigarette Industry, Bidi Industry, Wood and Cork Product, Furniture Industry, Pharmaceuticals, Fertilizer Industry, Petroleum Refinery, Earth ware Industry, Plastic Products, Glass Industry, Clay Industry, Cement, Transport Equipments, Miscellaneous Industry
13	Construction	CON	Building, Kutcha House, Agriculture Construction and Other Construction
14	Power	POW	Electricity, Water Generation, Gas Extraction and Distribution
15	Trade, Transport and Communications	TTC	Wholesale Trade, Retail Trade, Air Transport, Water Transport, Land Transport, Railway Transport, Other Transport,
16	Services	SVC	Housing and Real Estate Service, Health Service, Education Service, Public Administration and Defense, Bank and other Financial Services, Insurance, Professional Service, Entertainment, Hotel and Restaurant, Communication, Other Services, ICT

I.2. Sensitivity Analysis

I.2.1. Sensitivity Analysis with Respect to Skill Premium in Simulation 2

In the first skill development program (simulation 2), we assumed a skill premium of 148 percent. To check the robustness of our results with respect to this assumption, we performed the same simulation (simulation 2) alternatively using premiums that were 30 percentage points higher and 30 percentage points lower. While the sectoral output shows little deviation from the baseline case (Table I.4), the welfare estimates of the rural nonagricultural rich households have doubled in value for the higher skill premium case and were very small for the lower skill premium case (Table I.5). The urban highly educated households suffer larger losses for the higher skill premium case and smaller losses for the lower skill premium case. The reason for the welfare estimate change for the rural nonagricultural rich household is self-evident. The reason for the latter requires an explanation. The high-skill premium assumption implies that fewer units of skilled labor, which are estimated in the calibration process, exist in the status quo, given the wage incomes reported in the SAM. Even when the number of new skilled workers is the same (*i.e.*, 4,000 workers), their impact becomes larger in the skilled labor market, leading to the larger welfare deterioration in the urban highly educated households. Despite these variations in welfare-impact estimates for the two types of households, our findings are qualitatively robust.

Table I.4: Impacts on Sectoral Output Change with 30 Percentage Points Higher/Lower Skill Premium Case [Unit: Percentage Change from the Base]

	Baseline Case	30 Percentage Points Higher Skill Premium Case	30 Percentage Points Lower Skill Premium Case
Agriculture	–0.01	0.00	–0.01
Cotton Cultivation	–0.12	–0.12	–0.12
Mining and Quarrying	0.01	0.01	0.01
Food Products	0.00	0.00	0.00
Textile	0.29	0.30	0.29
Ready-Made Garments	–0.53	–0.53	–0.54
Ready-Made Garments hosting MNEs	24.90	24.90	24.89
Yarn Industry	–0.07	–0.06	–0.07
Paper, Printing, and Publishing	–0.05	–0.05	–0.05
Basic Chemical	–0.06	–0.06	–0.06
Metal, Machinery, and Equipment	–0.03	–0.03	–0.03
Other Manufacturing	–0.03	–0.03	–0.03
Construction	0.00	0.00	0.00
Power	0.28	0.28	0.28
Trade, Transport, and Communications	–0.04	–0.04	–0.04
Services	–0.02	–0.02	–0.02

Table I.5: Impacts on Household Welfare with 30 Percentage Points Higher/Lower Skill Premium Case [Unit: EV in Million BDT]

	Baseline Case	30 Percentage Points Higher Skill Premium Case	30 Percentage Points Lower Skill Premium Case
Rural			
Agricultural landless	67.2	67.3	67.0
Agricultural marginal	34.2	35.3	33.2
Agricultural small	94.4	96.6	92.3
Agricultural large	62.3	64.0	60.8
Nonagricultural poor	123.1	122.7	123.6
Nonagricultural rich	102.5	204.0	5.9
Urban			
Poorly educated	278.3	281.4	275.4
Highly educated	–79.3	–94.3	–65.1

I.2.2. Sensitivity Analysis with Respect to Labor Migration Premium in Simulation 3

In the second skill development program (simulation 3), we estimated the migration premium to be 187 percent. We also checked the robustness of our results with respect to this assumption by alternatively using migration premiums that were 30 percentage points higher and 30 percentage points lower. The results show no visible difference in the sectoral output changes between the baseline case and higher/lower migration premium cases (Table I.6). The welfare of the rural nonagricultural rich households increases/decreases substantially with the higher/lower emigration premium rates (Table I.7), but the magnitude of these shifts is smaller than that found in Table I.5 with the alternative skill premiums. Little change is found in the impacts on the other seven households.

Table I.6: Impacts on Sectoral Output Change with 30 Percentage Points Higher/Lower Emigration Premium Case [Unit: Percentage Change from the Base]

	Baseline Case	30 Percentage Points Higher Emigration Premium Case	30 Percentage Points Lower Emigration Premium Case
Agriculture	0.00	0.00	0.00
Cotton Cultivation	–0.20	–0.21	–0.19
Mining and Quarrying	0.01	0.01	0.01
Food Products	0.00	0.00	0.00
Textile	0.18	0.17	0.19
Ready-Made Garments	–0.60	–0.61	–0.60
Ready-Made Garments hosting MNEs	24.88	24.88	24.88
Yarn Industry	–0.15	–0.15	–0.14
Paper, Printing, and Publishing	–0.06	–0.06	–0.06
Basic Chemical	–0.08	–0.08	–0.08
Metal, Machinery, and Equipment	–0.03	–0.03	–0.03
Other Manufacturing	–0.04	–0.04	–0.04
Construction	0.00	0.00	0.00
Power	0.26	0.26	0.26
Trade, Transport, and Communications	–0.05	–0.05	–0.05
Services	–0.03	–0.03	–0.03

Table I.7: Impacts on Household Welfare with 30 Percentage Points Higher/Lower Emigration Premium Case [Unit: EV in Million BDT]

	Baseline Case	30 Percentage Points Higher Emigration Premium Case	30 Percentage Points Lower Emigration Premium Case
Rural			
Agricultural landless	67.2	67.3	67.1
Agricultural marginal	28.8	29.2	28.5
Agricultural small	87.6	88.7	86.5
Agricultural large	61.1	62.3	59.9
Nonagricultural poor	130.3	130.7	130
Nonagricultural rich	125.8	212.1	36.8
Urban			
Poorly educated	254.9	255.1	254.8
Highly educated	32.6	31.8	33.5

I.2.3. Sensitivity Analysis with Respect to Armington Elasticity of Substitution/ Transformation

The results of a CGE analysis often differ according to the assumption of some key parameter values, especially the Armington elasticities of substitution/transformation (σ/ψ). To test the robustness of our simulation results, we performed a sensitivity analysis by considering elasticity of substitution/transformation values that are 30 percent higher and 30 percent lower values than the base values. The results of the sensitivity analysis show that sectoral output does not differ substantially (Table I.8). The welfare estimates are only affected marginally by the parameter values (Table I.9).

Table I.8: Impacts on Sectoral Output Change with 30 Percent Higher/Lower Elasticity Case [Unit: Percentage Change from the Base]

	Baseline Case			30 Percent Higher Elasticity Case			30 Percent Lower Elasticity Case		
	Sim 1	Sim 2	Sim 3	Sim 1	Sim 2	Sim 3	Sim 1	Sim 2	Sim 3
Agriculture	–0.01	–0.01	0.00	–0.01	–0.01	0.00	–0.01	0.00	0.00
Cotton Cultivation	–0.12	–0.12	–0.20	–0.13	–0.13	–0.21	–0.11	–0.11	–0.19
Mining and Quarrying	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Food Products	–0.01	0.00	0.00	–0.01	0.00	0.00	–0.01	0.00	0.00
Textile	0.26	0.29	0.18	0.23	0.26	0.14	0.31	0.33	0.22
Ready-Made Garments	–0.55	–0.53	–0.60	–0.54	–0.53	–0.60	–0.55	–0.54	–0.61
Ready-Made Garments hosting MNEs	24.89	24.90	24.88	24.90	24.90	24.89	24.87	24.88	24.86
Yarn Industry	–0.08	–0.07	–0.15	–0.09	–0.07	–0.15	–0.08	–0.06	–0.15
Paper, Printing, and Publishing	–0.05	–0.05	–0.06	–0.05	–0.05	–0.06	–0.05	–0.05	–0.06
Basic Chemical	–0.07	–0.06	–0.08	–0.07	–0.06	–0.08	–0.06	–0.05	–0.07
Metal, Machinery, and Equipment	–0.03	–0.03	–0.03	–0.03	–0.03	–0.03	–0.03	–0.03	–0.03
Other Manufacturing	–0.04	–0.03	–0.04	–0.04	–0.03	–0.04	–0.04	–0.03	–0.03
Construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power	0.27	0.28	0.26	0.27	0.28	0.26	0.27	0.27	0.26
Trade, Transport, and Communications	–0.04	–0.04	–0.05	–0.05	–0.04	–0.05	–0.04	–0.04	–0.05
Services	–0.03	–0.02	–0.03	–0.03	–0.02	–0.03	–0.03	–0.02	–0.03

Table I.9: Impacts on Household Welfare with 30 Percent Higher/Lower Elasticity Case [Unit: EV in Million BDT]

	Baseline Case			30 Percent Higher Elasticity Case			30 Percent Lower Elasticity Case		
	Sim 1	Sim 2	Sim 3	Sim 1	Sim 2	Sim 3	Sim 1	Sim 2	Sim 3
Rural									
Agricultural landless	55.7	67.2	67.2	53.5	65.2	64.9	59.3	70.6	71.2
Agricultural marginal	19.7	34.2	28.8	18.3	32.8	27.2	22.2	36.7	31.6
Agricultural small	64.8	94.4	87.6	63.1	92.4	85.5	67.9	97.7	91.2
Agricultural large	44.0	62.3	61.1	42.5	60.4	59.1	46.8	65.5	64.5
Nonagricultural poor	112.0	123.1	130.3	109.0	120.2	127.0	117.0	128.1	136.0
Nonagricultural rich	–399.5	102.5	125.8	–402.9	99.4	122.1	–393.1	108.6	132.8
Urban									
Poorly educated	209.2	278.3	254.9	208.4	277.6	254.0	210.4	279.4	256.2
Highly educated	74.0	–79.3	32.6	71.7	–81.1	30.4	77.8	–76.1	36.6

I.3. Details of Bangladesh CGE Model

The basic structure of the Bangladesh CGE model is described in Figure 3.3 with flows of goods and factors. We develop a system of simultaneous equations for our CGE model by solving a number of optimization problems. For example, in the case of domestic production the profit maximization problem of the j_all-th sector can be written as follows:

For the first stage:

$$\text{maximize } \pi^{y}_{j\_all} = P^{y}_{j\_all} Y_{j\_all} - \sum_h P^{f}_{h} F_{h,j\_all}$$

$$\text{subject to } Y_{j\_all} = b_{j\_all} \prod_h F^{\beta_{h,j\_all}}_{h,\ j\_all}$$

For the second stage:

$$\text{maximize } \pi^{Z}_{j\_all} = P^{Z}_{j\_all} Z_{j\_all} - \left(P^{y}_{j\_all} Y_{j\_all} + \sum_{i\_all} P^{q}_{i\_all} X_{i\_all,j\_all}\right)$$

$$\text{subject to } Z_{j\_all} = \min\left(\frac{X_{i\_all,j\_all}}{ax_{i\_all,j\_all}}, \dots, \frac{X_{i\_all,j\_all\prime}}{ax_{i\_all,j\_all\prime}}, \frac{Y_{j\_all}}{ay_{j\_all}}\right)$$

Where,

$\pi^{y}_{j\_all}$	profit of the j_all-th sector producing composite factor Y_{j_all} in the first stage
$\pi^{Z}_{j\_all}$	profit of the j_all-th sector producing composite factor Y_{j_all} in the first stage
Y_{j_all}	composite factor, produced in the first stage and used in the second stage by the j_all-th sector
F_{h,j_all}	the h-th factor used by the j_all-th sector in the first stage
Z_{j_all}	gross domestic output of the j_all-th sector

X_{i_all,j_all}	intermediate input of the j_all-th goods used by the j_all-th sector
$P^{y}_{j\_all}$	price of the j_all-th composite factor
P^{f}_{h,j_all}	price of the h-th composite factor
$P^{z}_{j\_all}$	price of the j_all-th gross domestic output
P^{q}_{i}	price of the i_all-th composite goods
β_{h,j_all}	share coefficient in the composite factor production function
b_{j_all}	scaling coefficient in the composite factor production function
ax_{i_all,j_all}	input requirement coefficient of the i_all-th intermediate input for a unit of output in j_all-th good
ay_{j_all}	input requirement coefficient of the j_all-th composite good for a unit output of the j_all-th good.

By solving these two problems, we obtain following equations:

Composite factor production function

$$\mathrm{Y}_{j\_all} = b_{j\_all} \prod_h F_{h,j\_all}^{\beta_{h,j\_all}} \qquad \forall\, j\_all \qquad (1)$$

Factor demand function

$$F_{h,j\_all} = \frac{\beta_{h,j\_all} P^{y}_{j\_all}}{P^{f}_{h,j\_all}} Y_{j\_all} \qquad \forall\, h, j\_all \qquad (2)$$

Intermediate input demand function

$$X_{i\_all,j\_all} = ax_{i\_all,j\_all} Z_{j\_all} \qquad \forall\, i\_all, j\_all \qquad (3)$$

Composite factor demand function

$$Y_{j\_all} = ay_{j\_all} Z_{j\_all} \qquad \forall\, j\_all \qquad (4)$$

Gross domestic output production function

$$\mathrm{Z}_{j\_all} = \min\left(\frac{X_{i\_all,j\_all}}{ax_{i\_all,j\_all}}, \ldots, \frac{X_{i\_all,j\_all\prime}}{ax_{i\_all,j\_all\prime}}, \frac{Y_{j\_all}}{ay_{j\_all}}\right) \qquad \forall\, j\_all \qquad (5')$$

The production function (5′) generates rectangular isoquants, and the kinks in the isoquants cause difficulty in numerical computation. To resolve this computational complicacy, we replace (5′) with a zero-profit condition:

$$\pi^{Z}_{j\_all} = P^{Z}_{j\_all} Z_{j\_all} - \left(P^{y}_{j\_all} Y_{j\_all} + \sum_{i\_all} P^{q}_{i\_all} X_{i\_all,j\_all}\right) = 0 \qquad \forall\, j\_all$$

We eliminate X_{i_all,j_all} and Y_{j_all} using (3) and (4) to obtain:

$$P^{Z}_{j\_all} Z_{j\_all} - \left(ay_{j\_all} P^{y}_{j\_all} Z_{j\_all} + \sum_{i\_all} ax_{i\_all,j\_all} P^{q}_{i\_all} Z_{j\_all}\right) = 0 \qquad \forall\, j\_all$$

Again by eliminating Z_{j_all}, we get the following unit cost function:

$$P^{z}_{j\_all} = ay_{j\_all} P^{y}_{j\_all} + \sum_{i\_all} ax_{i\_all,j\_all} P^{q}_{i\_all,j\_all} \qquad \forall\, j\_all \qquad (5)$$

Replacing (5′) with (5) we can describe the industrial production structure in our CGE models with (1) to (5).

The gross domestic output produced by different industries (Z_{j_all}) is then transformed into domestic goods (D_{i_all}) and exports (E_{i_all}) by solving the following maximization problem:

$$\text{maximize } \pi_{i\_all} = \left(P^{e}_{i\_all} E_{i\_all} + P^{d}_{i\_all} D_{i\_all}\right) - \left(1 + \tau^{z}_{i\_all} + \tau^{s}_{i\_all}\right) P^{z}_{i\_all} Z_{i\_all}$$

$$\text{subject to } Z_{i\_all} = \theta_{i\_all} \left(\xi e_{i\_all} E^{\phi_{i\_all}}_{i\_all} + \xi d_{i\_all} D^{\phi_{i\_all}}_{i\_all}\right)^{\frac{1}{\phi_{i\_all}}}$$

Where,

π_{i_all} profit of the firm engaged in the i_all-th transformation

$P^{e}_{i\_all}$ price of the i_all-th export good in terms of domestic currency

$P^d_{i\_all}$ price of the i_all-th export good

$P^z_{j\_all}$ price of the i_all-th gross domestic output

E_{i_all} exports of the i_all-th good

D_{i_all} supply of the i_all-th domestic good

Z_{j_all} gross domestic output of the i_all-th good

$\tau^z_{j\_all}$ production tax on the i_all-th gross domestic output

$\tau^s_{i\_all}$ production subsidy on the i_all-th gross domestic output

θ_{i_all} scaling coefficient in the i_all-th transformation

$\xi d_{i\_all}, \xi e_{i\_all}$ share coefficients for the i_all-th good transformation

ϕ_{i_all} parameter defined by the elasticity of transformation $\left(\phi_{i\_all} = \frac{\psi_{i\_all}+1}{\psi_{i\_all}}, \psi_i \geq 1\right)$

ψ_{i_all} elasticity of transformation of the i_all-th good transformation $\left(\psi_{i\_all} = -\frac{d(E_{i\_all}/D_{i\_all})}{E_{i\_all}/D_{i\_all}} / \frac{d(P^e_{i\_all}/P^d_{i\_all})}{P^e_{i\_all}/P^d_{i\_all}}\right)$

By solving this maximization problem, we obtain the supply function of exports (7) and domestic goods (8) as well as the original transformation function (6):

Gross domestic output transformation function

$$Z_{i\_all} = \theta_{i\_all}\left(\xi e_{i\_all} E^{\phi_{i\_all}}_{i\_all} + \xi d_{i\_all} D^{\phi_{i\_all}}_{i\_all}\right)^{\frac{1}{\phi_{i\_all}}} \qquad \forall\, i\_all \qquad (6)$$

Export supply function

$$E_{i\_all} = \left(\frac{\theta^{\phi_{i\_all}}_{i\_all}\xi e_{i\_all}(1+\tau^z_{i\_all}+\tau^s_{i\_all})P^z_{i\_all}}{P^e_{i\_all}}\right)^{\frac{1}{1-\phi_{i\_all}}} Z_{i\_all} \qquad \forall\, i\_all \qquad (7)$$

Domestic good supply function

$$D_{i\_all} = \left(\frac{\theta^{\phi_{i\_all}}_{i\_all}\xi d_{i\_all}(1+\tau^z_{i\_all}+\tau^s_{i\_all})P^z_{i\_all}}{P^d_{i\_all}}\right)^{\frac{1}{1-\phi_{i\_all}}} Z_{i\_all} \qquad \forall\, i\_all \qquad (8)$$

Similarly by, setting and solving optimization problems for agents in the model, we can obtain a system of simultaneous equations. The full equations and variables of Bangladesh static CGE model are listed below:

Functional form of Bangladesh Static CGE Model

Sets, Variable, and Parameters

Sets

i_all, j_all	all sectors
i, j	sectors not hosting MNEs
i_MNE, j_MNE	sectors hosting MNEs
h, k	factors of production
$h1, k1$	capital
$h2, k2$	labor and land
r, s	institutions (household and corporation)
$r1, s1$	household

Endogenous variables

Y_{j_all}	composite factor (value added)
F_{h,j_all}	factor input used by all sectors
X_{i_all,j_all}	intermediate input
Z_{j_all}	gross domestic output
X_i^p	household consumption
X_i^g	government consumption
X_i^v	investment demand

E_{i_all}	exports
$M1_i$	imports for local firms' intermediate and final uses
$M2_{i\_all,j\_MNE}$	imports for MNEs' intermediate
Q_i	Armington's composite good
D_{i_all}	domestic good produced by all firms
$D1_i$	domestic good used for Armington's composite good
$D2_{i\_all,j\_MNE}$	domestic good used for composite intermediate inputs for MNEs
P^f_{h,j_all}	factor price
$P^y_{j\_all}$	composite factor price
$P^z_{j\_all}$	supply price of the gross domestic output
P^q_i	Armington's composite good price
$P^{q2}_{i\_all,j\_MNE}$	Armington's composite good price of MNEs' intermediate
$P^e_{i\_all}$	export price in local currency
P^{m1}_i	import price for local firms' intermediate and final uses in local currency
$P^{m2}_{i\_all,j\_MNE}$	import price for MNEs' intermediate in local currency
$P^d_{i\_all}$	domestic good price
ε	foreign exchange rate (domestic currency/foreign currency)
S^p_r	private savings by household and corporations
S^g	government savings
T^d_r	direct tax revenue
$T^z_{j\_all}$	production tax revenue
T^{m1}_j	import tariff revenue from local firms
$T^{m2}_{i\_all,j\_MNE}$	import tariff revenue from MNEs

$T^{s}_{j\_all}$	production subsidy
T^{x}_{j}	export subsidy
G^{t}_{r}	government transfer
UU_{r1}	utility of household (fictitious)
SW	social welfare

Exogenous variables

$FF_{r,h}$	factor endowment of household
$FFF_{i\_MNE,h}$	primary factor owned by foreigner
R^{m}	remittances
S^{f}	current account deficits in foreign currency term (foreign savings)
R^{f}	payment of foreign capital service
$P^{we}_{i\_all}$	price of exported goods in foreign currency
$P^{wm}_{i\_all}$	price of imported goods in foreign currency
τ^{d}_{r}	direct tax rate on household income
$\tau^{z}_{j\_all}$	production tax rate
τ^{m1}_{i}	import tariff rate on local firm's input
$\tau^{m2}_{i\_all,j\_MNE}$	import tariff rate on MNEs intermediate
$\tau^{s}_{i\_all}$	production subsidy rate
$\tau^{x}_{i\_all}$	export subsidy rate
τ^{g}_{r}	government transfer rate to household

Parameters

ax_{i_all,j_all}	input requirement coefficient of intermediate inputs

ay_{j_all}	input requirement coefficient of composite good
$\alpha_{i,r1}$	share coefficient of household for the consumption in the utility function
β_{h,j_all}	share coefficient for the factor used by firm in the composite factor production function.
b_{j_all}	scaling coefficient in the composite factor production function
μ_i	share of goods in government expenditure
λ_i	expenditure share of the goods in total investment
ss_r^p	average propensity for savings by the household
ss^g	average propensity for savings by the government
$\gamma 1_i$	scaling coefficient in the Armington composite good production function
$\gamma 2_{i\_all,j\_MNE}$	scaling coefficient in Armington composite intermediate input production function used by MNEs
$\delta m1_i$, $\delta d1_i$	input share coefficient in Armington composite good production function
$\delta m2_{i\_all,j\_MNE}$ $\delta d2_{i\_all,j\_MNE}$	input share coefficient in Armington composite intermediate input production function
η_{i_all}	parameter defined by the elasticity of substitution $\left(\eta_{i\_all} = \frac{\sigma_{i\_all}-1}{\sigma_{i\_all}}, \sigma_{i\_all} \leq 1\right)$
σ_{i_all}	elasticity of substitution in the Armington composite good production function $\left(\sigma_{i\_all} = -\frac{d(M_{i\_all}/D_{i\_all})}{M_{i\_all}/D_{i\_all}} / \frac{d(P^m_{i\_all}/P^d_{i\_all})}{P^m_{i\_all}/P^d_{i\_all}}\right)$
θ_{i_all}	scaling coefficient in the transformation function
ξd_{i_all}, ξe_{i_all}	share coefficients in the transformation function
ϕ_{i_all}	parameter defined by the elasticity of transformation $\left(\phi_{i\_all} = \frac{\psi_{i\_all}+1}{\psi_{i\_all}}, \psi_i \geq 1\right)$

ψ_{i_all} elasticity of transformation in the transformation function $\left(\psi_{i\_all} = -\frac{d(E_{i\_all}/D_{i\_all})}{E_{i\_all}/D_{i\_all}} / \frac{d(P^e_{i\_all}/P^d_{i\_all})}{P^e_{i\_all}/P^d_{i\_all}}\right)$

$\rho_{r,h}$ share of factors by household

Model

[Domestic Production Block]

Composite factor production function
$Y_{j\_all} = b_{j\_all} \prod_h F^{\beta_{h,j\_all}}_{h,j\_all}$ $\forall\ j\_all$

Factor demand function
$F_{h,j\_all} = \frac{\beta_{h,j\_all} P^y_{j\_all}}{P^f_{h,j\_all}} Y_{j\_all}$ $\forall\ h, j\_all$

Intermediate input demand function
$X_{i\_all,j\_all} = ax_{i\_all,j\_all} Z_{j\_all}$ $\forall\ i\_all, j\_all$

Composite factor demand function
$Y_{j\_all} = ay_{j\_all} Z_{j\_all}$ $\forall\ j\_all$

Unit cost function for gross domestic output for the local firm sector
$P^z_j = ay_j P^y_j + \sum_i ax_{i,j} P^q_i$ $\forall\ j$

Unit cost function for gross domestic output for the MNE sector
$P^z_{j\_MNE} = ay_{j\_MNE} P^y_{j\_MNE} + \sum_{i\_all} ax_{i\_all,j\_MNE} P^{q2}_{i\_all,j\_MNE}$ $\forall\ j\_MNE$

[Government]

Direct tax revenue function
$T^d_r = \tau^d_r \left(\sum_{h1}\left(\sum_j P^f_{h1,j} F_{h1,j}\right) \rho_{r,h1} + \sum_{h2}\left(\sum_{j\_all} P^f_{h2,j\_all} F_{h2,j\_all}\right) \rho_{r,h2}\right)$ $\forall\ r$

Production tax revenue function
$T^z_{j\_all} = \tau^z_{j\_all} P^z_{j\_all} Z_{j\_all}$ $\forall\ j\_all$

Import tariff revenue function
$T^m_i = \tau^{m1}_i P^{m1}_i M1_i + \sum_{j\_MNE} \tau^{m2}_{i,j\_MNE} P^{m2}_{i,j\_MNE} M2_{i,j\_MNE}$ $\forall\ i$

Government subsidy expense function

$$T^{s}_{j\_all} = \tau^{s}_{j\_all} P^{z}_{j\_all} Z_{j\_all} \qquad \forall\ j\_all$$

Export subsidy expense function

$$T^{x}_{j\_all} = \tau^{x}_{j\_all} P^{e}_{j\_all} E_{j\_all} \qquad \forall\ j\_all$$

Government transfer expense function

$$G^{t}_{r} = \tau^{g}_{r}\left(\sum_{s} T^{d}_{s} + \sum_{j\_all} T^{z}_{j\_all} + \sum_{j} T^{m}_{j} + \sum_{j\_all} T^{s}_{j\_all} + \sum_{j\_all} T^{x}_{j\_all}\right) \qquad \forall\ r$$

Government demand function

$$X^{g}_{i} = \frac{\mu_i}{P^{q}_{i}}\left(\sum_{r} T^{d}_{r} + \sum_{j\_all} T^{z}_{j\_all} + \sum_{j} T^{m}_{j} + \sum_{j\_all} T^{s}_{j\_all} + \sum_{j\_all} T^{x}_{j\_all} - \sum_{r} G^{t}_{r} - S^{g}\right) \qquad \forall\ i$$

[Investment and Savings]

Investment demand function

$$X^{v}_{i} = \frac{\lambda_i}{P^{q}_{i}}\left(\sum_{r} S^{p}_{r} + S^{g} + \varepsilon S^{f}\right) \qquad \forall\ i, r$$

Household savings function

$$S^{p}_{r} = ss^{p}_{r}\left(\sum_{h1}\left(\sum_{j} P^{f}_{h1,j} F_{h1,j}\right)\rho_{r,h1} + \sum_{h2}\left(\sum_{j\_all} P^{f}_{h2,j\_all} F_{h2,j\_all}\right)\rho_{r,h2} + G^{t}_{r} + \varepsilon R^{m}_{r}\right) \qquad \forall\ r$$

Government savings function

$$S^{g} = ss^{g}\left(\sum_{r} T^{d}_{r} + \sum_{j\_all} T^{z}_{j\_all} + \sum_{j} T^{m}_{j} + \sum_{j\_all} T^{s}_{j\_all} + \sum_{j\_all} T^{x}_{j\_all}\right)$$

[Household]

Household demand function

$$X^{p}_{i,r1} = \frac{\alpha_{i,r1}}{P^{q}_{i}}\left(\sum_{h1}\left(\sum_{j} P^{f}_{h1,j} F_{h1,j}\right)\rho_{r1,h1} + \sum_{h2}\left(\sum_{j\_all} P^{f}_{h2,j\_all} F_{h2,j\_all}\right)\rho_{r1,h2} + G^{t}_{r1} + \varepsilon R^{m}_{r1} - S^{p}_{r1} - T^{d}_{r1}\right) \qquad \forall\ i, r1$$

[Export and Import price and balance of payment constraint]

Export price conversion function

$$\left(1 + \tau^{x}_{i\_all}\right) P^{e}_{i\_all} = \varepsilon P^{we}_{i\_all} \qquad \forall\ i\_all$$

Import price conversion function

$$P^{m1}_{i} = \varepsilon P^{wm1}_{i} \qquad \forall\ i$$

Import price conversion function for MNEs intermediate inputs

$$P^{m2}_{i\_all,j\_MNE} = \varepsilon P^{wm2}_{i\_all,j\_MNE} \qquad \forall\, i\_all, j\_MNE$$

Balance of payment constraint

$$\sum_{i\_all} P^{we}_{i\_all} E_{i\_all} + \sum_r R^m_r + S^f - \sum_{h1,j\_MNE} \frac{P^f_{h1,j\_MNE}}{\varepsilon} FFF_{j\_MNE,h1} = \sum_i P^{wm1}_i M1_i + \sum_{i\_all,j\_MNE} P^{wm2}_{i\_all,j\_MNE} M2_{i\_all,j\_MNE}$$

[Substitution between Import and Domestic Good]

Armington composite good production function

$$Q_i = \gamma 1_i \left(\delta m1_i M1_i^{\eta_i} + \delta d1_i D1_i^{\eta_i}\right)^{\frac{1}{\eta_i}} \qquad \forall\, i$$

Import demand function for local firms' intermediate and final uses

$$M1_i = \left(\frac{\gamma 1_i^{\eta_i} \delta m1_i P_i^q}{(1+\tau_i^{m1}) P_i^{m1}}\right)^{\frac{1}{1-\eta_i}} Q_i \qquad \forall\, i$$

Domestic good demand function for local firms' intermediate and final uses

$$D1_i = \left(\frac{\gamma 1_i^{\eta_i} \delta d1_i P_i^q}{P_i^d}\right)^{\frac{1}{1-\eta_i}} Q_i \qquad \forall\, i$$

Composite good production function for MNEs' intermediate

$$X_{i\_all,j\_MNE} = \gamma 2_{i\_all,j\_MNE} \left(\delta m2_{i\_all,j\_MNE} M2^{\eta_{i\_all}}_{i\_all,j\_MNE} + \delta d2_{i\_all,j\_MNE} D2^{\eta_i}_{i\_all,j\_MNE}\right)^{\frac{1}{\eta_{i\_all}}} \qquad \forall\, i\_all, j\_MNE$$

Import demand function for MNEs' intermediate

$$M2_{i\_all,j\_MNE} = \left(\frac{\gamma 2^{\eta_{i\_all}}_{i\_all,j\_MNE} \delta m2_{i\_all,j\_MNE} P^{q2}_{i\_all,j\_MNE}}{(1+\tau^{m2}_{i\_all,j\_MNE}) P^{m2}_{i\_all,j\_MNE}}\right)^{\frac{1}{1-\eta_{i\_all}}} X_{i\_all,j\_MNE}$$

$$\forall\, i\_all, j\_MNE$$

Domestic good demand function for MNEs' intermediate

$$D2_{i\_all,j\_MNE} = \left(\frac{\gamma 2^{\eta_{i\_all}}_{i\_all,j\_MNE} \delta d2_{i\_all,j\_MNE} P^{q2}_{i\_all,j\_MNE}}{P^d_{i\_all}}\right)^{\frac{1}{1-\eta_{i\_all}}} X_{i\_all,j\_MNE}$$

$$\forall\, i\_all, j\_MNE$$

[Transformation between Export and Domestic Goods]

Gross domestic output transformation function

$$Z_{i\_all} = \theta_{i\_all}\left(\xi e_{i\_all} E_{i\_all}^{\phi_{i\_all}} + \xi d_{i\_all} D_{i\_all}^{\phi_{i\_all}}\right)^{\frac{1}{\phi_{i\_all}}} \qquad \forall\, i\_all$$

Export supply function

$$E_{i\_all} = \left(\frac{\theta_{i\_all}^{\phi_{i\_all}} \xi e_{i\_all}\left(1+\tau_{i\_all}^{z}+\tau_{i\_all}^{s}\right) P_{i\_all}^{z}}{P_{i\_all}^{e}}\right)^{\frac{1}{1-\phi_{i\_all}}} Z_{i\_all} \qquad \forall\, i\_all$$

Domestic good supply function

$$D_{i\_all} = \left(\frac{\theta_{i\_all}^{\phi_{i\_all}} \xi d_{i\_all}\left(1+\tau_{i\_all}^{z}+\tau_{i\_all}^{s}\right) P_{i\_all}^{z}}{P_{i\_all}^{d}}\right)^{\frac{1}{1-\phi_{i\_all}}} Z_{i\_all} \qquad \forall\, i\_all$$

[Market Clearing Conditions]

Market clearing condition for the Armington composite good

$$Q_i = \sum_{r1} X_{i,r1}^{p} + X_i^{g} + X_i^{v} + \sum_j X_{i,j} \qquad \forall\, i$$

Market clearing condition of domestic good for local firms' intermediate and final uses

$$D_i = D1_i + \sum_{j\_MNE} D2_{i,j\_MNE} \qquad \forall\, i$$

Market clearing condition of domestic good for MNEs' intermediate

$$D_{i\_MNE} = \sum_{j\_MNE} D2_{i\_MNE,j\_MNE} \qquad \forall\, i\_MNE$$

Market clearing condition of local capital

$$\sum_j F_{h1,j} = \sum_r FF_{r,h1} \qquad \forall\, h1$$

Market clearing condition for foreign capital

$$\sum_{j\_MNE} F_{h1,j\_MNE} = \sum_{j\_MNE} FFF_{J\_MNE,h1} \qquad \forall\, h1$$

Market clearing condition for labor

$$\sum_{j\_all} F_{h2,j\_all} = \sum_r FF_{r,h2} \qquad \forall\, h2$$

[Price Equalization Conditions]

Wage equalization condition across sectors

$$P_{h2,i\_all}^{f} = P_{h2,j\_all}^{f} \qquad \forall\, h2, j\_all$$

Price equalization condition of domestic capital across sectors

$$P^{f}_{h1,i} = P^{f}_{h1,j} \qquad \forall\, h1, i, j$$

Price equalization condition of foreign capital across MNE sectors

$$P^{f}_{h1,i\_MNE} = P^{f}_{h1,j\_MNE} \qquad \forall\, h1, i\_MNE, j\_MNE$$

[Utility and Fictitious Objective Function (Social Welfare)]

Household utility function

$$UU_{r1} = \prod_i {X^{p}_{i,r1}}^{\alpha_{i,r1}} \qquad \forall\ r1$$

Social welfare function

$$SW = \sum_{r1} UU_{r1}$$

I.4. Parameter Estimation Method

In our CGE model, there are many unknown parameters and exogenous variables which we cannot estimate by using econometric approach, because we only have a limited number of observations compared with that of those unknowns. To overcome this problem, we use an alternative estimation method called *calibration* based on data reported in the Social Accounting Matrix (SAM). Calibration technique solves the unknown parameter and exogenous variables using the values of endogenous variables in some known equilibrium which can be observed in the SAM. Let us express the system of simultaneous equations of our CGE model in vector form as follows:

$$\mathbf{CGE}(\mathbf{X}, \mathbf{Y}, \mathbf{A}) = \mathbf{0}$$

Where **X** denotes the vector of endogenous variables, **Y** denotes the vector of exogenous variables, and **A** denotes the vector of unknown parameters. While the main objective to solve the model system $\mathbf{CGE}(.)$ is for the vector of endogenous variables **X**, the calibration technique, however, solves the model system to estimate the vector of parameters **A** given exogenous variable vector **Y** and the initial equilibrium value vector of endogenous variables $\mathbf{X^0}$. In the absence of any shock, the following equation system holds:

$$\mathbf{CGE}(\mathbf{X^0}, \mathbf{Y}, \mathbf{A}) = \mathbf{0}$$

By solving this model system given the initial equilibrium value of endogenous variable vector $\mathbf{X^0}$ and value of exogenous variable vector **Y**, which can be observed and derived from the SAM, we can estimate the parameter vector **A**.[27]

[27] For details about calibration technique please see Hosoe *et al.* (2010).

To demonstrate the calibration process, let us show the share coefficient ($\alpha_{i,r1}$) of household ($r1$) for the consumption $X^{p}_{i,r1}$ in the utility function. We have the following demand function (Section I.3).

Household demand function

$$X^{p}_{i,r1} = \frac{\alpha_{i,r1}}{P^{q}_{i}}\left(\sum_{h1}\left(\sum_{j} P^{f}_{h1,j} F_{h1,j}\right)\rho_{r1,h1} + \sum_{h2}\left(\sum_{j\_all} P^{f}_{h2,j\_all} F_{h2,j\_all}\right)\rho_{r1,h2} + G^{t}_{r1} + \varepsilon R^{m}_{r1} - S^{p}_{r1} - T^{d}_{r1}\right) \qquad \forall\, i, r1$$

As this equation also hold in the initial equilibrium, we also have

$$X^{P^0}_{i,r1} = \frac{\alpha_{i,r1}}{P^{q^0}_{i}}\left(\sum_{h1}\left(\sum_{j} P^{f^0}_{h1,j} F^{0}_{h1,j}\right)\rho_{r1,h1} + \sum_{h2}\left(\sum_{j\_all} P^{f^0}_{h2,j\_all} F^{0}_{h2,j\_all}\right)\rho_{r1,h2} + G^{t^0}_{r1} + \varepsilon R^{m^0}_{r1} - S^{p^0}_{r1} - T^{d^0}_{r1}\right) \qquad \forall\, i, r1$$

Rearranging this equation for $\alpha_{i,r1}$, we get

$$\alpha_{i,r1} = X^{P^0}_{i,r1} P^{q^0}_{i} \Big/ \sum_{h1}\left(\sum_{j} P^{f^0}_{h1,j} F^{0}_{h1,j}\right)\rho_{r1,h1} + \sum_{h2}\left(\sum_{j\_all} P^{f^0}_{h2,j\_all} F^{0}_{h2,j\_all}\right)\rho_{r1,h2} + G^{t^0}_{r1} + \varepsilon R^{m^0}_{r1} - S^{p^0}_{r1} - T^{d^0}_{r1} \qquad \forall\, i, r1$$

All the values on the right hand side can be obtained and derived from the SAM. Similarly, from the following two equations, we can estimate the unknown coefficient of a Cobb-Douglas type production function (β_{h,j_all}) and a scaling coefficient in the composite factor production function (b_{j_all}).

Composite factor production function

$$\mathrm{Y}_{j\_all} = b_{j\_all} \prod_{h} F^{\beta_{h,j\_all}}_{h,j\_all} \qquad \forall\, j\_all$$

Factor demand function

$$F_{h,j\_all} = \frac{\beta_{h,j\_all} P^{y}_{j\_all}}{P^{f}_{h,j\_all}} Y_{j\_all} \qquad \forall\, h, j\_all$$

These equations also hold in the initial equilibrium.

$$Y^{0}_{j\_all} = b_{j\_all} \prod_{h} {F^{0}_{h,j\_all}}^{\beta_{h,j\_all}} \qquad \forall\, j\_all$$

$$F^{0}_{h,j\_all} = \frac{\beta_{h,j\_all} P^{y^{0}}_{j\_all}}{P^{f^{0}}_{h,j\_all}} Y^{0}_{j\_all} \qquad \forall\, h, j\_all$$

Rearranging for β_{h,j_all} and b_{j_all}, we get

$$\beta_{h,j\_all} = \frac{P^{f^{0}}_{h,j\_all} F^{0}_{h,j\_all}}{P^{y^{0}}_{j\_all} Y^{0}_{j\_all}} \qquad \forall\, h, j\_all$$

$$b_{j\_all} = \frac{Y^{0}_{j\_all}}{\prod_{h} {F^{0}_{h,j\_all}}^{\beta_{h,j\_all}}} \qquad \forall\, j\_all$$

All the values on the right hand side can be obtained and derived from the SAM.

Appendix II: Appendix for Chapter 4

II.1. Sensitivity Analysis

The simulation results of CGE analyses often vary depending on the assumptions made about key parameter values. To check the robustness of our results, we perform sensitivity analyses by changing the values of: i) elasticity of transformation in the labor transformation function ($\chi_{r,h2}$) from 1.2 to 0.9 and 1.5; ii) elasticity of investment allocation (ζ) from 1 to 2; iii) rate of return of capital (ror) from 0.05 to 0.06; iv) capital depreciation rate (dep) from 0.04 to 0.05; v) population growth rate (pop) from 0.011 to 0.006; and vi) unemployment rates to twice as high as their original values.

The alternative parameter values used in our sensitivity analysis produce results similar to our original simulation results shown in the main part. For instance, with a smaller elasticity parameter in the labor transformation function $(\chi_{r,h2} = 0.9)$, the output expansion would be slightly smaller (Figure II.1), because the migration decision and labor allocation between the domestic and foreign labor markets are now less elastic to the foreign wage rate change. As a result, the changes in both domestic and foreign employments would be less affected (Figures II.2 & II.3). The wage rate change in the domestic labor market would be slightly smaller in simulation 1, but larger in simulations 2 and 3 with a less elastic labor transformation function (Figure II.4). The magnitude of the changes in GDP, GNP, and household welfare would become marginally smaller in the smaller elasticity case (Figures II.5 & II.6). The opposite is true in the case of the higher elasticity parameter in the labor transformation function $(\chi_{r,h2} = 1.5)$ (Figures II.7 to II.12). Similarly, the impacts of alternative values of ζ, ror, dep, pop, and the rate of unemployment are found to be minimal.

Figure II.1: Output with $\chi_{r,h2} = 0.9$ [Deviation from BAU, Billion BDT]

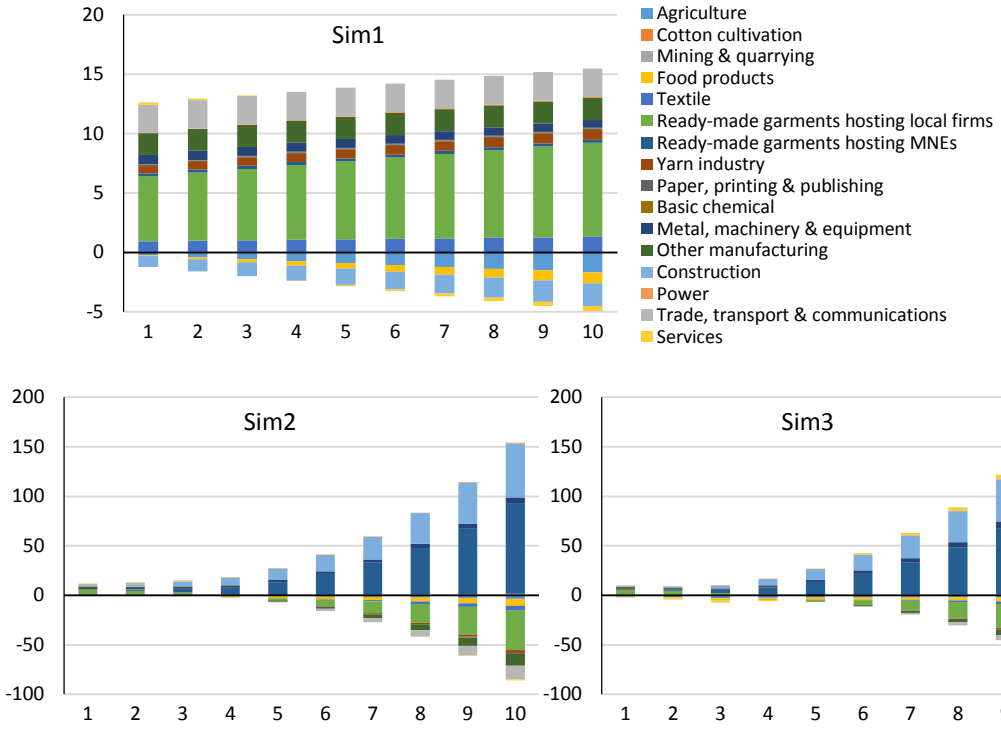


Figure II.2: Domestic and Foreign Employment, and Leisure of Unskilled Workers with $\chi_{r,h2} = 0.9$ [% Change from BAU Total Endowment]

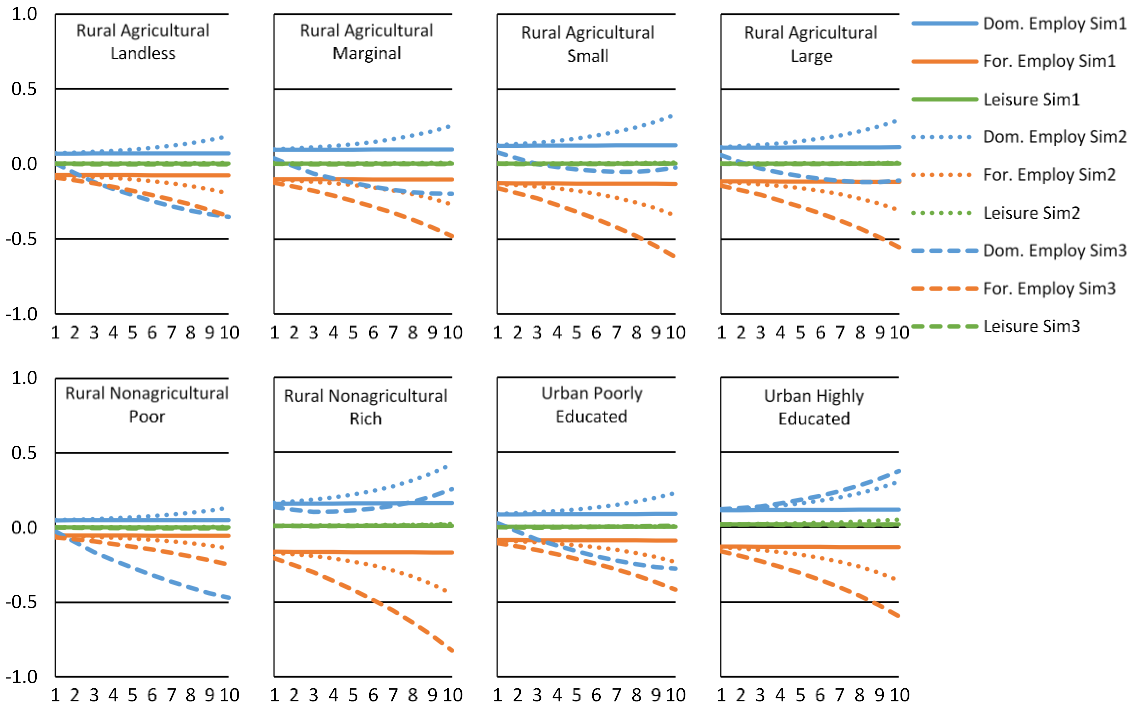


Figure II.3: Domestic and Foreign Employment, and Leisure of Skilled Workers with $\chi_{r,h2} = 0.9$ [% Change from BAU Total Endowment]

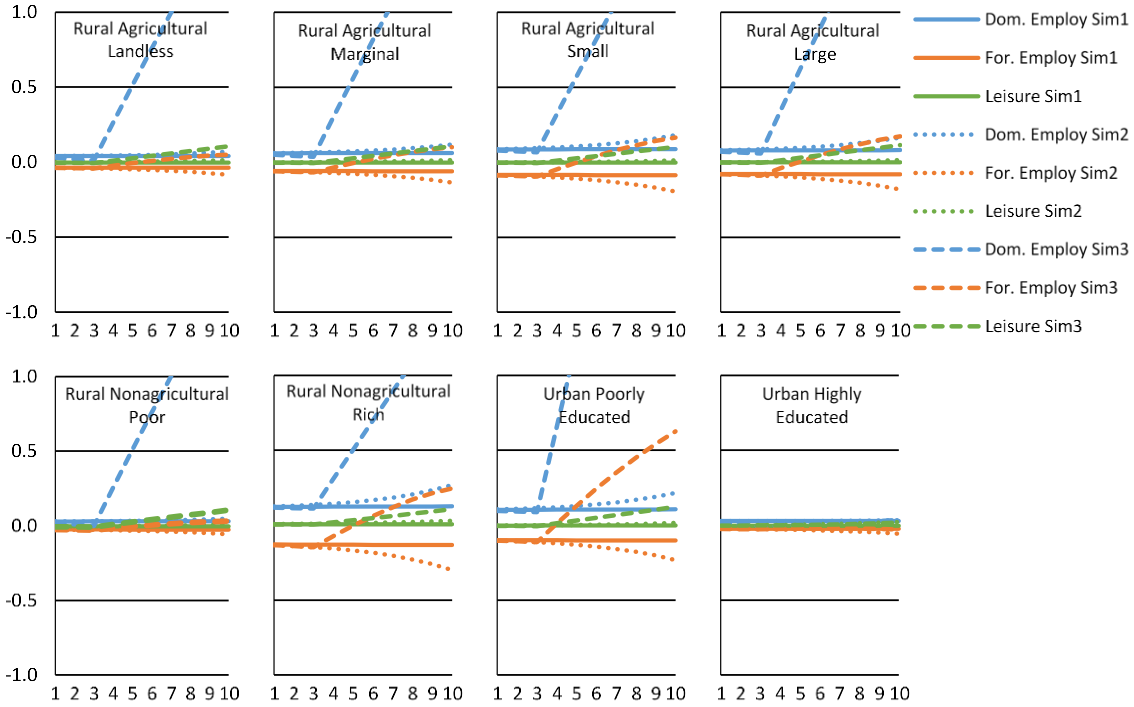


Figure II.4: Changes in Domestic Labor Wage with $\chi_{r,h2} = 0.9$ [Deviation from BAU, % Change]

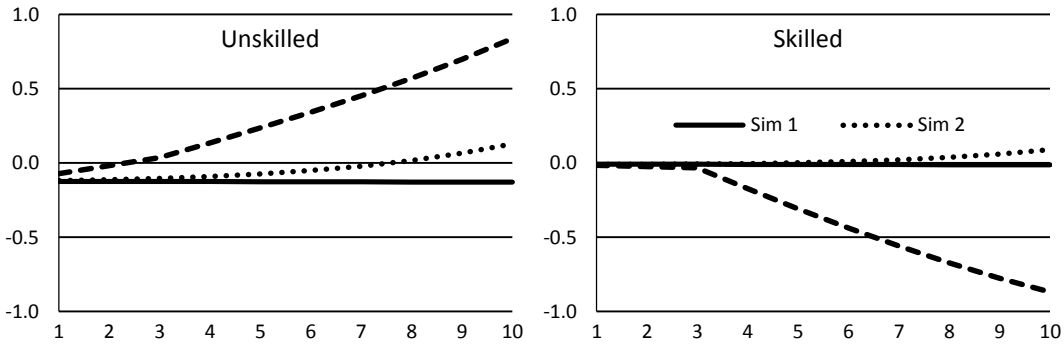


Figure II.5: GDP and GNP with $\chi_{r,h2} = 0.9$ [Deviation from BAU, % Change]

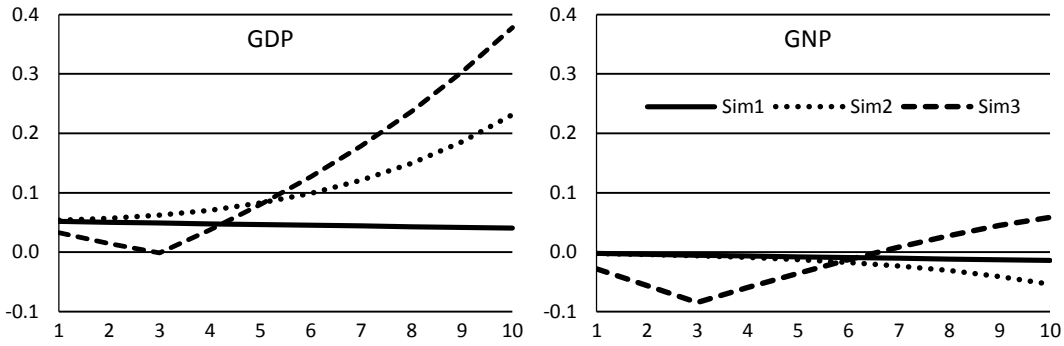


Figure II.6: Household Welfare with $\chi_{r,h2} = 0.9$ [EV in Billion BDT]

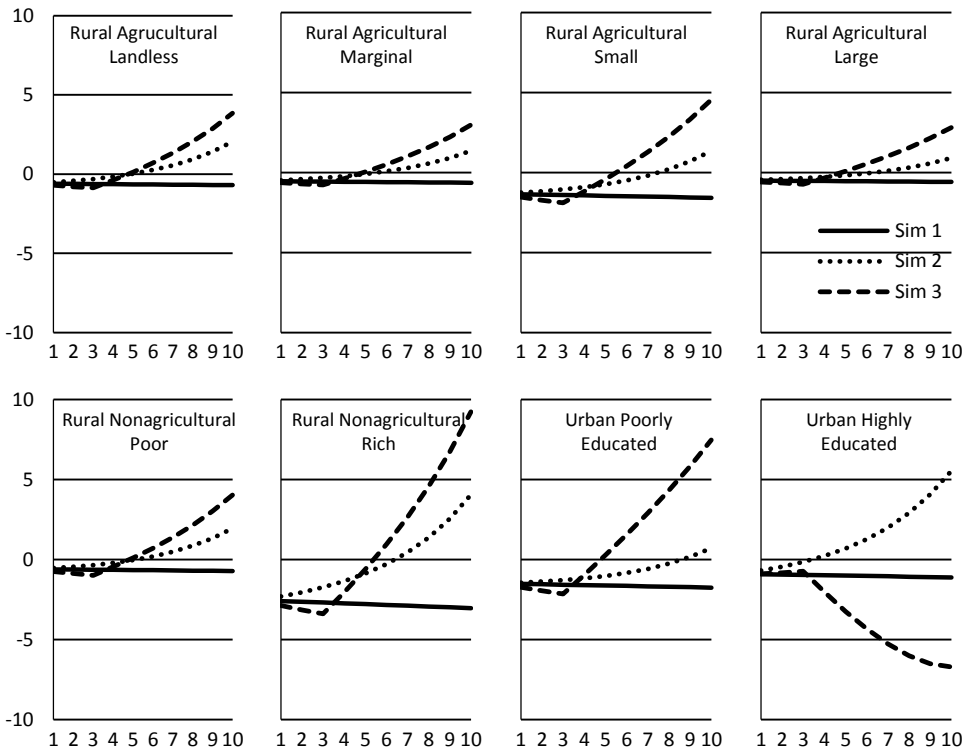


Figure II.7: Output with $\chi_{r,h2} = 1.5$ [Deviation from BAU, Billion BDT]

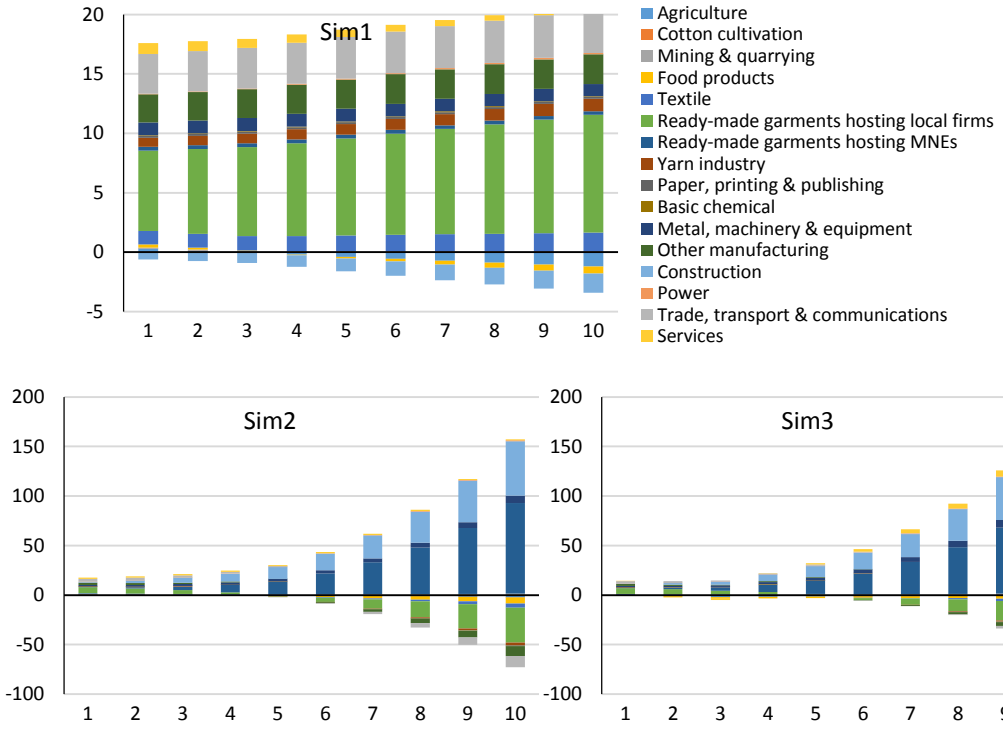


Figure II.8: Domestic and Foreign Employment, and Leisure of Unskilled Workers with $\chi_{r,h2} = 1.5$ [% Change from BAU Total Endowment]

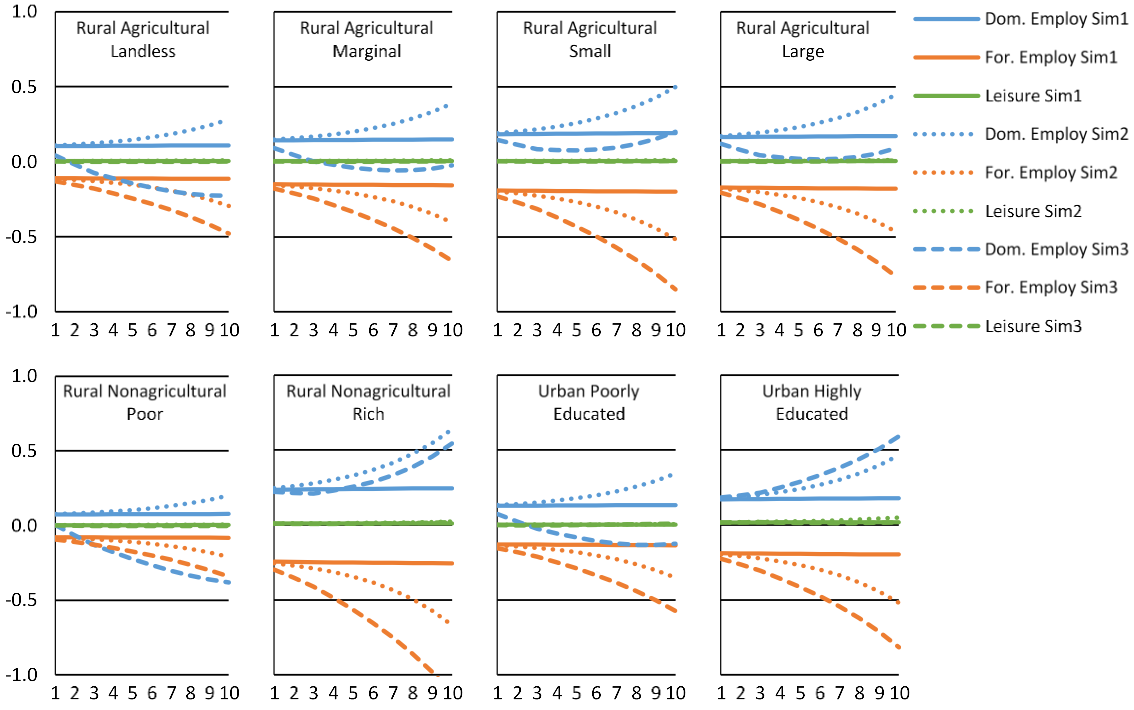


Figure II.9: Domestic and Foreign Employment, and Leisure of Skilled Workers with $\chi_{r,h2} = 1.5$ [% Change from BAU Total Endowment]

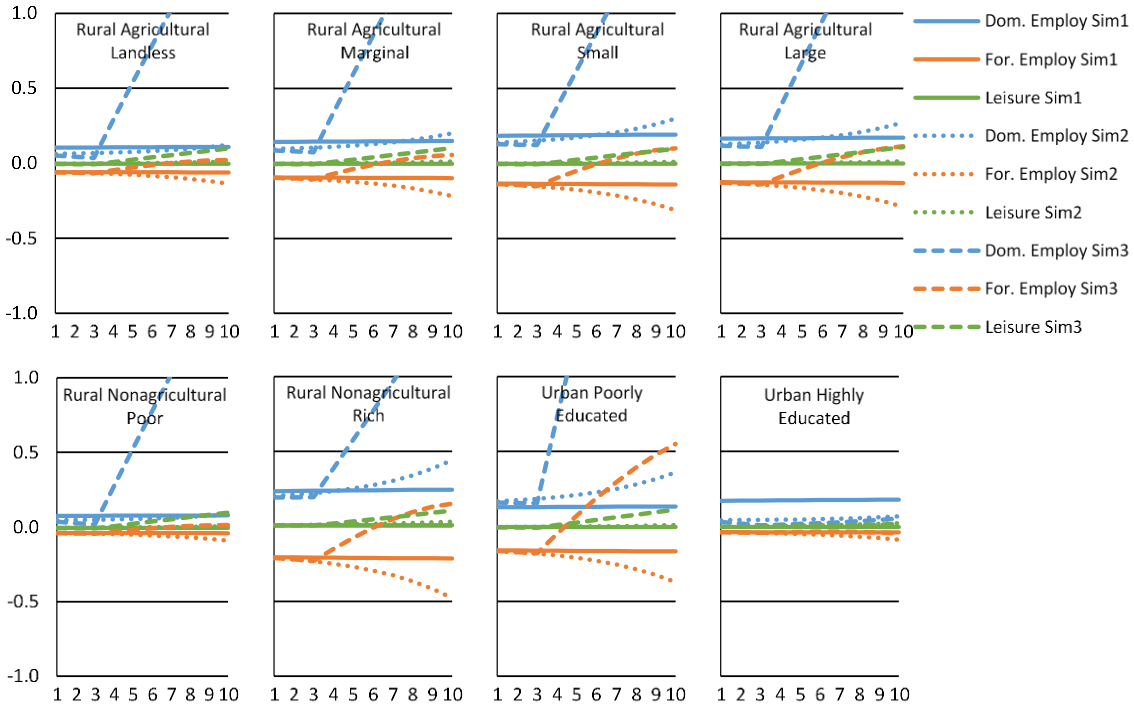


Figure II.10: Changes in Domestic Labor Wage with $\chi_{r,h2} = 1.5$ [Deviation from BAU, % Change]

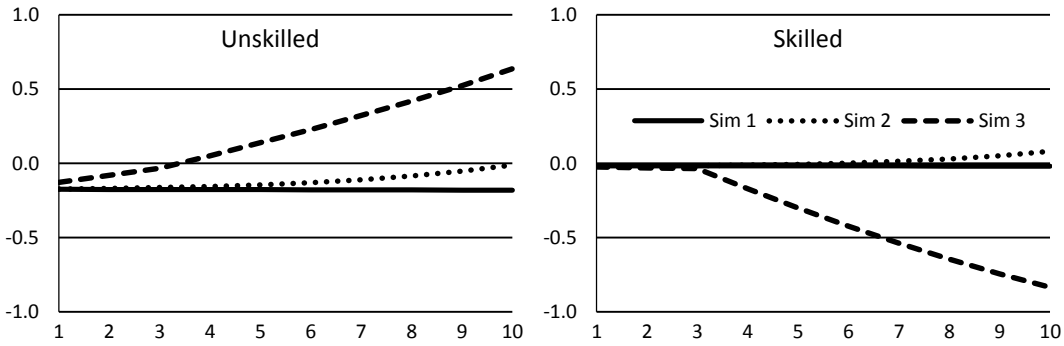


Figure II.11: GDP and GNP with $\chi_{r,h2} = 1.5$ [Deviation from BAU, % Change]

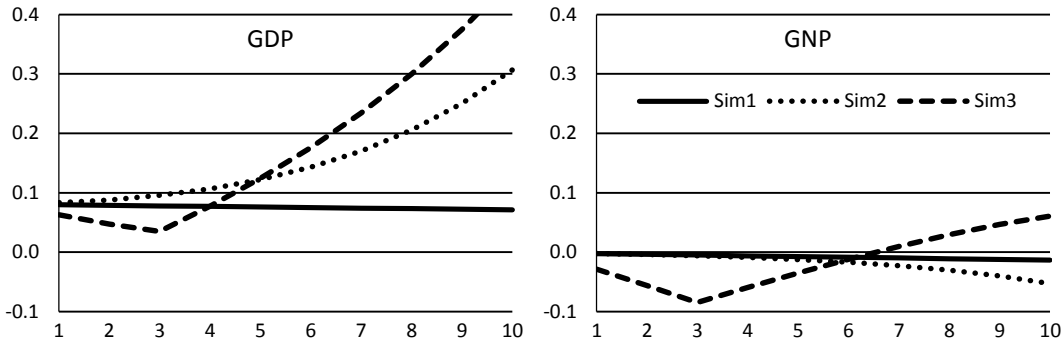


Figure II.12: Household Welfare with $\chi_{r,h2} = 1.5$ [EV in Billion BDT]

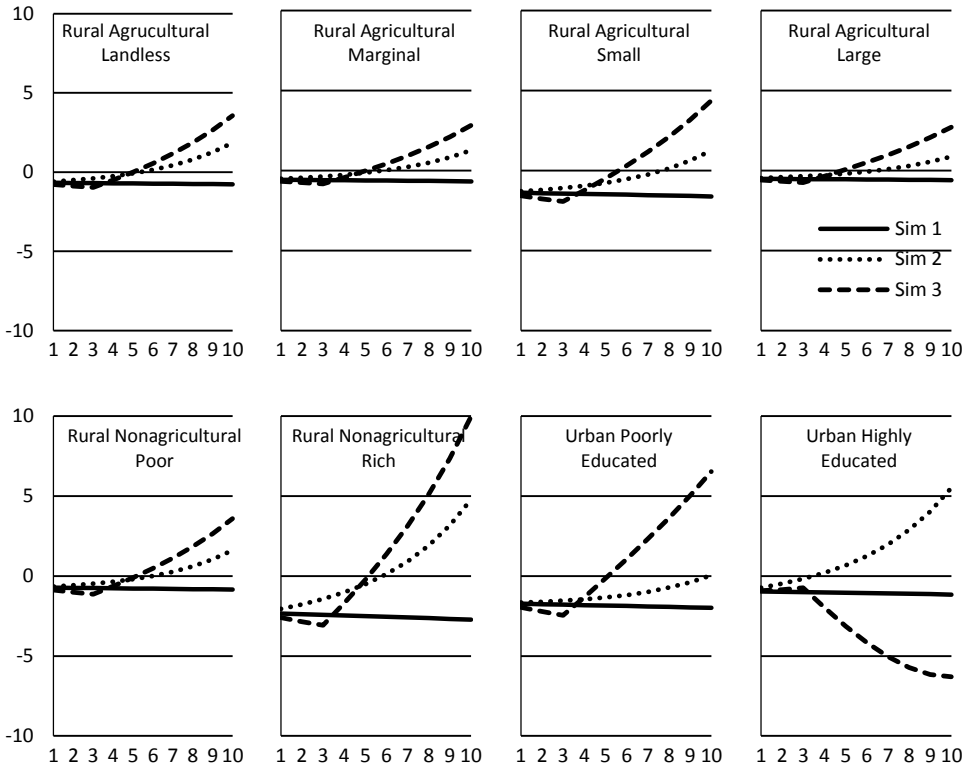


Figure II.13: Output with $\zeta = 2$ [Deviation from BAU, Billion BDT]

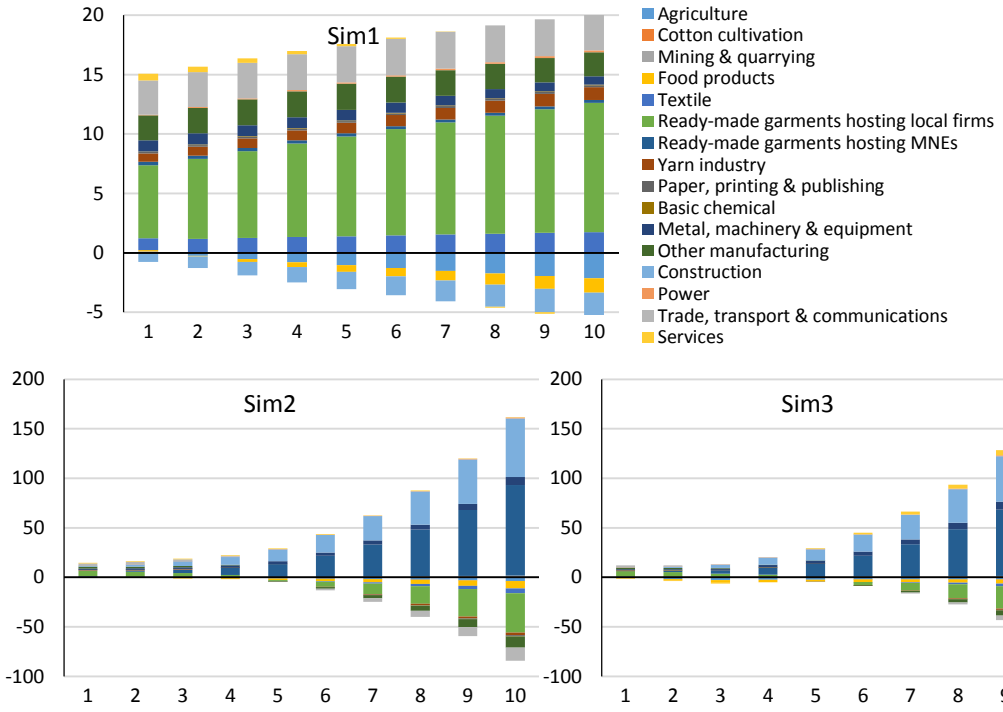


Figure II.14: Domestic and Foreign Employment, and Leisure of Unskilled Workers with $\zeta = 2$ [% Change from BAU Total Endowment]

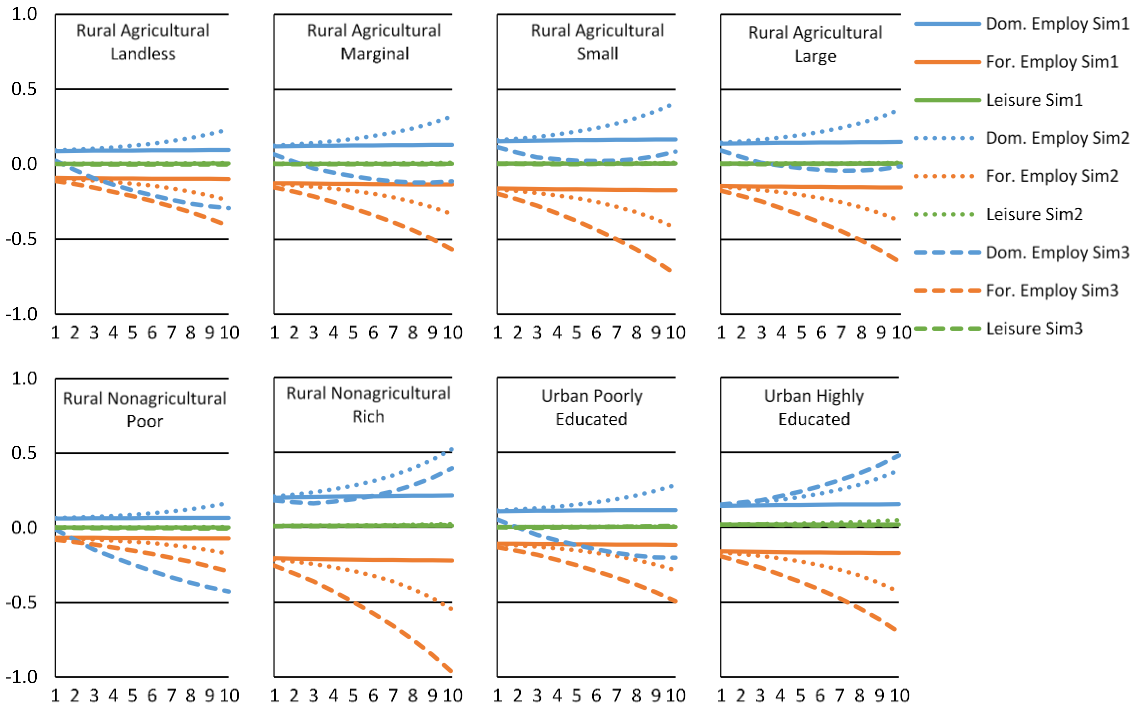


Figure II.15: Domestic and Foreign Employment, and Leisure of Skilled Workers with $\zeta = 2$ [% Change from BAU Total Endowment]

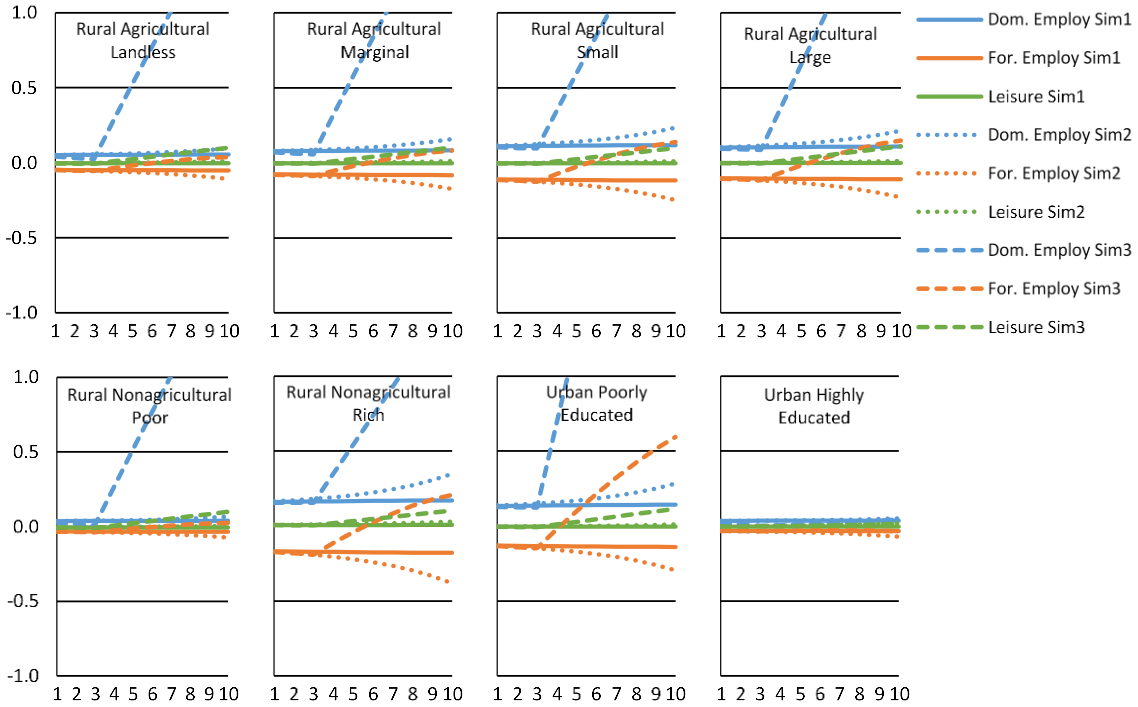


Figure II.16: Changes in Domestic Labor Wage with $\zeta = 2$ [Deviation from BAU, % Change]

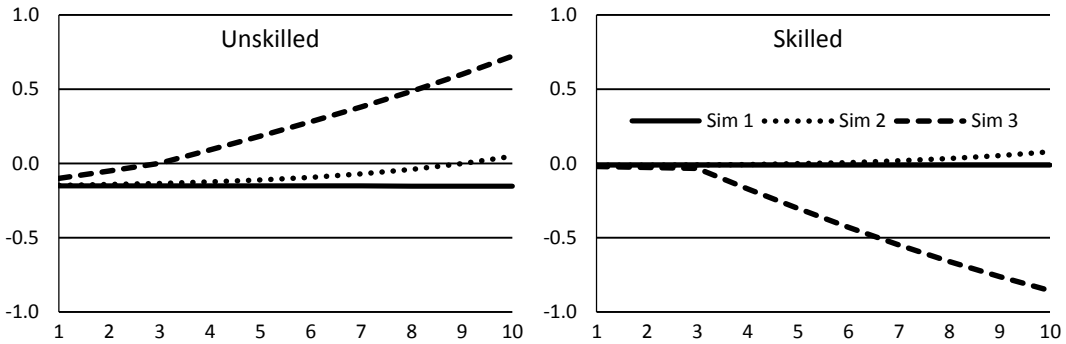


Figure II.17: GDP and GNP with $\zeta = 2$ [Deviation from BAU, % Change]

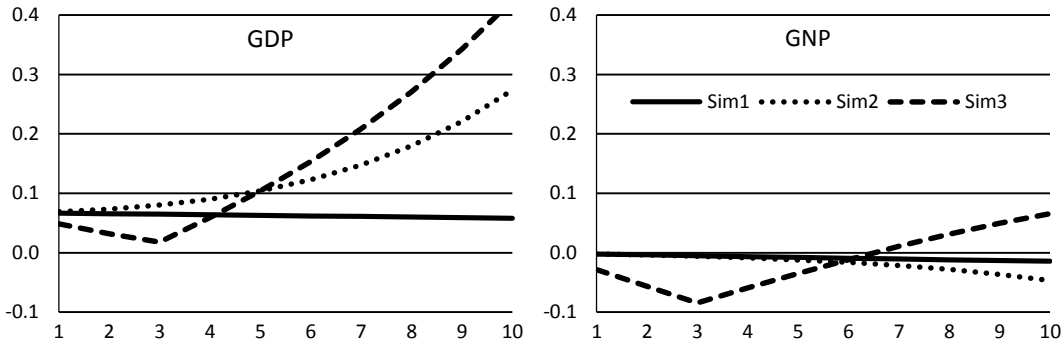


Figure II.18: Household Welfare with $\zeta = 2$ [EV in Billion BDT]

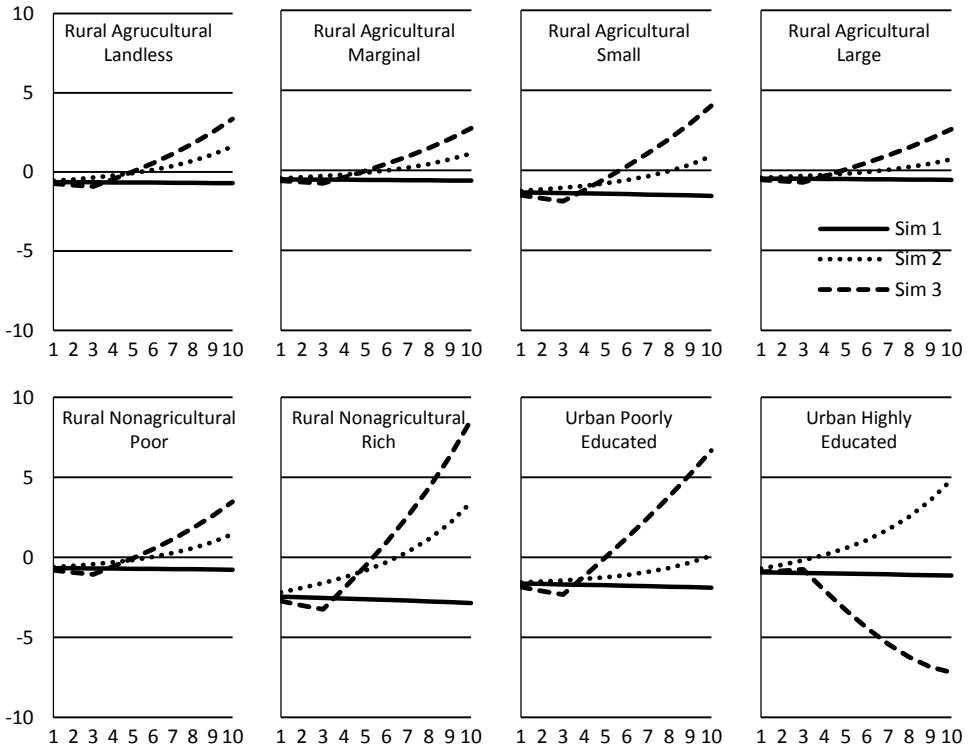


Figure II.19: Output with $ror = 0.06$ [Deviation from BAU, Billion BDT]

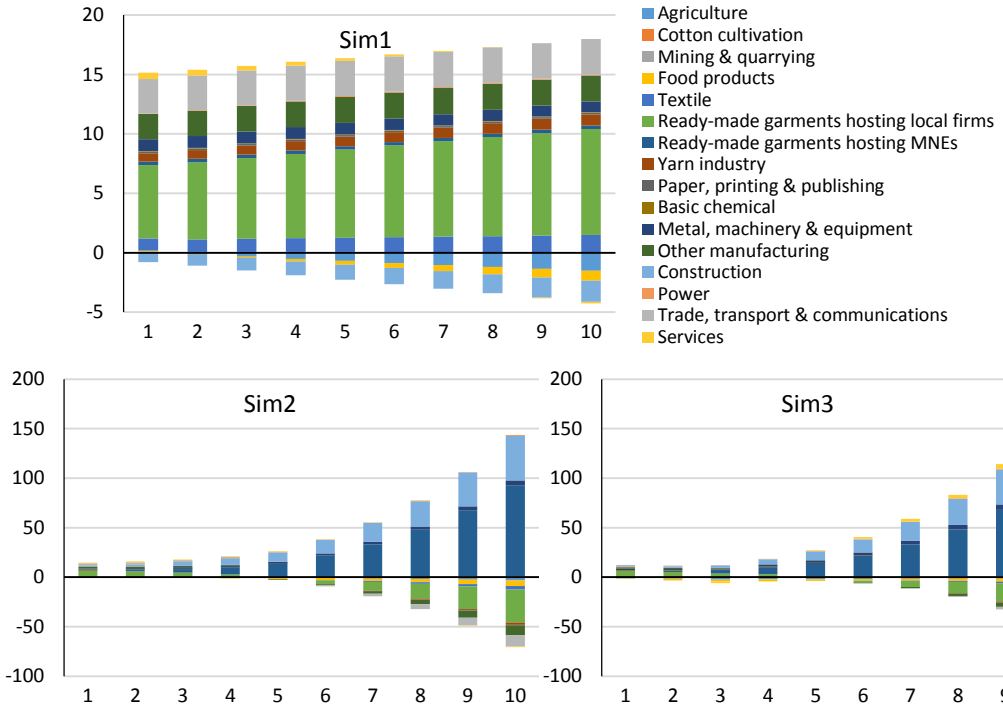


Figure II.20: Domestic and Foreign Employment, and Leisure of Unskilled Workers with $ror = 0.06$ [% Change from BAU Total Endowment]

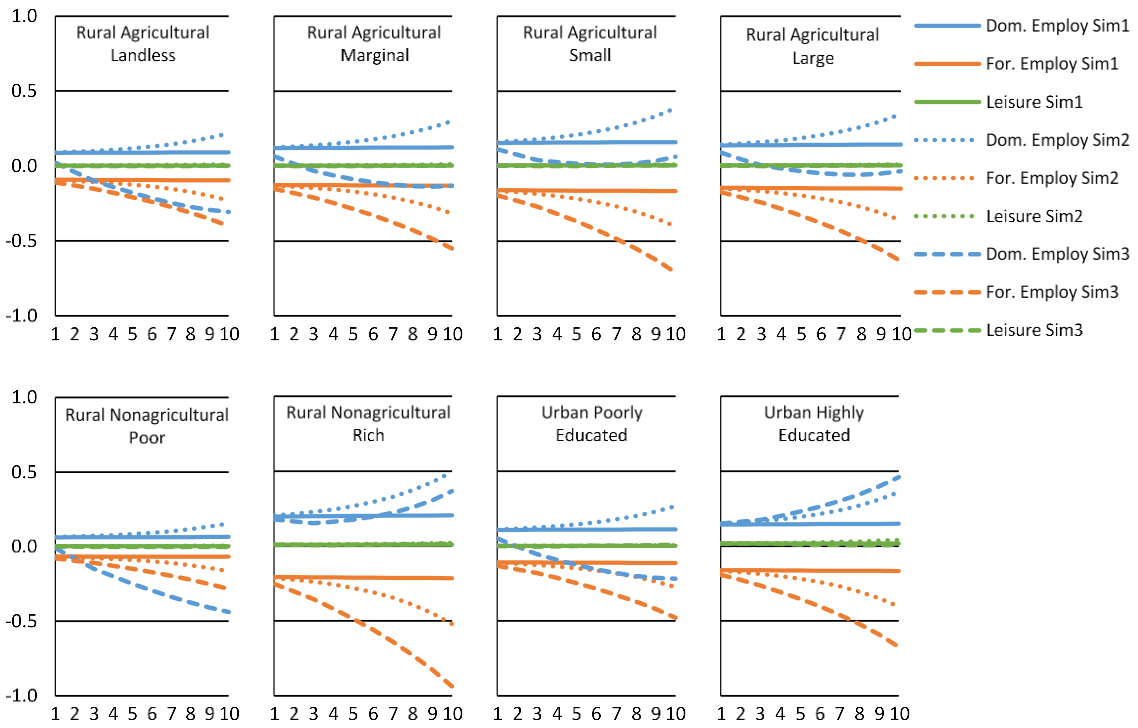


Figure II.21: Domestic and Foreign Employment, and Leisure of Skilled Workers with $ror = 0.06$ [% Change from BAU Total Endowment]

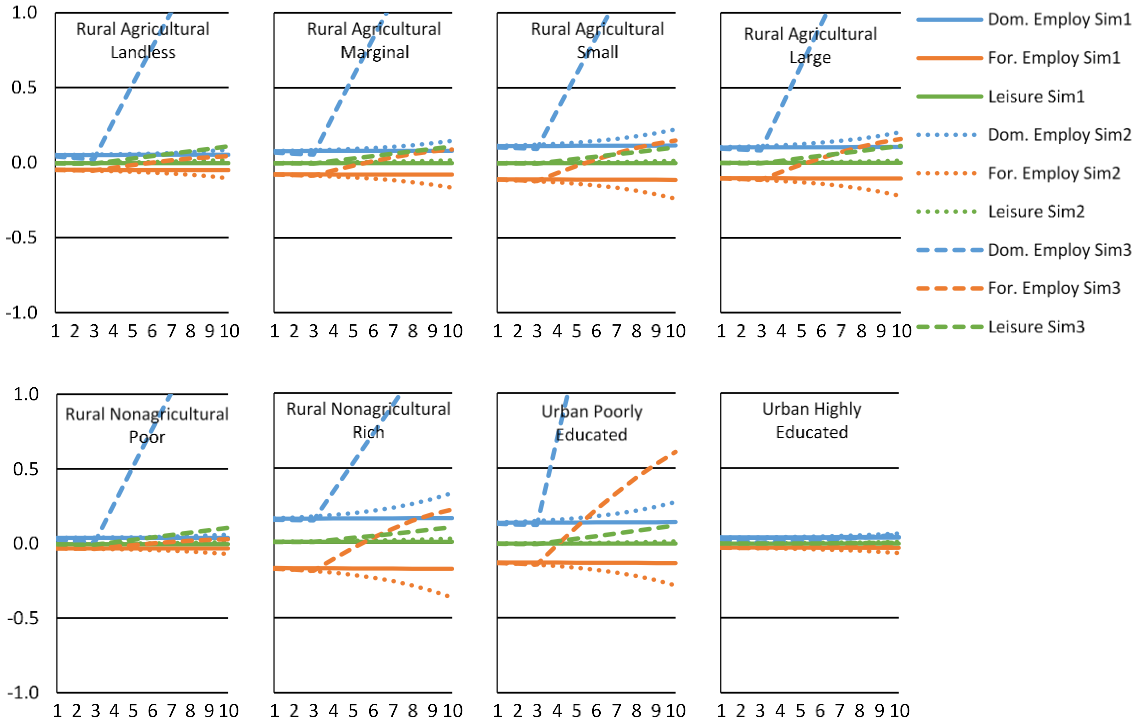


Figure II.22: Changes in Domestic Labor Wage with $ror = 0.06$ [Deviation from BAU, % Change]

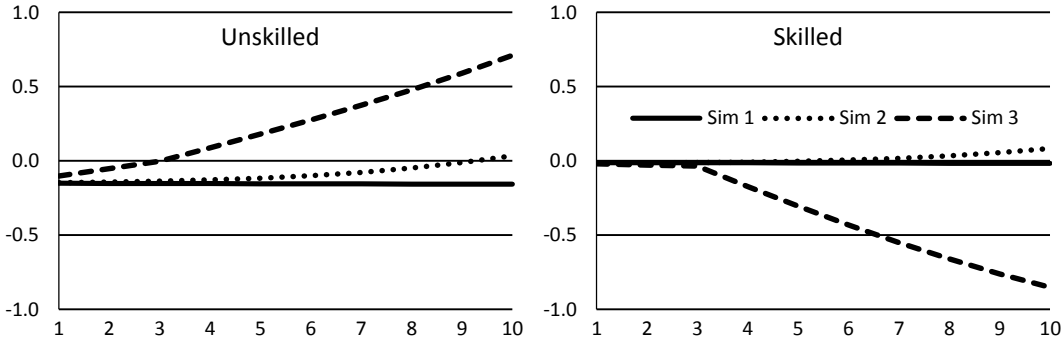


Figure II.23: GDP and GNP with $ror = 0.06$ [Deviation from BAU, % Change]

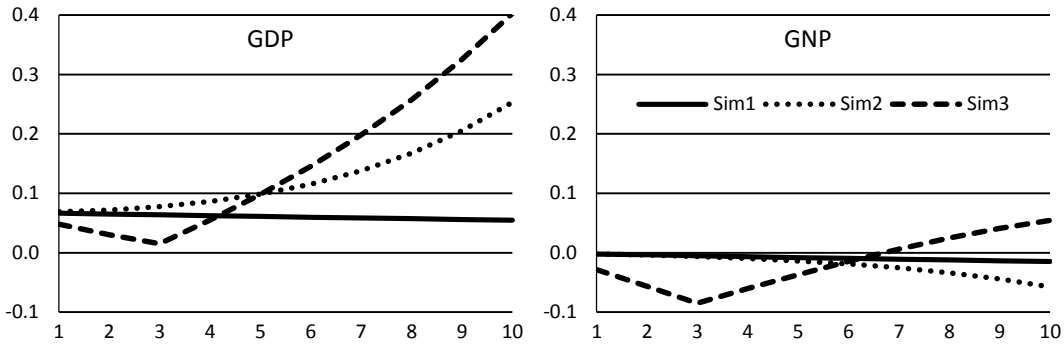


Figure II.24: Household Welfare with $ror = 0.06$ [EV in Billion BDT]

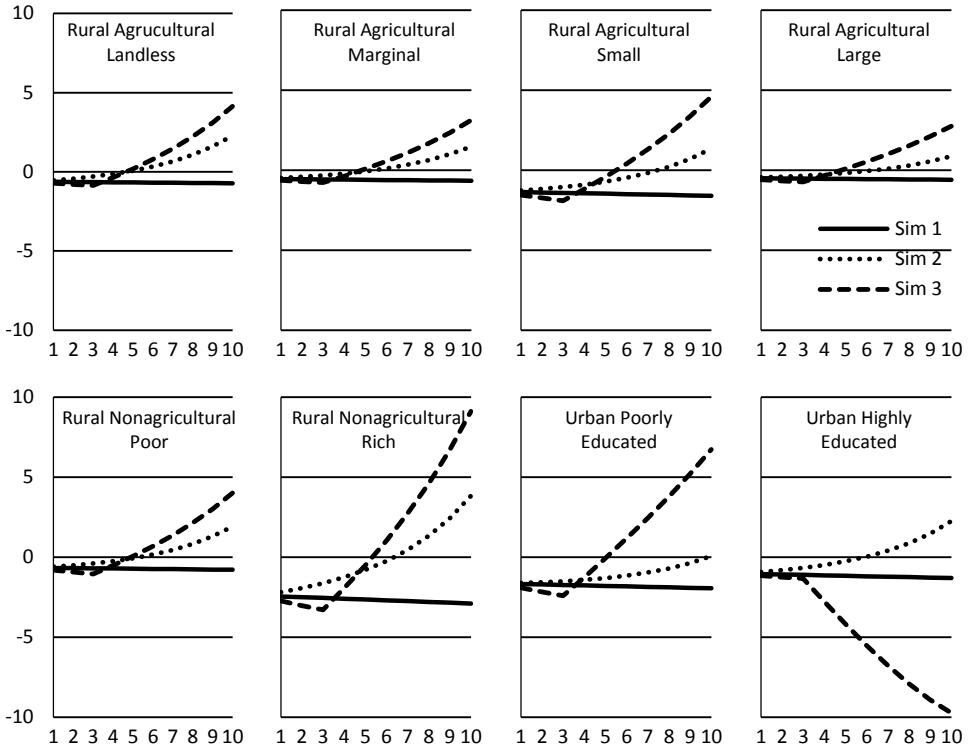


Figure II.25: Output with $dep = 0.05$ [Deviation from BAU, Billion BDT]

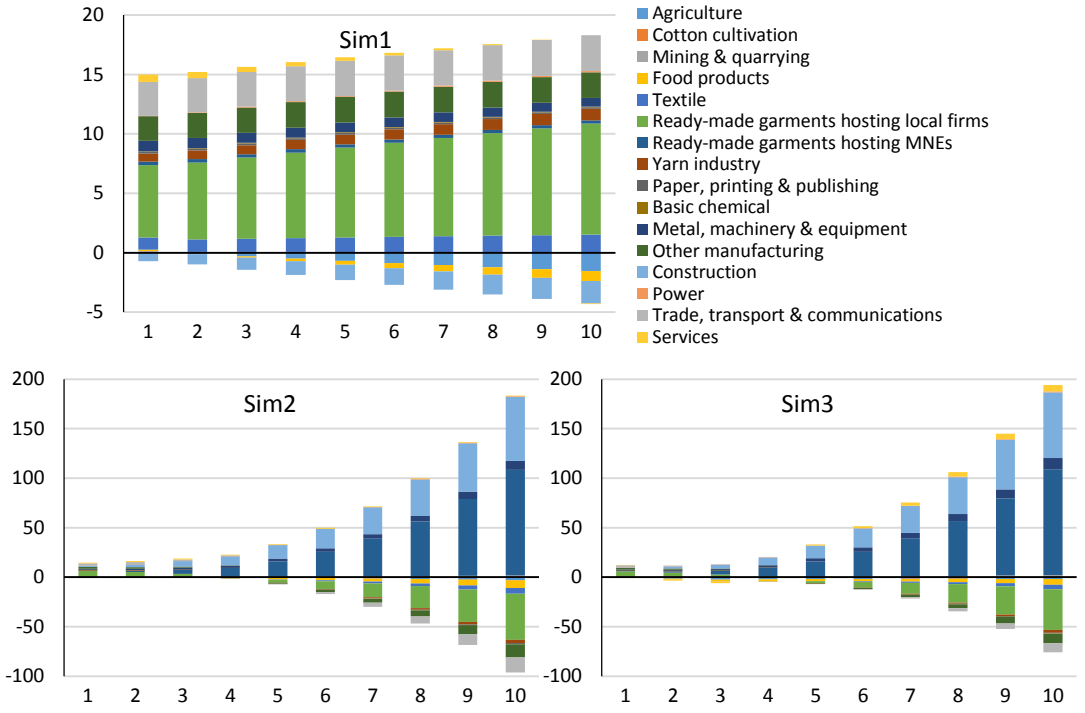


Figure II.26: Domestic and Foreign Employment, and Leisure of Unskilled Workers with $dep = 0.05$ [% Change from BAU Total Endowment]

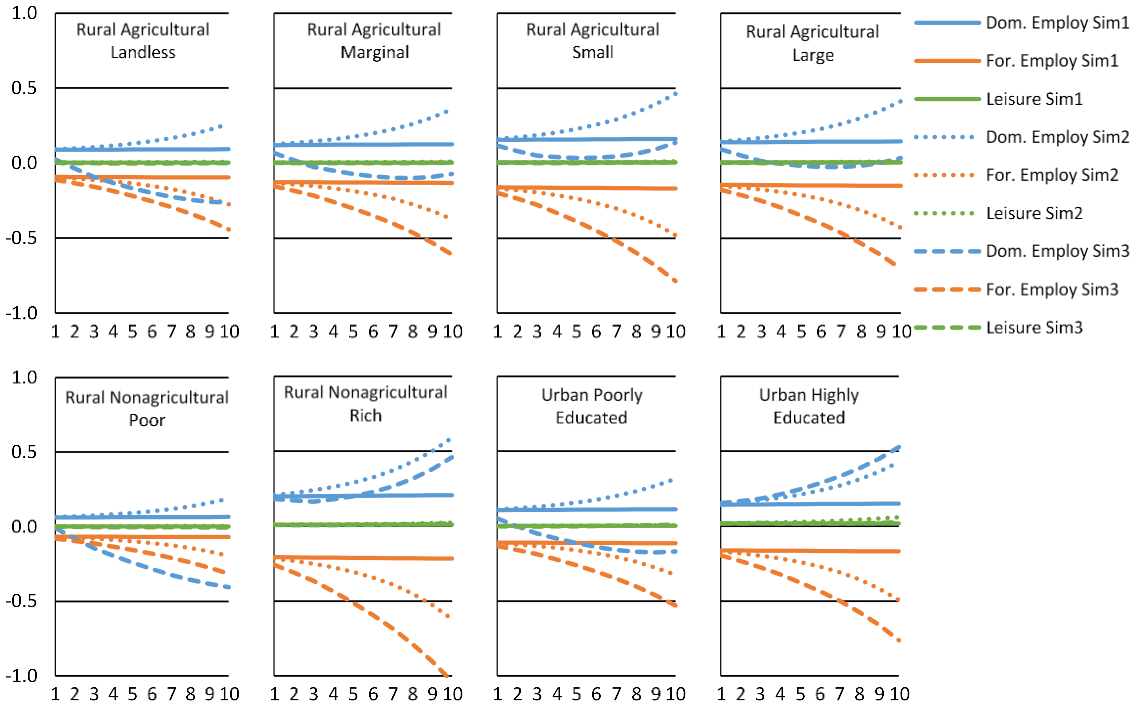


Figure II.27: Domestic and Foreign Employment, and Leisure of Skilled Workers with $dep = 0.05$ [% Change from BAU Total Endowment]

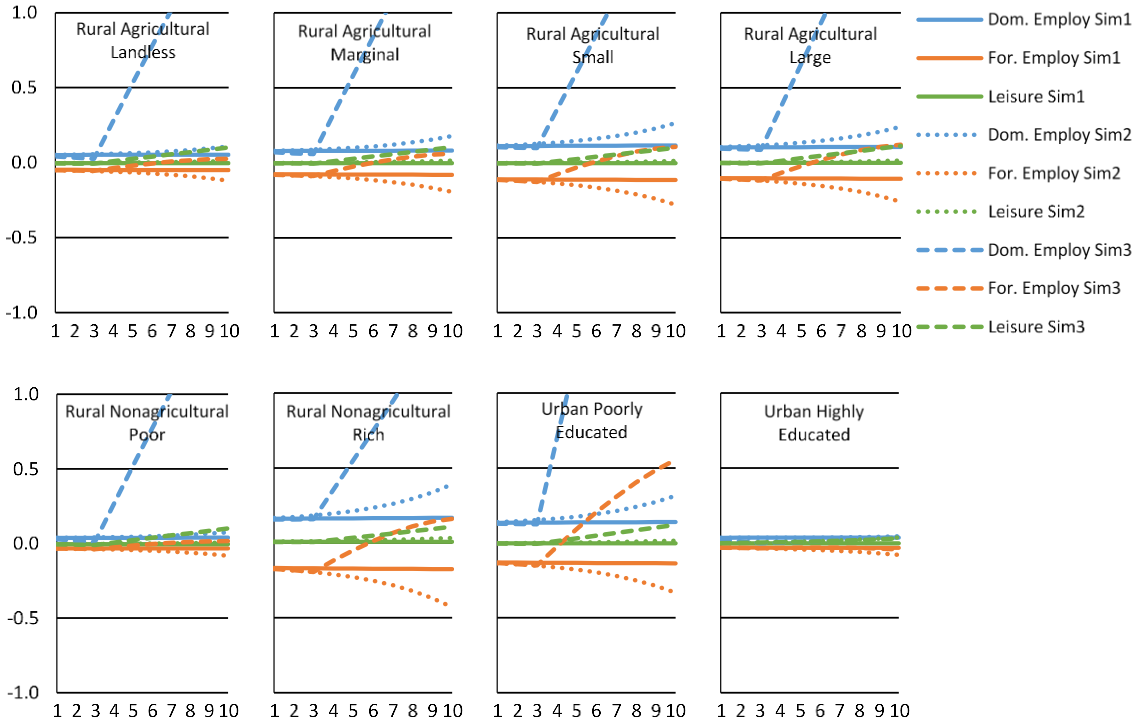


Figure II.28: Changes in Domestic Labor Wage with $dep = 0.05$ [Deviation from BAU, % Change]

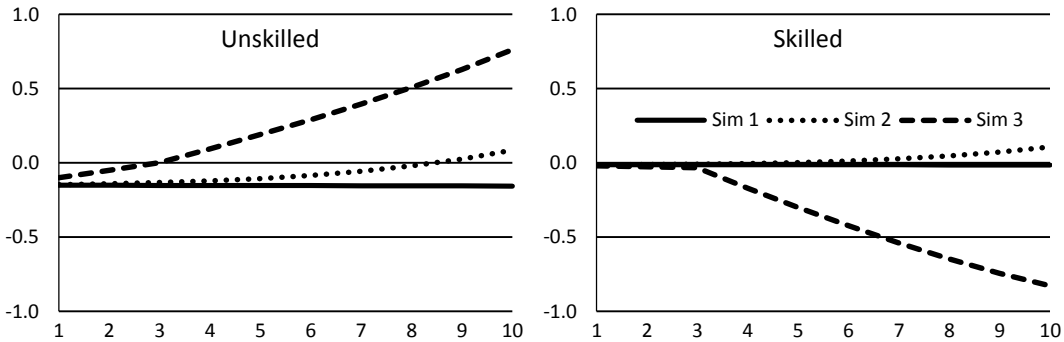


Figure II.29: GDP and GNP with $dep = 0.05$ [Deviation from BAU, % Change]

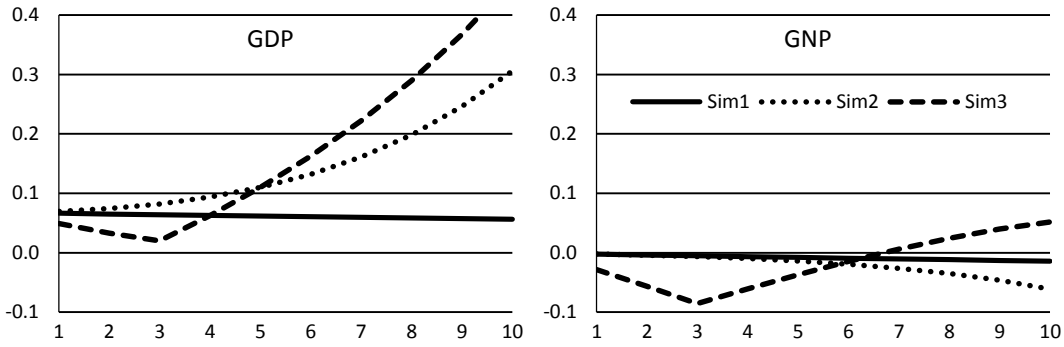


Figure II.30: Household Welfare with $dep = 0.05$ [EV in Billion BDT]

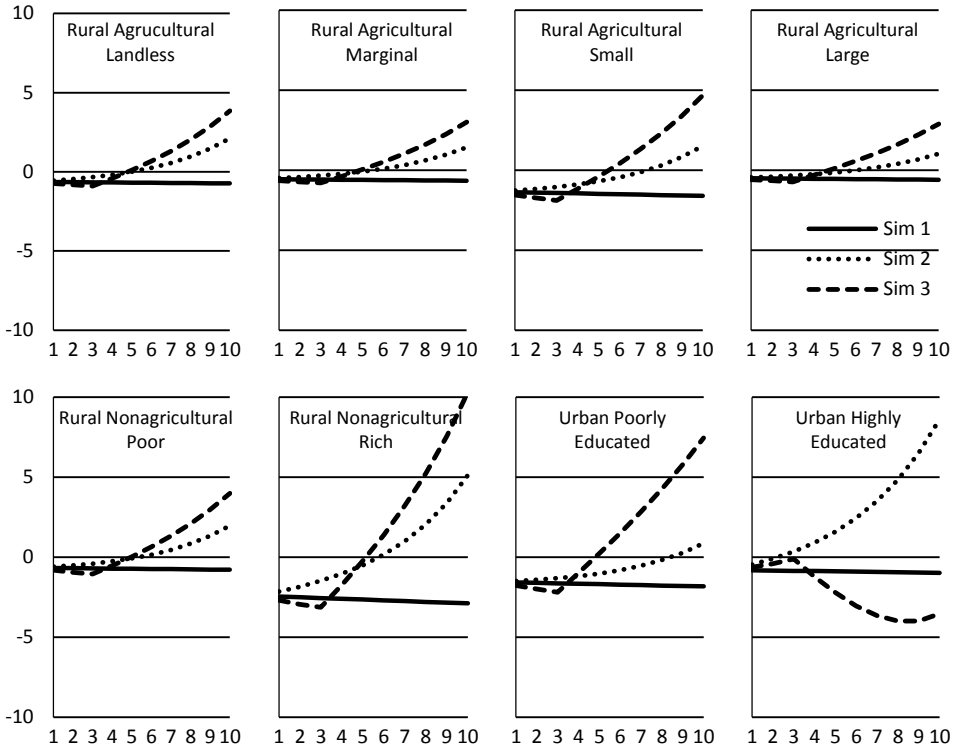


Figure II.31: Output with $pop = 0.006$ [Deviation from BAU, Billion BDT]

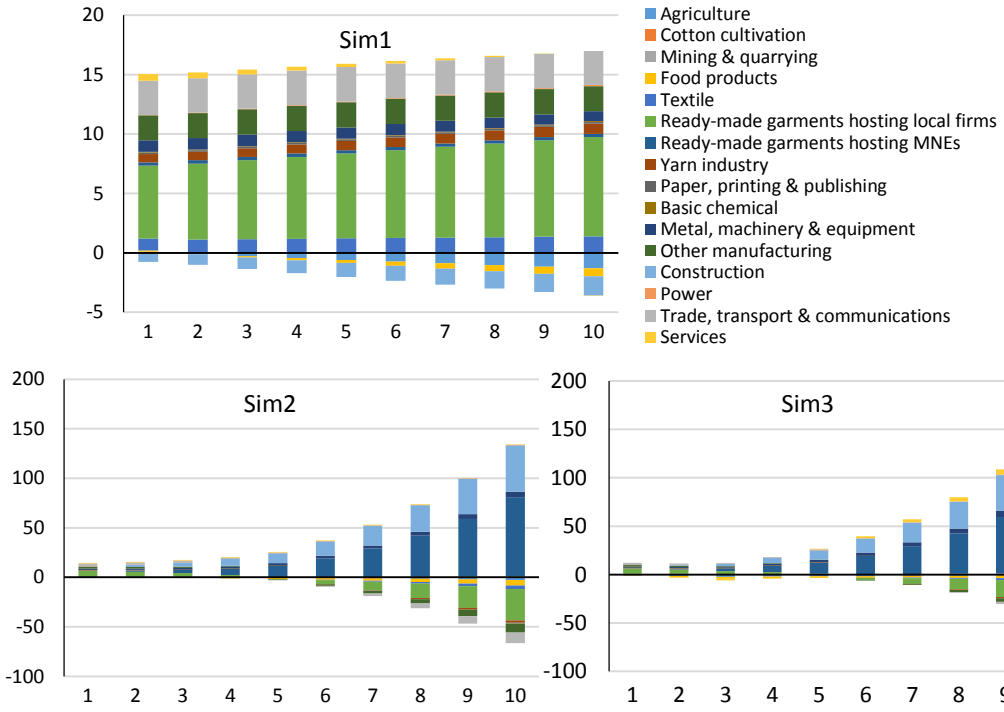


Figure II.32: Domestic and Foreign Employment, and Leisure of Unskilled Workers with $pop = 0.006$ [% Change from BAU Total Endowment]

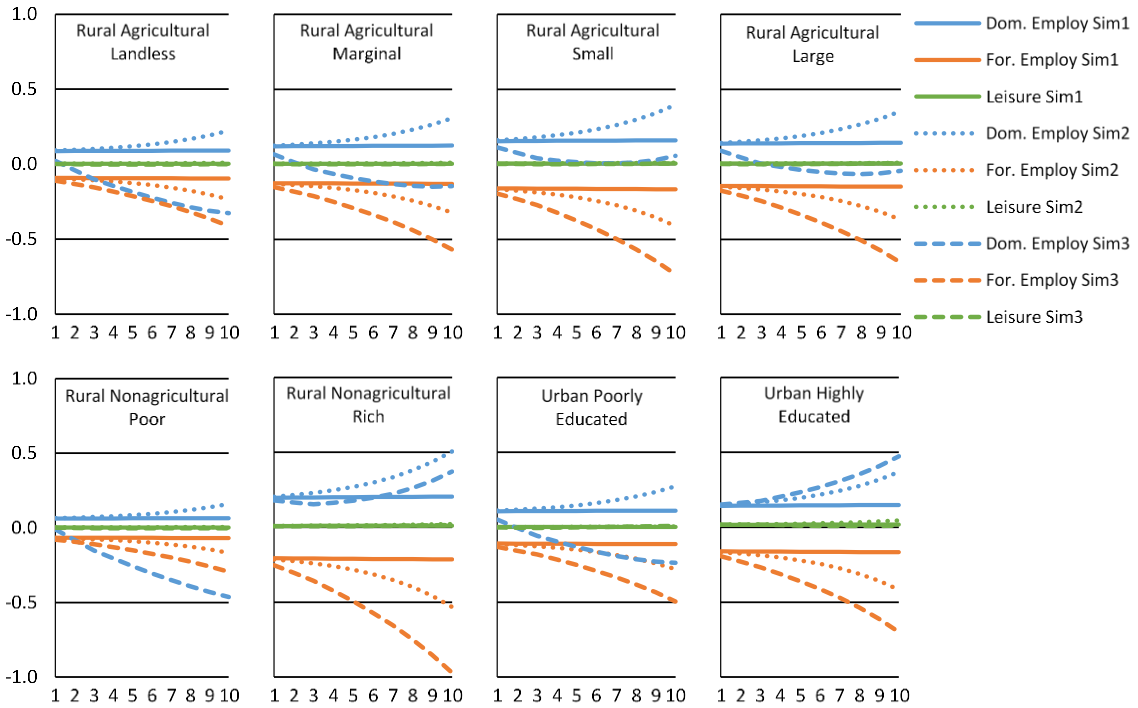


Figure II.33: Domestic and Foreign Employment, and Leisure of Skilled Workers with $pop = 0.006$ [% Change from BAU Total Endowment]

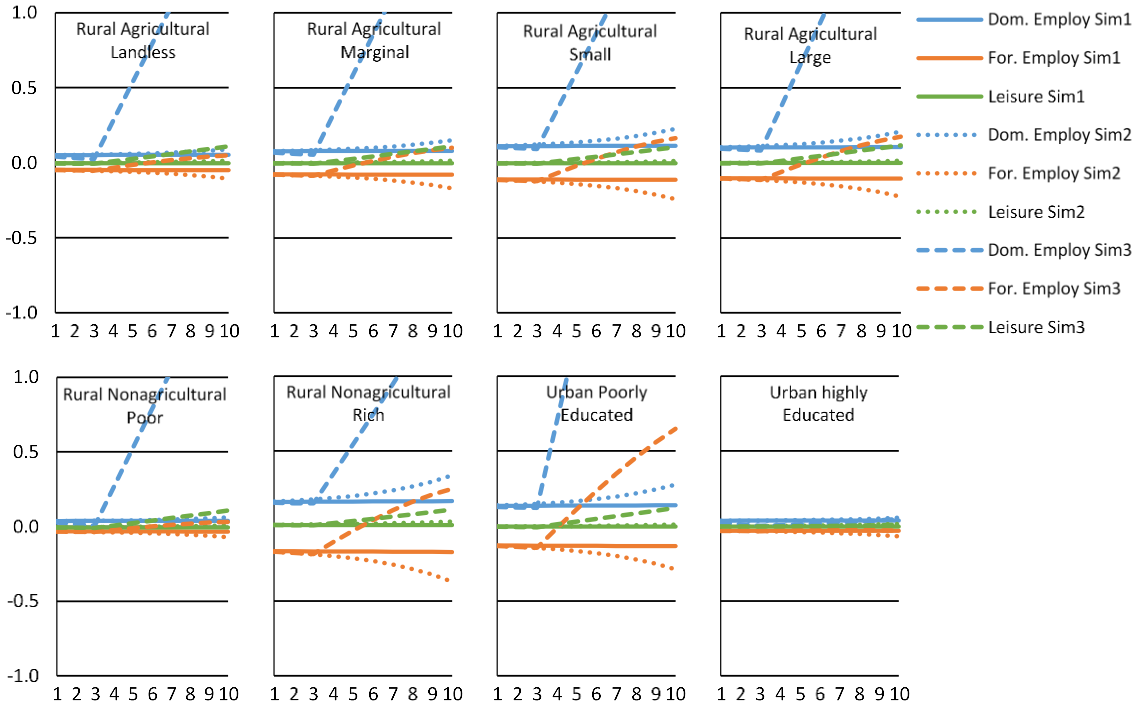


Figure II.34: Changes in Domestic Labor Wage with $pop = 0.006$ [Deviation from BAU, % Change]

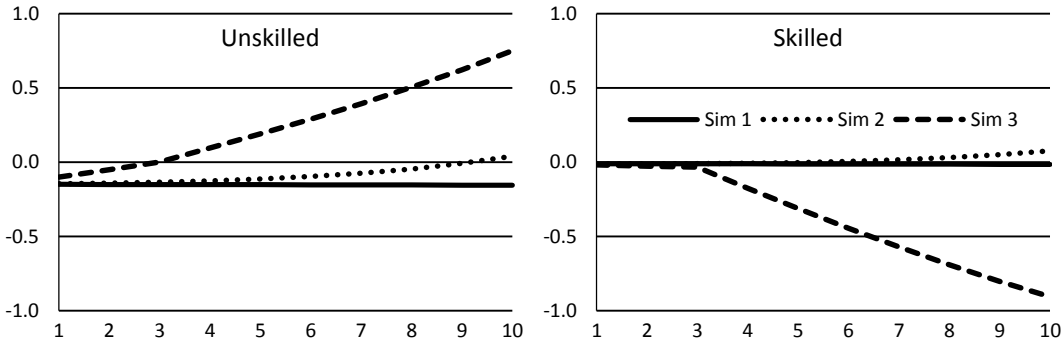


Figure II.35: GDP and GNP with $pop = 0.006$ [Deviation from BAU, % Change]

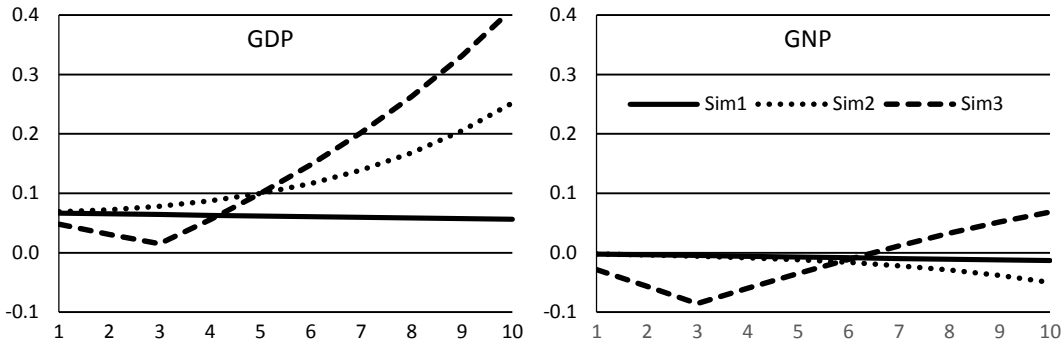


Figure II.36: Household Welfare with $pop = 0.006$ [EV in Billion BDT]

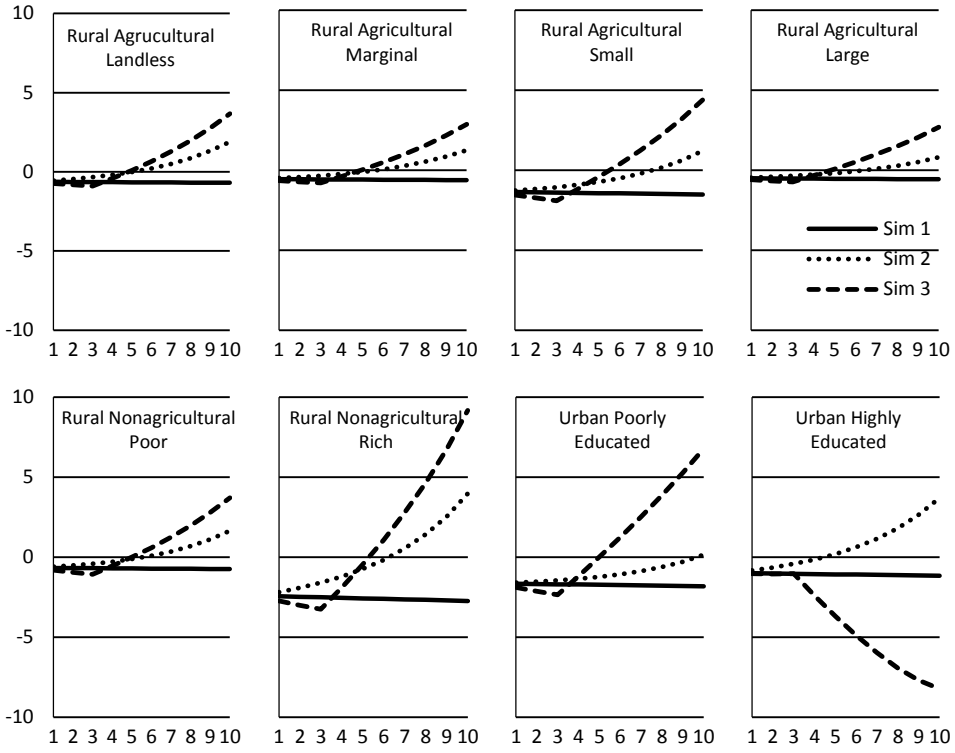


Figure II.37: Output with Double Unemployment Rate [Deviation from BAU, Billion BDT]

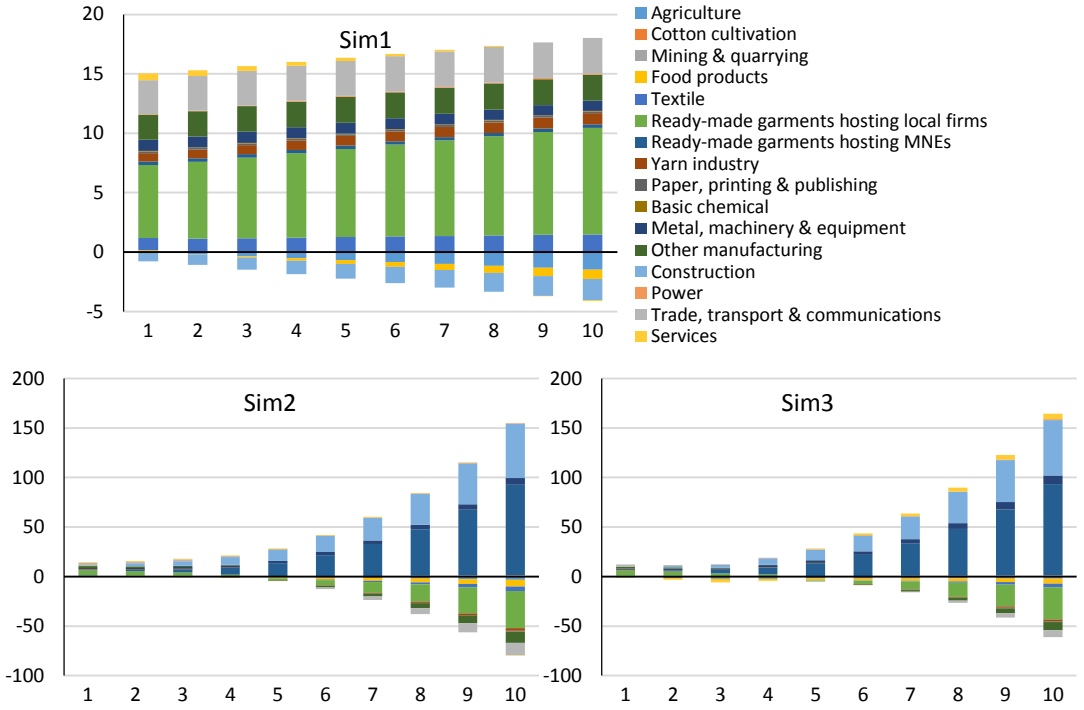


Figure II.38: Domestic and Foreign Employment, and Leisure of Unskilled Workers with Double Unemployment Rate [% Change from BAU Total Endowment]

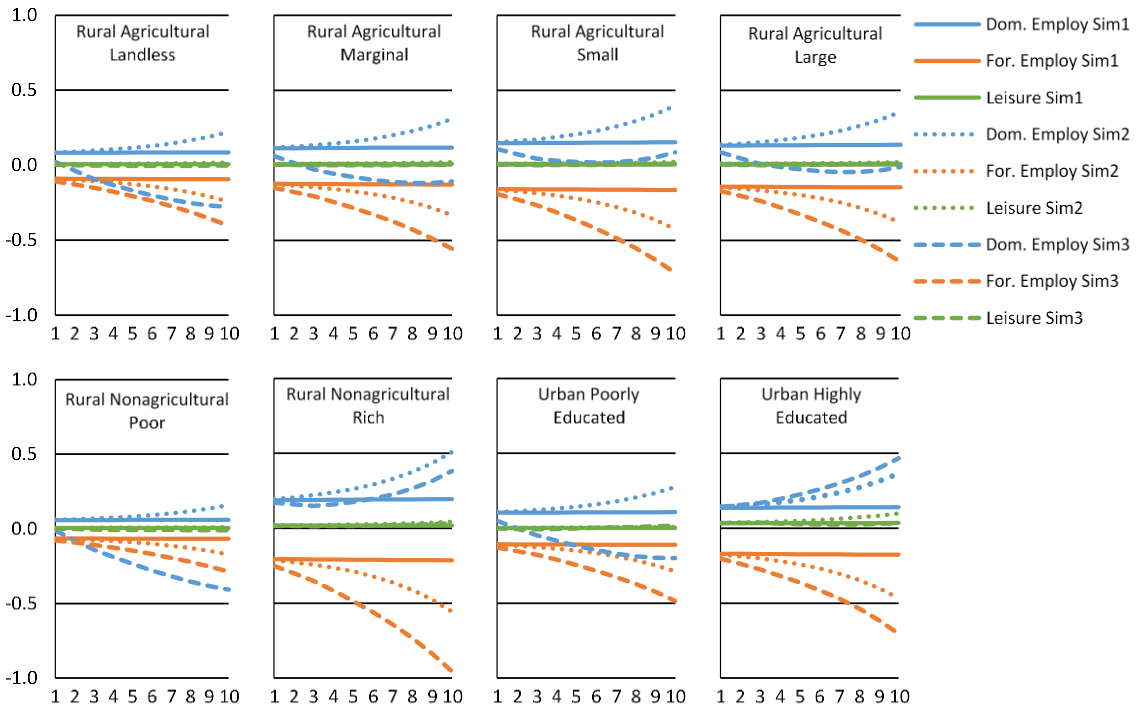


Figure II.39: Domestic and Foreign Employment, and Leisure of Skilled Workers with Double Unemployment Rate [% Change from BAU Total Endowment]

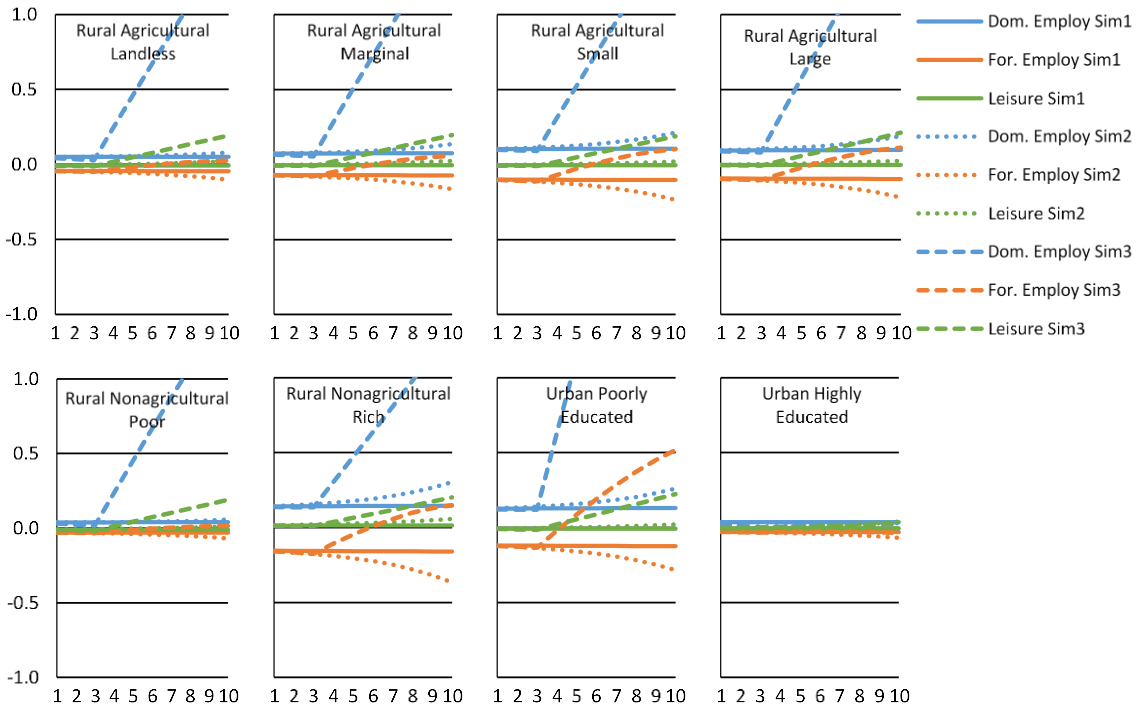


Figure II.40: Changes in Domestic Labor Wage with Double Unemployment Rate [Deviation from BAU, % Change]

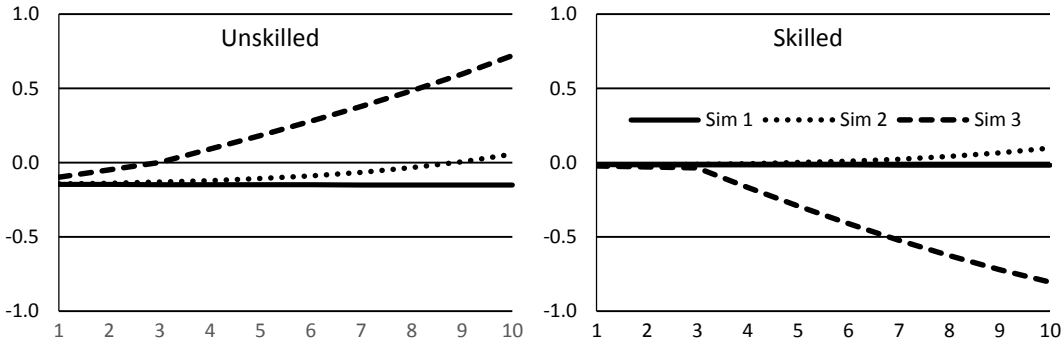


Figure II.41: GDP and GNP with Double Unemployment Rate [Deviation from BAU, % Change]

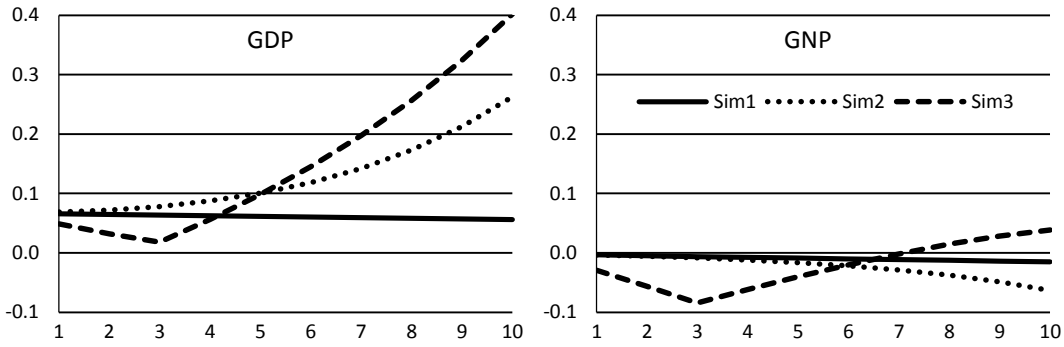
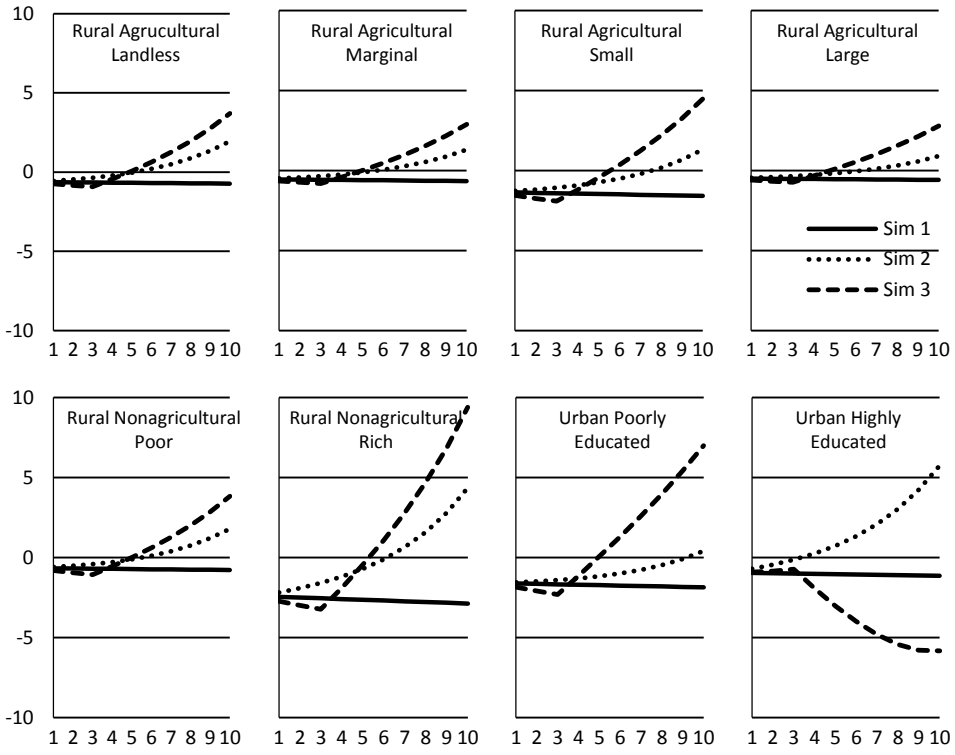


Figure II.42: Household Welfare with Double Unemployment Rate [EV in Billion BDT]



II.2. Functional form of Bangladesh Dynamic CGE Model

We do not show the time period index *t* in our dynamic model for simplicity unless there is no confusion.

Sets

i_all, j_all	all sectors
i, j	sectors not hosting MNEs
i_MNE, j_MNE	sectors hosting MNEs
h, k	factors of production
$h1, k1$	capital
$h2, k2$	labor
r, s	institutions (households and corporations)
$r1, s1$	households
r2,s2	corporations
t	time period (0, 1, 2, …, 10)

Endogenous variables

Y_{j_all}	composite factor (value added)
F_{h,j_all}	factor input used by all sectors
X_{i_all,j_all}	intermediate inputs
Z_{j_all}	gross domestic output
X_i^p	household consumption
X_i^v	investment demand
E_{i_all}	exports
$MLOC_i$	imports for local firms' intermediate and final uses

$MMNE_{i\_all,j\_MNE}$	imports for MNEs' intermediate uses
Q_i	Armington composite goods
D_{i_all}	domestic goods produced by all firms
$DLOC_i$	domestic goods used for Armington composite goods
$DMNE_{i\_all,j\_MNE}$	domestic goods used for composite intermediate inputs for MNEs
$TF_{r,h2}$	labor endowment of households employed in domestic and foreign labor markets
$FF_{r,h}$	factor endowment of households and corporations employed in domestic market
$RF_{r,h2}$	labor endowment of households employed in foreign labor market
$L_{r,h2}$	unemployed labor force of households
$FFF_{i\_MNE,h}$	primary factors owned by foreigners
R_r^m	remittance income of households
P_{h,j_all}^f	factor prices in domestic industries
$P_{r,h2}^{tf}$	composite labor wages of households
$P_{r,h2}^{ff}$	labor wages of households in domestic market
$P_{r,h2}^{rf}$	labor wages of households in foreign labor market in local currency
$P_{j\_all}^y$	composite factor prices
$P_{j\_all}^z$	supply prices of gross domestic output
P_i^q	Armington composite goods prices
P_r^{cc}	households' composite consumption good prices
P_{i_all,j_MNE}^{qMNE}	Armington's composite goods prices of MNEs' intermediate goods
$P_{i\_all}^e$	export prices in local currency

P_i^{mLOC}	import prices for local firms' intermediate and final goods in local currency
P_{i_all,j_MNE}^{mMNE}	import prices for MNEs' intermediate goods in local currency
$P_{i\_all}^{d}$	domestic goods prices
P^k	composite investment goods (or new capital goods) price
ε	foreign exchange rate (domestic currency/foreign currency)
S_r^p	private savings by households and corporations
S^g	government savings
T_r^d	lump-sum direct tax revenue
$T_{j\_all}^z$	production tax revenue
T_j^{mLOC}	import tariff revenue from local firms' imported inputs, and final demand
T_{i_all,j_MNE}^{mMNE}	import tariff revenue from MNEs imported inputs
T^m	total import tariff
$T_{j\_all}^s$	production subsidies
$T_{j\_all}^x$	export subsidies
G_r^t	government transfers
KK_{j_all}	capital stock (exogenous at the beginning of each period)
II_{j_all}	sectoral investment
III	composite investment goods
CC_r	composite consumption goods (or felicity)
UU_r	households' utility
SW	social welfare

Exogenous variables

X_i^g	government consumption
$LF_{r,h2}$	total labor force of households
S^f	current account deficits in foreign currency (foreign savings)
P_{h2}^{wrf}	labor wages of households in foreign labor markets in foreign currency
P^{wk}	prices of foreign capital goods in foreign currency
$P_{i\_all}^{we}$	prices of exported goods in foreign currency
P_i^{wmLOC}	prices of imported goods in foreign currency
P_{i_all,j_MNE}^{wmMNE}	prices of imported goods in foreign currency
$PRICE$	price index
τ_r^d	household share of direct tax
$\tau_{j\_all}^z$	production tax rates
τ_i^{mLOC}	import tariff rates on local firm's inputs
$\tau_{i\_all,j\_MNE}^{mMNE}$	import tariff rates on MNEs intermediate goods
$\tau_{i\_all}^s$	production subsidy rates
$\tau_{i\_all}^x$	export subsidy rates
τ_r^g	government transfer rates to households

Parameters

ax_{i_all,j_all}	input requirement coefficients of intermediate inputs
ay_{j_all}	input requirement coefficients of composite goods
$\alpha_{i,r}$	share parameters in composite consumption production function
a_r	scale parameter in composite consumption function

$\alpha 1_r$	share parameter in utility function
$\alpha 2_{r,h2}$	share parameter in utility function
β_{h,j_all}	share parameter in production function
b_{j_all}	scale parameter in production function
μ_i	share parameter of government consumption
λ_i	share parameter of investment demand
$\delta mLOC_i, \delta dLOC_i$	input share coefficients in Armington composite goods production function
$\delta mMNE_{i\_all,j\_MNE}$, $\delta dMNE_{i\_all,j\_MNE}$	input share coefficients in Armington composite intermediate input production function for MNEs
γLOC_i	scaling coefficient in the Armington composite goods production function
$\gamma MNE_{i\_all,j\_MNE}$	scaling coefficient in Armington composite intermediate input production function for MNEs
σ_{i_all}	elasticity of substitution in the Armington composite goods production function $\left(\sigma_{i\_all} = -\frac{d(M_{i\_all}/D_{i\_all})}{M_{i\_all}/D_{i\_all}} / \frac{d(P^m_{i\_all}/P^d_{i\_all})}{P^m_{i\_all}/P^d_{i\_all}}\right)$
η_{i_all}	parameter defined by the elasticity of substitution $\left(\eta_{i\_all} = \frac{\sigma_{i\_all}-1}{\sigma_{i\_all}}, \sigma_{i\_all} \leq 1\right)$
$\xi d_{i\_all}, \xi e_{i\_all}$	share parameter in the gross domestic output transformation function
θ_{i_all}	scale parameter in the gross domestic output transformation function
ϕ_{i_all}	parameter defined by the elasticity of transformation of gross domestic output $\left(\phi_{i\_all} = \frac{\psi_{i\_all}+1}{\psi_{i\_all}}, \psi_i \geq 1\right)$
ψ_{i_all}	elasticity of transformation in the gross domestic output transformation function $\left(\psi_{i\_all} = -\frac{d(E_{i\_all}/D_{i\_all})}{E_{i\_all}/D_{i\_all}} / \frac{d(P^e_{i\_all}/P^d_{i\_all})}{P^e_{i\_all}/P^d_{i\_all}}\right)$
$\omega d_{r,h2}$, $\omega e_{r,h2}$	share parameter in the labor transformation function

$\kappa_{r,h2}$	scale parameter in the labor transformation function
$\nu_{r1,h2}$	parameter defined by the elasticity of transformation in the labor transformation function $\left(\nu_{r1,h2} = \frac{\chi_{r,h2}+1}{\chi_{r,h2}}, \chi_{r,h2} \geq 1\right)$
$\chi_{r,h2}$	elasticity of transformation in the labor transformation function $\left(\chi_{r,h2} = -\frac{d(RF_{r,h2}/FF_{r,h2})}{RF_{r,h2}/FF_{r,h2}} / \frac{d(P^{rf}_{r,h2}/P^{ff}_{r,h2})}{P^{rf}_{r,h2}/P^{ff}_{r,h2}}\right)$
$\rho_{r,h}$	factor shares of households
ι	scale parameter in composite investment good production function
ζ	price sensitivity parameter of investment allocation
ss_r^p	average propensity for savings by households
pop	population growth rate
dep	depreciation rate
ror	(physical) rate of return of capital

MODEL

i. Domestic Production Block

Composite factor production function

$Y_{j\_all} = b_{j\_all} \prod_h F_{h,j\_all}^{\beta_{h,j\_all}}$ $\forall\ j\_all$

Factor demand function

$F_{h,j\_all} = \frac{\beta_{h,j\_all} P^y_{j\_all}}{P^f_{h,j\_all}} Y_{j\_all}$ $\forall\ h, j\_all$

Intermediate input demand function

$X_{i\_all,j\_all} = ax_{i\_all,j\_all} Z_{j\_all}$ $\forall\ i\_all, j\_all$

Composite factor demand function

$Y_{j\_all} = ay_{j\_all} Z_{j\_all}$ $\forall\ j\_all$

Unit cost function for gross domestic output for the local firm sector

$$P_j^z = ay_j P_j^y + \sum_i ax_{i,j} P_i^q \qquad \forall j$$

Unit cost function for gross domestic output for the MNE sector

$$P_{j\_MNE}^z = ay_{j\_MNE} P_{j\_MNE}^y + \sum_{i\_all} ax_{i\_all,j\_MNE} P_{i\_all,j\_MNE}^{qMNE} \qquad \forall j\_MNE$$

ii. Government

Lump-sum direct tax revenue function

$$T_r^d = \tau_r^d \left(\sum_i p_i^q X_i^g + \sum_r G_r^t - \left(\sum_{j\_all} T_{j\_all}^z + \sum_i T_i^m - \sum_{j\_all} T_{j\_all}^s - \sum_{j\_all} T_{j\_all}^x \right) \right) \qquad \forall r$$

Production tax revenue function

$$T_{j\_all}^z = \tau_{j\_all}^z P_{j\_all}^z Z_{j\_all} \qquad \forall j\_all$$

Import tariff revenue function

$$T_i^m = \tau_i^{mLOC} P_i^{mLOC} MLOC_i + \sum_{j\_MNE} \tau_{i,j\_MNE}^{mMNE} P_{i,j\_MNE}^{mMNE} MMNE_{i,j\_MNE} \qquad \forall i$$

Government subsidy expanse function

$$T_{j\_all}^s = \tau_{j\_all}^s P_{j\_all}^z Z_{j\_all} \qquad \forall j\_all$$

Export subsidy expanse function

$$T_{j\_all}^x = \tau_{j\_all}^x P_{j\_all}^e E_{j\_all} \qquad \forall j\_all$$

Government transfer expanse function

$$G_r^t = \tau_r^g \left(T^d + \sum_{j\_all} T_{j\_all}^z + \sum_j T_j^m + \sum_{j\_all} T_{j\_all}^s + \sum_{j\_all} T_{j\_all}^x \right) \qquad \forall r$$

iii. Investment and Savings

Investment demand function

$$X_i^v = \frac{\lambda_i}{P_i^q} p^k \sum_{j\_all} II_{j\_all} \qquad \forall i$$

Household savings function

$$S_r^p = ss_r^p \left(\sum_{h1} \left(\sum_j P_{h1,j}^f F_{h1,j} \right) \rho_{r,h1} + \sum_{h2} \left(\sum_{j\_all} P_{h2,j\_all}^f F_{h2,j\_all} \right) \rho_{r,h2} + G_r^t + \varepsilon R_r^m - T_{r,}^d \right) \qquad \forall r$$

Government savings function

$$S^g = ss^g \left(\sum_r T_r^d + \sum_{j\_all} T_{j\_all}^z + \sum_j T_j^m + \sum_{j\_all} T_{j\_all}^s + \sum_{j\_all} T_{j\_all}^x \right)$$

iv. Households

Demand function for the Armington composite good

$$X_{i,r}^{p} = \frac{\alpha_{i,r}}{P_i^q} P_r^{cc} CC_r \qquad \forall\, i,r$$

Composite consumption production function

$$CC_r = a \prod_i X_{i,r}^{p\ \alpha_{i,r}} \qquad \forall\, r$$

Composite consumption demand function

$$CC_r = \frac{\alpha 1_{,r}}{P_r^{cc}} \left(\sum_{h2} P_{r,h2}^{tf} LF_{r,h2} + \rho_{r,h1} \sum_{h1,j} P_{h1,j}^{f} F_{h1,j} + Gt_r - Td_r - Sp_r \right) \qquad \forall\, r$$

Leisure demand function

$$L_{r,h2} = \frac{\alpha 2_{,r,h2}}{P_{r,h2}^{tf}} \left(\sum_{h2} P_{r,h2}^{tf} LF_{r,h2} + \rho_{r,h1} \sum_{h1,j} P_{h1,j}^{f} F_{h1,j} + Gt_r - Td_r - Sp_r \right) \forall\, r$$

v. Export and Import Prices and Balance of Payments Constraint

Export price conversion function

$$\left(1 + \tau_{i\_all}^{x}\right) P_{i\_all}^{e} = \varepsilon_t P_{i\_all}^{we} \qquad \forall\, i\_all$$

Import price conversion function

$$P_i^{mLOC} = \varepsilon_t P_i^{wmLOC} \qquad \forall\, i$$

Import price conversion function for MNEs' intermediate inputs

$$P_{i\_all,j\_MNE}^{mMNE} = \varepsilon_t P_{i\_all,j\_MNE}^{wmMNE} \qquad \forall\, i\_all, j\_MNE$$

Foreign capital goods price conversion function

$$P^k = \varepsilon P^{wk}$$

Wage conversion function of migrants

$$P_{r,h2}^{rf} = \varepsilon P_{r,h2}^{wrf} \qquad \forall\, r, h2$$

Balance of payment constraint

$$\sum_{i\_all} P_{i\_all}^{we} E_{i\_all} + S^f + P^{wk} \sum_{j\_MNE} II_{j\_MNE} + \sum_r Rm_r = \sum_i P_i^{wmLOC} MLOC_i +$$
$$\sum_{i\_all,j\_MNE} P_{i\_all,j\_MNE}^{wmMNE} MMNE_{i\_all,j\_MNE} + \sum_{h1,j\_MNE} \frac{P_{h1,j\_MNE}^{f}}{\varepsilon} F_{h1,j\_MNE}$$

vi. Substitution between Imports and Domestic Goods

Armington composite good production function

$$Q_i = \gamma LOC_i \left(\delta mLOC_i MLOC_i^{\eta_i} + \delta dLOC_i DLOC_i^{\eta_i} \right)^{\frac{1}{\eta_i}} \qquad \forall\, i$$

Import demand function for local firms' intermediate and final uses

$$MLOC_i = \left(\frac{\gamma LOC_i^{\eta_i}\delta mLOC_i P_i^q}{(1+\tau_i^{mLOC})P_i^{mLCO}}\right)^{\frac{1}{1-\eta_i}} Q_i \qquad \forall\, i$$

Domestic good demand function for local firms' intermediate and final uses

$$DLOC_i = \left(\frac{\gamma LOC_i^{\eta_i}\delta dLOC_i P_i^q}{P_i^d}\right)^{\frac{1}{1-\eta_i}} Q_i \qquad \forall\, i$$

Composite good production function for MNEs' intermediate

$$X_{i\_all,j\_MNE} = \gamma MNE_{i\_all,j\_MNE}\left(\delta mMNE_{i\_all,j\_MNE} MMNE_{i\_all,j\_MNE}^{\eta_{i\_all}} + \delta dMNE_{i\_all,j\_MNE} DMNE_{i\_all,j\_MNE}^{\eta_i}\right)^{\frac{1}{\eta_{i\_all}}} \qquad \forall\, i\_all, j\_MNE$$

Import demand function for MNEs' intermediate

$$MMNE_{i\_all,j\_MNE} = \left(\frac{\gamma MNE_{i\_all,j\_MNE}^{\eta_{i\_all}}\delta mMNE_{i\_all,j\_MNE} P_{i\_all,j\_MNE}^{qMNE}}{(1+\tau_{i\_all,j\_MNE}^{mMNE})P_{i\_all,j\_MNE}^{mMNE}}\right)^{\frac{1}{1-\eta_{i\_all}}} X_{i\_all,j\_MNE} \qquad \forall\, i\_all, j\_MNE$$

Domestic good demand function for MNEs' intermediate

$$DMNE_{i\_all,j\_MNE} = \left(\frac{\gamma MNE_{i\_all,j\_MNE}^{\eta_{i\_all}}\delta dMNE_{i\_all,j\_MNE} P_{i\_all,j\_MNE}^{qMNE}}{P_{i\_all}^d}\right)^{\frac{1}{1-\eta_{i\_all}}} X_{i\_all,j\_MNE} \qquad \forall\, i\_all, j\_MNE$$

vii. Transformation between Exports and Domestic Goods

Gross domestic output transformation function

$$Z_{i\_all} = \theta_{i\_all}\left(\xi e_{i\_all} E_{i\_all}^{\phi_{i\_all}} + \xi d_{i\_all} D_{i\_all}^{\phi_{i\_all}}\right)^{\frac{1}{\phi_{i\_all}}} \qquad \forall\, i\_all$$

Export supply function

$$E_{i\_all} = \left(\frac{\theta_{i\_all}^{\phi_{i\_all}}\xi e_{i\_all}(1+\tau_{i\_all}^z+\tau_{i\_all}^s)P_{i\_all}^z}{P_{i\_all}^e}\right)^{\frac{1}{1-\phi_{i\_all}}} Z_{i\_all} \qquad \forall\, i\_all$$

Domestic good supply function

$$D_{i\_all} = \left(\frac{\theta_{i\_all}^{\phi_{i\_all}}\xi d_{i\_all}(1+\tau_{i\_all,t}^z+\tau_{i\_all,t}^s)P_{i\_all}^z}{P_{i\_all}^d}\right)^{\frac{1}{1-\phi_{i\_all}}} Z_{i\_all} \qquad \forall\, i\_all$$

viii. Transformation between Migrant Workers and Domestic Workers

Labor transformation function

$$TF_{r,h2} = \kappa_{r,h2}\left(\omega e_{r,h2} RF_{r,h2}^{\nu_{r,h2}} + \omega d_{r,h2} FF_{r,h2}^{\nu_{r,h2}}\right)^{\frac{1}{\nu_{r,h2}}} \qquad \forall\, r, h2$$

Labor supply function in foreign labor market

$$RF_{r,h2} = \left(\frac{\kappa_{r,h2}^{\nu_{r,h2}} \omega e_{r,h2} P_{r,h2}^{TF}}{P_{r,h2}^{rf}}\right)^{\frac{1}{1-\nu_{r,h2}}} TF_{r,h2} \qquad \forall\, r1, h2$$

Labor supply function in domestic labor market

$$FF_{r1,h2} = \left(\frac{\kappa_{r,h2}^{\nu_{r1,h2}} \omega d_{r1,h2} P_{r,h2}^{TF}}{P_{r,h2}^{ff}}\right)^{\frac{1}{1-\nu_{r,h2}}} TF_{r,h2} \qquad \forall\, r1, h2$$

ix. Dynamic Equations

Composite investment good production function

$$III = \iota \prod_i X_i^{\nu \lambda_i}$$

Sectoral investment allocation function

$$P^k II_j = \frac{p_{CAP,j}^{f\ \zeta} F_{CAP,j}}{\sum_i p_{CAP,i}^{f\ \zeta} F_{CAP,i}} \left(\sum_r S_r^p + S^g + \varepsilon S^f\right) \qquad \forall\, i$$

x. Evolution of State Variable and Exogenous Variable

Capital accumulation

$$KK_{j\_all,t+1} = (1 - dep) KK_{j\_all,t} + II_{j\_all,t} \qquad \forall\, j\_all, t$$

Labor endowment

$$LF_{r,h2,t+1} = (1 + pop) LF_{r,t} \qquad \forall\, r, h2, t$$

Government consumption

$$X_{i,t+1}^g = (1 + pop) X_{i,t}^g \qquad \forall\, i, t$$

Foreign savings

$$S_{i,t+1}^f = (1 + pop) S_{i,t}^f \qquad \forall\, i, t$$

xi. Market Clearing Conditions

Market clearing condition for Armington composite good

$Q_i = \sum_{r1} X_{i,r1}^{p} + X_i^{g} + X_i^{v} + \sum_j X_{i,j}$ $\forall\, i$

Market clearing condition of domestic good for local firms' intermediate and final uses

$D_i = DLOC_i + \sum_{j\_MNE} DMNE_{i,j\_MNE}$ $\forall\, i$

Market clearing condition of domestic good for MNEs' intermediate

$D_{i\_MNE} = \sum_{j\_MNE} DMNE_{i\_MNE,j\_MNE}$ $\forall\, i\_MNE$

Market clearing condition for labor

$F_{h1,j\_all} = rorKK_{j\_all}$ $\forall\, h1, j\_all$

Market clearing condition for labor

$\sum_{j\_all} F_{h2,j\_all} = \sum_r FF_{r,h2}$ $\forall\, h2$

Equilibrium of total labror force to work and consume leisure

$LF_{r,h2} = TF_{r,h2} + L_{r,h2}$ $\forall\, r, h2$

Market clearing condition for composite investment goods

$\sum_{j\_all} II_{j\_all} = III$

xii. Price Equalization Conditions

Factor price (wage) equalization conditions

$P_{h2,i\_all}^{f} = P_{h2,j\_all}^{f}$ $\forall\, h2, i\_all$

$P_{h2,i\_all}^{f} = P_{r,h2}^{ff}$ $\forall\, r, h2, i\_all$

$P_{r,h2}^{rf} = P_{s,h2}^{rf}$ $\forall\, r, s, h2$

$P_{r,h2}^{ff} = P_{s,h2}^{ff}$ $\forall\, r, s, h2$

xiii. Fictitious Objective Function and Social Welfare

Household utility function

$UU_r = {CC_r}^{\alpha 1_r} \prod_{h2} {L_{r,h2}}^{\alpha 2_{r,h2}}$ $\forall\, r$

Social welfare function

$SW = \sum_r UU_r$

Price index [numeraire price]

$$PRICE = \frac{\sum_j P_j^q Q00_j}{\sum_i Q00_i}$$