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Welfare and Economy-Wide Effects of Azerbaijan's Accession to the World Trade Organization: A Quantitative Assessment

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Abstract

Welfare and economy-wide effects of Azerbaijan's accession to the World Trade Organization: A quantitative assessment

Azerbaijan applied for membership in the World Trade Organization (WTO) in 1997 and negotiations are still ongoing. Accession to the WTO requires the applicant countries to align economic policies with the organization's rules and principles. Such changes in policies likely have a substantial impact on economic performance and social conditions in the applicant country. The key policy changes anticipated to accompany Azerbaijan's WTO accession include lowering of import tariffs and a reduction of agricultural subsidies.

This study assesses the impact of these policy reforms in Azerbaijan in a quantitative (*ex-ante*) analysis using national economic indicators (such as key macroeconomic variables and domestic production in sectors) and social indicators (such as welfare at a household level and the incidence of poverty). The analysis considers Azerbaijan to become a member as both developed and developing country as the status is still uncertain in current stage of negotiations. A country-specific, multi-sector, static *computable general equilibrium model* complemented by a multi-household, non-behavioral *micro-simulation model* with an endogenous poverty line is developed to perform the analysis. Coupling these two approaches allows incorporating a complex set of interactions among production sectors, markets, heterogeneous consumers, and other institutions across the economy. Consequently, the analysis offers a comparatively complete picture of likely WTO membership impacts.

Model results show that policy reforms associated with Azerbaijan accession to the WTO have an overall positive effect on economic performance and the social situation. The WTO membership generates pronounced structural adjustment throughout the economy. It generally favors export-intensive manufacturing sectors such as tobacco, chemical products, beverages, prepared and preserved fruits/vegetables, minerals, and textiles. In contrast, policy reforms reduce production in domestic-oriented sectors, such as leather, agriculture, sugar, ferrous metals, apparel and furs. Accession increases the overall scale of Azerbaijan's foreign trade and diversifies imports and exports in terms of commodity composition and geographical distribution. Results also indicate that membership improves the level of welfare of the vast majority of households in Azerbaijan. However, welfare gains are unevenly distributed among households belonging to different income groups/deciles and regions. In particular, membership is expected to be more (less) beneficial for the wealthiest (poorest) stratum of the population. Moreover, rural households gain significantly more in terms of welfare compared to their urban counterparts. Rather importantly, WTO accession accelerates an already positive trend in the poverty-alleviation process at national and regional level. In case Azerbaijan is granted a "developing country" status, WTO membership generates stronger gains in terms of poverty alleviation and welfare improvement compared to the status as "developed country". Lastly, it is worthwhile noting that liberalization of trade policies in form of reduced tariffs is the main driving force for the results described above.

Keywords: *World Trade Organization, Azerbaijan, Computable General Equilibrium Model, Micro-simulation Model, Trade Liberalization, Agricultural Policy Reforms.*

Kurzfassung

Auswirkungen des Beitritts Aserbaidschans zur Welthandelsorganisation auf die Wohlfahrt und Gesamtwirtschaft: eine quantitative Bewertung

Die Verhandlungen zur 1997 beantragten Aufnahme Aserbaidschans in die Welthandelsorganisation sind noch nicht abgeschlossen. Der Beitritt verlangt, dass Bewerberstaaten ihre Wirtschaftspolitik an den Regeln der Organisation ausrichten. Diese Politikreformen lassen substantielle wirtschaftliche und soziale Auswirkungen in den Ländern erwarten. Aserbaidschans WTO-Beitritt lässt den Abbau von Handelshemmnissen durch Zollsenkungen und die Reduktion von Agrarsubventionen erwarten.

Die vorliegende Studie zielt auf die quantitative (*ex-ante*) Analyse der Auswirkungen dieser Politikreformen auf nationale wirtschaftliche Indikatoren (wie makroökonomische Variablen und Produktion in Sektoren) und soziale Indikatoren (Wohlfahrt auf Haushaltsebene und Armutsinzidenz). Aufgrund der Unsicherheit in den gegenwärtigen Verhandlungen zum Mitgliedsstatus Aserbaidschans, berücksichtig die Analyse den Beitritt als Entwicklungsland und auch als entwickeltes Land. Zur Analyse wird ein landesspezifisches, multi-sektorales, statisches angewandtes allgemeines *Gleichgewichtsmodell* entwickelt, ergänzt durch ein multi-haushalt, nicht-verhaltensbasiertes *Mikrosimulationsmodell* mit endogener Armutsgrenze. Diese Kombination erlaubt die Abbildung komplexer Interaktionen zwischen Produktionssektoren, Märkten, heterogenen Verbrauchern und anderen Institutionen der Gesamtwirtschaft für vergleichsweise umfassende Analyse der Beitrittsfolgen.

Die Modellergebnisse lassen auf insgesamt positive wirtschaftliche und soziale Auswirkungen des WTO-Beitritts Aserbaidschans schließen. Die Mitgliedschaft führt zu ausgeprägten Struktureffekten in der gesamten Wirtschaft. Die Produktion in exportintensiven Verarbeitungssektoren wie Tabak, chemische Produkte, Getränke, verarbeitete Früchte und Gemüse, Mineralstoffe und Textilien wird gefördert. Im Gegensatz dazu sinkt die Produktion in inlandsorientierten Sektoren, wie Leder, Landwirtschaft, Zucker, Eisenmetalle sowie Kleidung und Pelze. Der Beitritt erhöht grundsätzlich den Außenhandel und diversifiziert Importe und Exporte hinsichtlich Komposition und geographischer Verteilung der gehandelten Waren. In Bezug auf die sozialen Aspekte des WTO-Beitritts zeigt sich, dass das Wohlstandsniveau der großen Mehrheit der Haushalte in Aserbaidschan ansteigt. Allerdings sind die Wohlfahrtsgewinne ungleichmäßig unter Haushalten verschiedener Einkommensgruppen und Regionen verteilt. Die wohlhabendste (ärmste) Schicht profitiert mehr (weniger) von der Mitgliedschaft. Außerdem können ländliche Haushalte deutlich größere Wohlfahrtsgewinne im Vergleich mit städtischen Haushalte erwarten. Wichtig erscheint, dass der WTO-Beitritt die bereits positive Tendenz der Armutsbekämpfung auf nationaler und regionaler Ebene beschleunigt. Für den Mitgliedstatus als "Entwicklungsland" verstärkt sich der positive Einfluss auf Wohlfahrtsniveau der Haushalte und Armutsbekämpfung verglichen mit dem Status als "entwickeltes Land". Besonders anzumerken gilt, dass die erwarteten Zollsenkungen die Hauptantriebskraft für die oben angeführten Ergebnisse ist.

Schlüsselwörter: *Welthandelsorganisation, Aserbaidschan, Angewandtes Allgemeines Gleichgewichtsmodell, Mikrosimulation, Handelsliberalisierung, agrarpolitische Reformen.*

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List of Abbreviations

AoA	Agreement on Agriculture
ASEAN	Association of Southeast Asian Nations
AzCGE	Computable General Equilibrium Model for Azerbaijan
AzSTAT	State Statistical Committee of Azerbaijan
BoP	Balance of Payments
CBA	Central Bank of Azerbaijan
CEPII	Centre d'Etudes Prospectives et d'Informations Internationales
CES	Constant Elasticity of Substitution
CET	Constant Elasticity of Transformation
CGE	Computable General Equilibrium Model
CIS	Commonwealth of Independent States
CNS	Constrained Non-linear System
COICOP	Classification of Individual Consumption According to Purpose
EU	European Union
EV	Equivalent Variation
FGT	Foster-Greer-Thorbecke
FTA	Free Trade Agreement
GAMS	General Algebraic Modeling System
GATS	General Agreement on Trade in Services
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GTAP	Global Trade Analysis Project
HBS	Household Budget Survey
IO	Input-Output
ITC	International Trade Centre
MacMap	Market Access Map
MERCOSUR	Mercado Común del Sur
MIRAGE	Modeling International Relationships in Applied General Equilibrium
NAFTA	North American Free Trade Agreement
OECD	Organization for Economic Co-operation and Development
PPF	Production Possibility Frontier
ROW	Rest of the World
SAM	Social Accounting Matrix
SNA	System of National Accounts
SOCAR	State Oil Company of Azerbaijan Republic
SSAP	State Support to Agricultural Producers
TRIPS	Agreement on Trade-Related Aspects of Intellectual Property Rights
UNCTAD	United Nations Conference on Trade and Development
USA	United States of America
WTO	World Trade Organization

List of Units and Currencies

AZN	National Currency of Azerbaijan
US$	Unitet States Dollar
mln	Million
bln	Billion

1 GENERAL INTRODUCTION

1.1 Motivation and research objective

Upon gaining independence following the dissolution of the Soviet Union in 1991, Azerbaijan embarked on an impressive journey of economic development. The disintegration of centrally-planned economy, abrupt end of traditional economic relationships with trading partners within the Union states, and domestic political instability in the first years of independence drove the hindrance in economic growth. The gross domestic product (GDP) growth rate was negative during the first half of the 1990s, with an annual average decrease of 15.6 percent.[1] However, in the second half of the decade, the economy recovered from this recession and posted an annual average growth rate of 6.1 percent. Between 2000 and 2013, Azerbaijan boasted, on average, per annum double-digit growth rate, which was more than 12.2 percent—one of the highest in the world. The strong growth of the Azerbaijani economy during that period led to more than a seven-fold increase in the real income of the population and a four-fold decrease in the level of economy-wide unemployment. Thus, much of the population escaped from poverty; the overall poverty rate decreased from 50 percent in 2001 (the first year for which official poverty data is available) to less than 6.6 percent by end of 2013. Azerbaijan now potentially qualifies as an upper-middle-income country.[2] Extensive supply of natural resources (crude oil and natural gas) coupled with relatively well-managed macroeconomic policies and stringent structural reforms (with technical and financial assistance of the World Bank and the International Monetary Fund) have been responsible for such an economic development in Azerbaijan.

Given this impressive performance, the principal question in the minds of policy-makers, economists, and representatives of the business community in Azerbaijan is whether the country's accession to international trade unions such as the World Trade Organization (WTO) will offer new opportunities or challenges for further economic and social development in the country. Azerbaijan applied for a WTO membership in 1997 aiming to deepen its formal integration with the global economic community and its negotiations are still ongoing. It is well-known that accession to WTO requires the applicant

[1] Notice that unless otherwise noted, all data in this as well as in following parts of this thesis is taken from the State Statistical Committee of Azerbaijan (AzSTAT).

[2] World Bank qualifies the economies according to their per capita income level into different categories and upper-middle-income countries have income per capita between US$ 4,126 and US$ 12,745 (as of July 2014).

countries to align their wide-ranging domestic economic policy measures with the organization's rules and principles, and such movements in policies in turn can have a substantial impact on economic performance and social environment of the applicant country. Although it has been more than fifteen years since Azerbaijan applied for membership, the policy-makers, economists, and representatives of the business community still continue the controversial debate about the impending gains and losses that would be associated with its WTO accession. On the one hand, advocates of accession argue that WTO membership would increase the country's access to better goods and services at lower prices in addition to enhancing its access to foreign technology, all of which would create beneficiary conditions for domestic producers and consumers, particularly those in lower-income groups (Bayramov, 2012; Ibadoglu, 2011). On the other hand, opponents of accession argue that Azerbaijan remains a country in transition with incomplete economic reforms, and is thus incapable to exploit the full benefits of being the WTO member. These opponents of accession argue that membership in the WTO would mean tougher competition from foreign goods in the local market, which would decrease the market share of domestic producers—or even push them out of markets—and thereby would generate widespread unemployment and poverty (Huseynov, 2008; Samedzadeh, 2011; Manafov, 2012). These arguments are based primarily on a comparative analysis of the experiences of post-Soviet states that are already WTO members and on the fears of various industrial and agricultural lobbies that oppose the intended reforms. In contrast, to best of our knowledge, there seems to be no empirical literature that comprehensively and systematically assesses the likely effects that will accrue to Azerbaijan from joining the WTO.[3] This absence of empirical research may be the underlying reason why those on different sides of the debate see things so differently as well as the reason behind the slow accession process. Against this background, this study will make an important contribution toward filling a gap in the literature by quantitatively evaluating the effects of WTO membership for Azerbaijan.

Apparently, debates regarding the potential consequences of Azerbaijan's WTO accession cover both economic and social aspects of the likely effects.[4] Therefore, the outcome of accession should be explored in more detail based on the economic and social consequences of accession. With this in mind, this thesis is guided by the following research questions:

[3] Using a simple macro-econometric approach, Lord and Ahmadov (2008) evaluated the impact of WTO accession. Nevertheless, they do not consider all aspects of the effects as well as of the expected policy changes due to WTO membership.

[4] Note that throughout the whole study, we refer to "social aspects" of the likely effects as the distributional and poverty effects.

i. *What would be the impact of Azerbaijan's WTO accession on its key macroeconomic variables?*

ii. *What would be the impact of Azerbaijan's WTO accession on performance of domestic production sectors?*

iii. *How would WTO membership affect households-level welfare and incidences of poverty?*[5]

It is believed that the study will provide valuable insights into the likely impact of Azerbaijan's WTO accession on its economic performance and social environment and therefore will play a crucial role in advancing some of the arguments that have been made on this subject.

1.2 Methodological approach and data sources

To address the research questions outlined above, this study develops and employs two stand-alone models—a comparative static single-country computable general equilibrium (CGE) model and a micro-simulation model based on neoclassical economic theory—and links them in a layered fashion (hereafter referred to as the CGE micro-simulation model).

As numerical models originating from Walrasian general equilibrium theory, CGE models have been widely used in *ex-ante* policy analysis. These classes of models are able to capture all interactions between the various economic agents that make up an economy, which makes them a more powerful technique in policy analysis than partial equilibrium models. The prototype of the CGE model was developed by Johansen (1960) and was later improved by Dervis et al. (1982) and Shoven and Walley (1992). Although CGE models are an ideal modeling tool for evaluating economy-wide effects of intended policy changes (such as on various macroeconomic and/or on sectoral level variables) and can also provide valuable insight into the impact of policy shocks on welfare level of aggregated households or household groups, they fail to capture the substantial heterogeneity among households and are thus not particularly well-suited to poverty as well as in-depth welfare analyses.[6] This is the principal shortcoming of CGE models in the context of this research.

[5] To the best of our knowledge, this thesis is one of the first to analyze the "depth" issues regarding the impacts of economic integration. We refer to "depth" as the dimensions (both economic and social) of the impacts.

[6] A number of attempts have been made on poverty and distributional analysis within the CGE framework, which make use of representative household or few household groups (e.g., see Colatei and Round, 2000; Fane and Warr, 2002; Decaluwe et al., 2005). All applications assume that the distribution of relative income within each household group represented in the model follows an exogenously fixed statistical law (e.g., beta or

A micro-simulation model is instead a more accurate instrument that permits robust inferences about how household level welfare and poverty incidences would be affected by certain policy reforms because it is able to incorporate large-scale heterogeneity across households and individuals. The concept of micro-simulation models was introduced to the social sciences half a century ago in Orcutt (1957) and Orcutt et al. (1961), however, the use of this class of models is a relatively new method of *ex-ante* policy evaluation (Zuchelli et al., 2012).[7] Despite the usefulness of the micro-simulation model in detailed welfare assessments, the primary drawback of this type of model is that it mainly operates in the partial equilibrium context and thus does not reflect the important general equilibrium effects of policy changes.

Linking the CGE and micro-simulation models allows us to overcome their shortcomings and simultaneously combine the advantages of both models. The word "linking" here refers primarily to integrating the results from the CGE model into the micro-simulation model through a vector of changes in important variables as an outcome of policy changes, without any further interaction between the models. This makes it possible to investigate the effects of policy shocks on individual-level decision-making units, such as an individual household in the economy in a general equilibrium setting.

Consequently, merging the two models makes it possible to capture the effects of policy shocks with respect to all of the research questions that are relevant to our study. More precisely, the CGE model makes it possible to address research questions (i) and (ii), and the micro-simulation model makes it possible to address research question (iii).

In order to implement the CGE model, this study constructs a unique Social Accounting Matrix (SAM) for the Azerbaijani economy while using diverse data sources. The data from a nation-wide survey on households' budget, obtained explicitly from the AzSTAT, is used to implement the micro-simulation part of our modeling exercise.

1.3 Structure of the thesis

Based on the research objective outlined above, this thesis comprises seven chapters, which are structured as follows.

log-normal). However, an assumption of constant relative income distribution within households or group of households is not observed in reality and Colombo (2010) and Savard (2005) demonstrated that employing the CGE model alone with single or few representative households can lead to misleading conclusions when the objective of research is to estimate poverty and distributional outcomes of policy reforms.

[7] For an extensive review of micro-simulation models applied for various policy analyses see *inter alia*, Mitton et al. (2000), Farrell et al. (2013), and Campbell and Ballas (2013).

Following this general introduction, Chapter 2 begins with a brief introduction to the WTO and the status of the WTO accession process for Azerbaijan. This chapter also reviews relevant domestic economic policy measures in Azerbaijan and assesses their compatibility with WTO requirements; it thus envisages likely shifts in those economic policies. The subsequent chapters first draw upon the relevant theoretical discussions and then simulate the effects of WTO accession on Azerbaijan's economic performance and social environment based on the analysis presented in this chapter.

Chapter 3 reviews theoretical and empirical evidence on the economic and social impacts of changes in policies that would come along with Azerbaijan's accession to the WTO. The chapter also briefly discusses the phenomenon known as "Dutch disease" in the Azerbaijani economy (as a country-specific distinctiveness) and provides a theory-based analysis of how WTO accession might affect Dutch disease. The thorough discussion of economic theory carried out in this chapter sets a sophisticated basis for further empirical analysis.

Chapter 4 describes the methodological approach used in the empirical part of the research. Toward this end, the chapter explains the main reasons why the CGE micro-simulation modeling framework is the most suitable for this particular study and it also reviews the studies that employ CGE and its linked micro-simulation models in areas that are relevant to this study. Next, the structure of the single-country static CGE micro-simulation model for Azerbaijani economy is described. The description includes not only an explanation of the functional forms chosen for the model and behavioral equations of all economic agents, but also comprises a detailed discussion on the key assumptions and closure rules of the model.

Chapter 5 presents a framework for building a comprehensive database for the CGE micro-simulation model. First, the chapter describes a Household Budget Survey (HBS) that is used in the implementation of the micro-simulation model. Then the chapter goes on to describe how the SAM is developed for the Azerbaijani economy, which is the underlying database for the CGE model. The reconciliation and balancing procedure are discussed as important steps in the process of developing a consistent database. Thirdly, the chapter indicates the sources of the model's behavioral parameters. Later in the chapter, descriptive statistics based on reference year data are highlighted: the specificities of the national economy and the characteristics of households in general, and of poor ones in particular, are carefully presented. This knowledge will help to explain the outcome of the modeling exercises in the following chapter.

Once the necessary database for the model has been assembled, Chapter 6 begins by presenting the set of stylized counterfactual policy simulation scenarios based on discussions from Chapter 2. Next, the changes in all study-relevant economic and social indicators, as derived from the policy simulation exercises, are carefully presented and thoroughly discussed. Because the developed model is static in nature, these results indicate the short- to medium-term effects of policy changes.

Finally, the first part of Chapter 7 presents the systematic sensitivity analysis that is used to determine the robustness of the model's results. The behavioral parameters of the model are varied for this purpose. The second part of this chapter summarizes the major findings of this research, provides relevant policy implications, acknowledges the most important limitations of the study, and discusses possible avenues for future research.

2 THE WTO AND THE RELEVANT ECONOMIC POLICY OF AZERBAIJAN

As mentioned already, to qualify for WTO accession, an applicant country must amend a number of domestic economic policy norms and regulations that do not conform to WTO standards. Azerbaijan has already introduced a considerable number of new norms and regulations in recent years, which have moved the country toward compliance with WTO rules, particularly following the presidential approval of the "Action Plan on Bringing the National Legislation into Conformity with the Requirements of the WTO" in 2006.[8] Despite these achievements, however, there are still significant obstacles to the success of the negotiations regarding Azerbaijan's accession. As the head of the group in charge of the WTO negotiations, Mammad-Guliyev, has emphasized, "[…] *the most contentious issues that arose during the course of negotiations are the level of domestic support for agricultural producers and barriers to market access for goods due to applied tariffs."*[9] Because Azerbaijan currently does not impose any quantitative restrictions on trade (such as import quotas, export quotas, or tariff-rate quotas), does not impose export subsidies, and has relatively liberal import and export license procedures, it is unsurprising that the issues discussed most heatedly in connection with Azerbaijan's membership in the WTO are domestic support measures for agriculture and the tariff regime.[10] Hence, this chapter as well as this study focuses primarily on these two issues, considering them in the context of Azerbaijan's WTO accession process. More specifically, this chapter aims to review the existing agricultural and tariff policy regimes in Azerbaijan and then assess the changes that might be expected in those policy environments upon accession. Also, in this chapter, Azerbaijan's agricultural sector and patterns of foreign trade will be discussed briefly. However, before proceeding to discussing of these issues, it is worthwhile to give a brief introduction to WTO and the status of the accession process for Azerbaijan.

[8] During the years following the enactment of the "action plan", the government undertook a series of systematic reforms that were designed to facilitate Azerbaijan's accession to WTO (more than 40 laws and regulations had been drafted and adopted to ensure compliance to corresponding WTO regulations). As a result, the World Bank named Azerbaijan as one of the top ten reformers in its annual Doing Business report in 2010.

[9] Interview with Deputy Foreign Minister of Azerbaijan, Mahmud Mammad-Guliyev; retrieved from "Olaylar" online newspaper (November, 2011).

[10] Export subsidies are prohibited according to Agreement on Subsidies and Countervailing Measures (Article 2.3 in connection with Article 3.1(a)). Import and export quotas are also prohibited under the General Agreement on Tariffs and Trade, Article XI (with certain exceptions that must be administered in a non-discriminatory manner).

2.1 World Trade Organization and Azerbaijan

The WTO is a legal and institutional organization that regulates multilateral trade. The organization's overriding objectives are to let world trade flow as freely as possible and to ensure that trade occurs on a predictable and safe basis, thereby contributing to the sustainable economic development of its member states.

The WTO was established in 1995, as an outcome of the Uruguay Round, it has basically replaced the General Agreement on Tariffs and Trade (GATT). As a multilateral agreement, GATT played an important role in the regulation of international trade from 1947 until the creation of the WTO. In contrast to the GATT, the scope of the WTO covers more policy areas than merchandise trade and tariffs; it includes agreements on intellectual property (Trade Related Aspects of Intellectual Property Rights (TRIPS)) and trade in services (General Agreement of Trade in Services (GATS)). All decisions in the WTO are made by the member states, where the regulations are the outcome of negotiations among the member states. As of June 2014, the WTO included 160 members, which accounted more than 96 percent of the world trade and 24 states had the observer status and were seeking membership.

Generally, accession to WTO should be regarded as a difficult and complicated process, which may be lengthy, requiring high level of preparation, and coordination among government agencies (UNCTAD, 2001). As stated already, accession process for Azerbaijan began when the country submitted its membership application in 1997. In the same year, the General Council established a working party responsible for learning the rules governing domestic economic policy while holding negotiations according to the WTO requirements. In 1999, the government of Azerbaijan submitted a lengthy memorandum to the working party, describing all the essential features of its economic policy, which formulated a shape for further negotiations. In 2002, five years after the submission of its application, the first working party meeting in response to the memorandum was held. In the same year, Azerbaijan was granted observer status. Until now, eleven working party meetings were held with representatives of Azerbaijan's government.[11]

Parallel to its tough negotiations with the WTO, Azerbaijan has initiated bilateral negotiations with all interested WTO member states regarding market access for foreign producers to different segments of the domestic market and other similar issues. Today, Azerbaijan has signed five bilateral agreements (with Turkey, Kyrgyzstan, Oman, United Arab Emirates, and

[11] For a detailed chronology of accession process, see Hasanov and Zeynalov (2010).

Georgia), however, negotiations with fifteen other countries are currently underway, including the leading players in WTO: the USA, EU, Canada, and Japan.

2.2 Azerbaijan's agricultural sector, agricultural policy, and WTO requirements

2.2.1 Agriculture sector in Azerbaijan

As a traditional production sector, agriculture is an important component of non-oil/non-gas economy in Azerbaijan. Over the last decade, the share of this sector in non-oil/non-gas GDP was averaged around 20 percent. The agriculture sector is also the major employer of the economy. For instance, according to the official statistics, this sector made up almost 37.1 percent of total workforce (employed and self-employed) by the end of 2013. In line with overall economic development, the agriculture sector also experienced a challenging transition period.

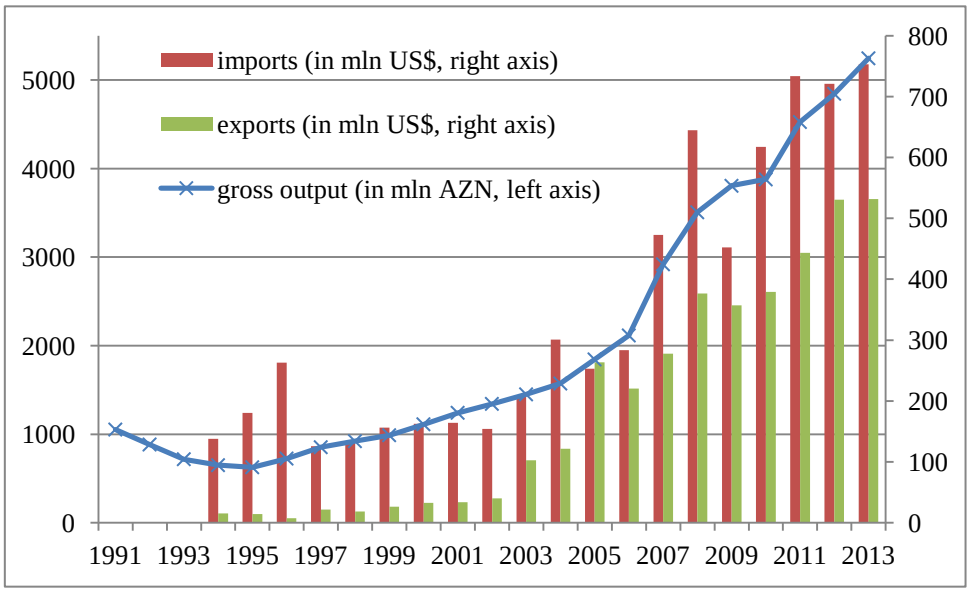
At the early years of independency, agricultural production went into a steeper decline. During 1991-1995, this sector fell by an average 11.9 percent per annum (Figure 2.1). Contraction in agricultural production led to a decline in agricultural exports and on average contraction rate was 24.9 percent, between 1994 and 1996. Over the same period, imports of agricultural products increased significantly, with average rate of growth 38.3 percent per annum, to meet surging domestic demand. The poor performance of agrarian sector in the first years of independency was largely the outcome of a breakdown of large state and collective farm systems (known as kolkhoz and sovkhoz).

The continuous decline in agricultural production made it inevitable to introduce systemic market-oriented reforms in the agricultural sector. To this end, in 1995-1996, government passed several laws on agricultural reforms path, including law on the "Basics of Agrarian Reform", the "Reforms of State and Collective Farms", and the "Land Reforms". As a result, state and collectively owned agricultural assets were transferred to the private ownership. These far-reaching reforms led to the agricultural sector's recovery in 1997 and this sector has since been growing at an average annual rate of 12.8 percent. In value terms, between 1997 and 2013, gross agricultural output increased from AZN[12] 853.5 mln to AZN 5,244.6 mln, representing a more than six-fold growth. Over the same period, in line with the expanding domestic supply, agricultural export increased significantly and by the end of 2013 was accounted US$ 531.4 mln, almost fourteen times larger than the export volume of agriculture

[12] AZN (Manat) is the national currency of Azerbaijan and the exchange rate was 1 AZN=1.27 US$, as of end of 2013 (source: Central Bank of Azebaijan (CBA), http://www.cbar.az/).

observed in 1997. During 1997-2013, total agricultural imports increased more than four times and accounted US$ 752.9 mln at the end of 2013. As can be seen from the trade data, Azerbaijan remains a net importer of agricultural commodities and the gap between imports and exports stretch up to US$ 221.2 mln in 2013.

FIGURE 2.1: Agricultural production and trade, at current prices (1991-2013)



Note: The data on trade patterns of agriculture sector is available since 1994.
Source: AzSTAT and UNdata

Domestic support measures for agriculture launched by government following the radical agrarian reforms are also the important inspiring element of growth in the agriculture sector. This support measures will be extensively discussed in the following subsection.

2.2.2 Azerbaijan's agricultural policy and its compliance with WTO requirements

The government of Azerbaijan considers agriculture to be a strategically important sector in its economic diversification policy within the non-oil/non-gas sectors. Therefore, government created large-scale domestic support measures for agricultural producers in order to promote agricultural growth. This assistance to the agricultural producers can be classified into three broad categories, depending on their nature.

The first category is *direct budgetary support* (or *direct income support*) measures. "The law of State Support to Agricultural Producers" (SSAP, 2007) defines the principles of the government's direct budgetary support for agricultural producers. This policy includes per-hectare payments for agricultural producers, with the objective of reversing the reduction of the areas sown with wheat and rice. Payment is granted based on the area sown at a rate of

AZN 40, generating an average annual cost to the government of approximately AZN 23.4 mln. Furthermore, due to the law of SSAP the implementation strategy is changed in the field of fuel and motor oil support. Before the SSAP, the support of agricultural producers in fuel and motor oil were covered by subsidized prices. However, with the law of SSAP, the government supports agricultural producers through direct payments at a rate of AZN 40 (per hectare). For this purpose, the government pays out an average of AZN 26 mln each year.

The second category of support for agriculture is classified as *input subsidies*, which are intended to stimulate production while easing the variable input costs of agricultural producers. In 2004, the parastatal Agroleasing Open Joint Stock Company was created by the government. This company plays an important role in implementing domestic support policy in agriculture. In particular, the company plays the following roles in the development of agricultural sector:

- It provides fertilizer to agricultural producers at a price that is 50 percent subsidized. The overall expenses for fertilizer support are AZN 24 mln annually with modest yearly fluctuations.
- The agricultural animal supply support measure is the only one that directly supports the livestock sector. The government attempts to assist the livestock sector by improving the quality of animal breeding stock by importing superior animals (mainly from EU countries). Farmers can buy these animals from the company, which pays half of their price; the farmers themselves pay 25 percent up front, with the remaining 25 percent due within three years. For this purpose, the government spent AZN 35.7 mln, between 2009 and 2013.
- A subsidy for irrigation water is another important support measure that the company provides to agricultural producers. Given that the larger part of Azerbaijan's cultivated land is irrigated,[13] irrigation water subsidy is essential. This subsidy ensures that agricultural producers receive irrigation water while paying less than 10 percent of the total cost.
- Another way that the company supports farmers is by providing machinery and technical equipments. The company imports agricultural machinery and equipments, and sells it to farmers under abatement conditions. In particular, the farmers can buy

[13] According to the statistics of Ministry of Agriculture of the Republic of Azerbaijan, more than 75 percent of cultivated land was irrigated in year 2013.

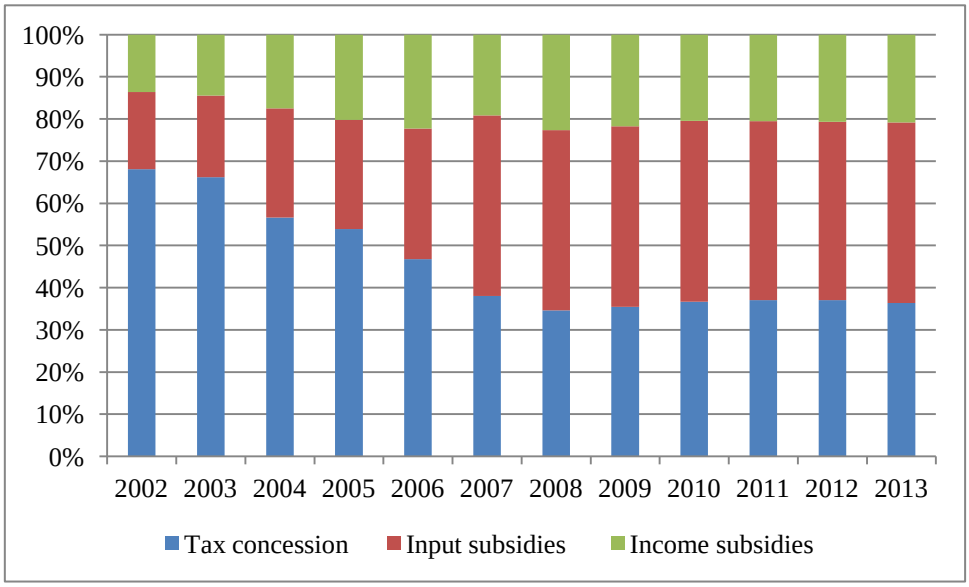
agricultural machinery or technical equipments for only 60 percent of standard market prices, while paying 20 percent of their initial value and the rest within the following 10 years with no interest. The government expenditure for this purpose fluctuates sharply across the years.

In addition, preferential credit policies provided through the National Fund of Entrepreneurship Support to the agricultural producers can be considered as input subsidies. The fund charges an interest rate that is one-third to one-sixth of that offered by commercial banks or non-bank credit organizations.

Tax concessions for agricultural producers comprise the last category of domestic support measures (based on the "Law on terms of the tax exemptions on agricultural producers", which enacted in 1999). The relevant regulation exempt agricultural producers from tax payments, including profit taxes, value-added taxes, and income taxes. The only tax payment required is the land-use tax payment. The estimated benefits that agricultural producers received from the tax concessions were approximately AZN 127.5 mln in 2013.

There has been a visible changes in the structure of support measures across the categories between 2002 (first year for which official data is available) and 2013 (see Figure 2.2).

FIGURE 2.2: The composition of domestic support measures in agriculture, in percentage (2002-2013)



Source: Ministry of Agriculture of the Republic of Azerbaijan and AzSTAT

In particular, the share of tax benefits in total agriculture support was declining over time from 68.1 percent in 2002 to 36.3 percent in 2013. However, the share of income support (from 13.6 percent in 2002 to 20.8 percent in 2013) and input subsidies (from 18.3 percent in

2002 to 42.8 percent in 2013) has been increased for the same period of time. Apparently, the share of cash transfers within the agriculture support measures have been increased significantly. This is because of the fact that the sharp increase in government revenues in recent years, stimulated by the large output expansion of natural resources, allowed the government to assist the agricultural sector mainly by means of cash transfers.

In general, the negotiations concerning agriculture policy within the WTO are more controversial than those related to other economic policies because in addition to creating trade barriers while using the tariff and non-tariff measures, most countries employ various domestic support measures for agricultural producers, which also causes a distortion in international trade. According to the WTO rules, domestic agricultural support measures are separated into two categories. The first category includes support measures that are exempt from reduction. These measures fall into the green or blue boxes and are considered to have limited or no trade- and production-distorting effects (Agreement on Agriculture (AoA), Annex 2 and Article 6(5)).[14] The second category includes support measures that are subject to reduction commitments, if they are above the related *de minimis* level laid down in the AoA (Article 6). These measures fall into the amber box and are considered to have trade- and production-distorting effects. The *de minimis* level is defined as the permitted level of aggregate support that is considered to be trade and production distorting, expressed as a percentage of the country's total agricultural production (in annual basis).

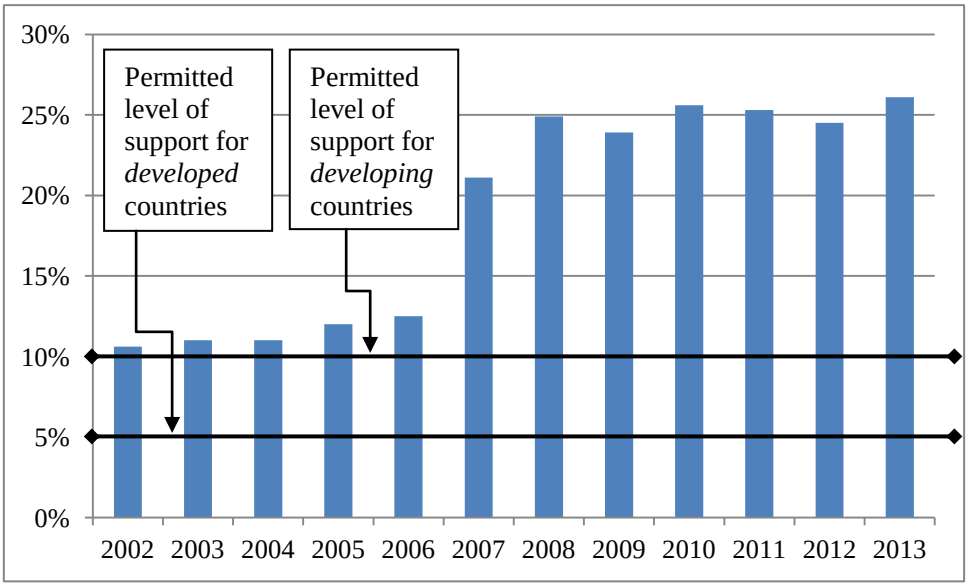
Given the nature of the government interventions described above, it is straightforward to conclude that if Azerbaijan becomes a WTO member, all these agricultural support measures will be permissible for inclusion in the amber box type of measures. The share of aggregate support in gross output increased continuously from 2002 (first year for which data is available) onward because the growth in the gross agricultural output has been lower than the expansion in aggregate support. Although the overall support consisted of only 10.6 percent of the total domestic agricultural output in 2002, this number steadily increased over time, reaching nearly 26.1 percent in 2013 (see Figure 2.3).

However, the WTO-permitted current *de minimis* level is 5 percent for those countries that acceded with developed country status and 10 percent for those countries that acceded with developing country status (Article 6.4, AoA). Consequently, if it aspires to WTO accession, Azerbaijan must adjust its domestic support level to make it consistent with WTO-imposed

[14] This support measures includes, the general services in research, pest, and disease control; training, inspection, marketing, and promotion services; among others.

rules. In other words, the government must reduce the level of its domestic support to the WTO-defined *de minimis* level, either to 5 or to 10 percent level, depending on the country's accession status. [15] Because there is no official WTO definition of "developed" and "developing" countries, acceding countries generally determine for themselves whether they are developing or developed. However, this determination can be challenged by other member states that wish to use the WTO provisions only for true developing countries.

FIGURE 2.3: The percentage share of total subsidies in gross agricultural output (2002-2013)



Source: Ministry of Agriculture of the Republic of Azerbaijan

Azerbaijan's desire in its negotiations with the WTO is to become a part of this organization with developing country status, which would allow the government to support agricultural sector more than is permitted in developed countries, as stated by Minister of Economy and Industry of Azerbaijan. [16] Nevertheless, according to the WTO practice, all post-Soviet countries, in which Azerbaijan were the part of, are jointed to the organization in the capacity of the developed countries (e.g., Kyrgyzstan, Georgia, Ukraine, and Moldova). Thus, the WTO requirement for Azerbaijan to join the organization as a developed country status is not surprising. However, it remains unclear whether Azerbaijan will join the WTO with

[15] It is worth noting that according to the Revised Draft Modalities for Agriculture (2008), the WTO member states intended to cut the *de minimis* level by at least 50 percentage points from the current level for developed countries, whereas developing countries are expected to apply two-thirds of this cut. However, new members will be exempt from this reduction. Therefore, it is less likely that this expected new regulation will apply in the case of Azerbaijan.

[16] Retrieved from the interview with Minister of Economy and Industry of Azerbaijan ("Dəyərlər" newspaper; June, 2009).

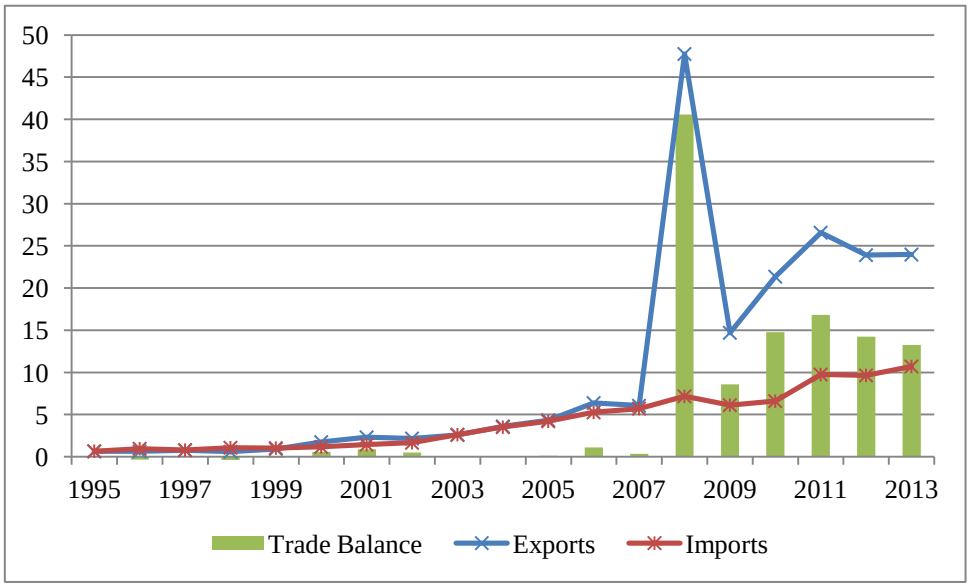
developed or developing country status and negotiations on this issue are ongoing. In either case, the accession would create ambitious targets that would substantially alter the support measures in the agricultural sector.

2.3 Azerbaijan's trade patterns, tariff policy, and WTO requirements

2.3.1 Trade patterns of Azerbaijan

Over the last two decades, Azerbaijan's foreign trade turnover that includes agriculture, industry, and services increased significantly, with sharp fluctuations in exports (see Figure 2.4). Export growth was largely driven by expansion in oil and gas industries, whereas import growth was largely driven by increase in domestic demand on foreign machinery and equipments. Total exports from Azerbaijan increased from about US$ 0.6 bln in 1995 to over US$ 6.1 bln in 2007, a more than ten-fold expansion. Total imports increased from US$ 0.7 bln in 1995 to US$ 5.7 bln by 2007, a more than eight-fold expansion. Between 1995 and 1999, trade balance was negative and accounted 23.5 percent of GDP (on average per annum). However, since 2000, Azerbaijan experienced a positive trade balance, with an annual average trade surplus of 22.8 percent of GDP, between 2000 and 2007.

FIGURE 2.4: Trade patterns, at current prices and in bln US$ (1995-2013)



Source: AzSTAT

In 2008, Azerbaijan's export volume increased sharply and amounted US$ 47.8 bln. The massive expansion of output in oil and gas industries and the skyrocketing oil prices in the world market were responsible for such an extraordinary growth in exports. Given that in the same year total imports (US$ 7.2 bln) was considerable less than total exports, trade surplus

of the country was very high, equivalent to 47.2 percent of GDP. In the following years, Azerbaijan's overall exports contracted significantly, whilst imports continued to increase. Contraction in exports occurred as a result of low oil prices in the world market caused by the global financial crisis that emerged in late 2008 and fall in output of oil and gas industries. However, the growth in imports was largely attributable to the continuously rising domestic demand on foreign goods. As of 2013 year end, Azerbaijan's total exports accounted US$ 23.9 bln, which is two times contraction from exports observed in 2008. In the same year, imports of the country were accounted by around US$ 10.7 bln, an increase of 50 percent from the imports recorded in 2008. Nevertheless, between 2009 and 2013, Azerbaijan's overall trade balance has remained positive and trade surplus has ranged between 18.1 to 36.1 percent of GDP.

Throughout 1990s, Azerbaijan's main trade partners were the countries of the Commonwealth of Independence States (CIS).[17] However, a significant reorientation in Azerbaijan's foreign trade has taken place starting from 2000. In particular, the trade turnover with CIS countries shrank, whereas the trade turnover with all destinations outside the CIS countries increased significantly.

2.3.2 Azerbaijan's tariff regime and its compliance with WTO requirements

Another central element of the negotiations between Azerbaijan and the WTO is its trade policy, which are composed of tariff regulations. All regulations concerning tariffs and their implementation in Azerbaijan are based on the "Tariff law" that was adopted in 1997 and revised twice, in 1999 and 2001. The tariff structure in Azerbaijan contains 10,661 tariff lines and consists of three forms (Tariff law, Article 4). The first are *ad valorem* duties that are applied at uniform rates with an interval of 0 – 15 percent of the declared custom values. The second form consists of per-unit-based specific tariffs (non-*ad valorem* duties) that are applied to certain products, such as tobacco products and alcoholic beverages. The third is a combination of these two types of tariffs. The general tariff scheme includes a high degree of tariff escalation, which means that the rates of the tariffs increase with the level of processing of the goods: the tariffs levied on raw materials are the lowest, whereas those levied on final goods are the highest. Because Azerbaijan signed a multilateral preferential trade area agreement upon establishing a free trade zone with the countries of the CIS in 1994 imports

[17] Notice that Georgia withdrew from the CIS in 2009. However, Azerbaijan and Georgia have a bilateral trade agreement and provide equal preferential treatment to one another.

from those countries are exempt from tariffs.

The simple average tariff rate for all products fluctuates in Azerbaijan, depending on the estimation methodology used. However, the common rate was approximately 9.0 percent in 2013 (based on the WTO statistics) after the *ad valorem* equivalence of specific tariffs had been taken into account. In addition, there are remarkable differences between the tariff rates for agricultural and non-agricultural products, with higher average rates applied to the former. Azerbaijan's average tariff rate for agricultural products was 13.2 percent in 2013, whereas the corresponding rate was 8.3 percent for non-agricultural products during the same year.

Unlike domestic support measures in agriculture, the degree and nature of reforms in tariff regulations for merchandised trade in each applicant country is determined through a process of negotiation. Therefore, it is not possible to know the exact level of changes in tariff regulations in Azerbaijan ahead of time. Conversely, continuing negotiations indicate that the country is likely to gradually reduce its tariff rates. Mammad-Guliyev has emphasized that the nations in the Working Party (notably, Switzerland and the EU member states) are requiring Azerbaijan to reduce its applied tariff rates up to two or three times.[18] This request is not surprising, because the tariff rates in Azerbaijan are more restrictive than they are in other states from the former Soviet Union that have already become members of the WTO. For instance, according to the WTO statistics, the average tariff rate was only 1.5 percent in neighboring Georgia, which received membership in 2000, for the year 2013. Moreover, this rate was 4.5 percent in the recently (relatively) acceded Ukraine (in 2008) during that same year. In addition, the tariff rates for agricultural and non-agricultural commodities in Georgia were 5.9 and 0.7 percent, respectively, in 2013 and in Ukraine; these rates were 9.2 and 3.8 percent, respectively. Apparently, the average tariff rates in Azerbaijan are significantly higher (for both agricultural and non-agricultural commodities) than they are in some WTO member states that are former Soviet states. Consequently, applied tariff rates in Azerbaijan are very much likely to undergo a substantial reduction following the WTO membership.

2.4 Concluding remarks

The core focus of this chapter was to determine what WTO accession would mean for Azerbaijan. In other words, our primary aim was to define the types of policy changes that would likely be necessary for Azerbaijan's accession to the WTO. For this purpose, we have tested the compatibility of agricultural and tariff policies in Azerbaijan with the letter and

[18] Retrieved from the "Həftə Içi" newspaper (March, 2010).

spirit of the WTO's requirements. It is found that WTO membership will reduce Azerbaijan's ability to provide government support to agriculture sector because the current regulations fail to meet the WTO rules. The reductions would be even higher if the country accede the organization with the developed country status. In addition, Azerbaijan will likely have to undertake substantial reforms in its trade policy regime through tariff liberalization upon accession to the WTO.

These expected policy reforms could be regarded the most important changes to Azerbaijan's economic policy regime since the late 1990s. In turn, this could have profound impact on the future course of Azerbaijan's economic and social development.

3 THEORETICAL BACKGROUND OF WTO-IMPOSED REFORMS

After determining the shape of potential policy changes that will accompany Azerbaijan's accession to the WTO, in this chapter, we provide a theoretical discussion of how such policy changes might affect the nation's economic performance and social environment and also present a relevant empirical evidence.

The principal aim of the chapter is to establish a basis for further and more sophisticated empirical analysis.

3.1 Economics of trade liberalization[19]

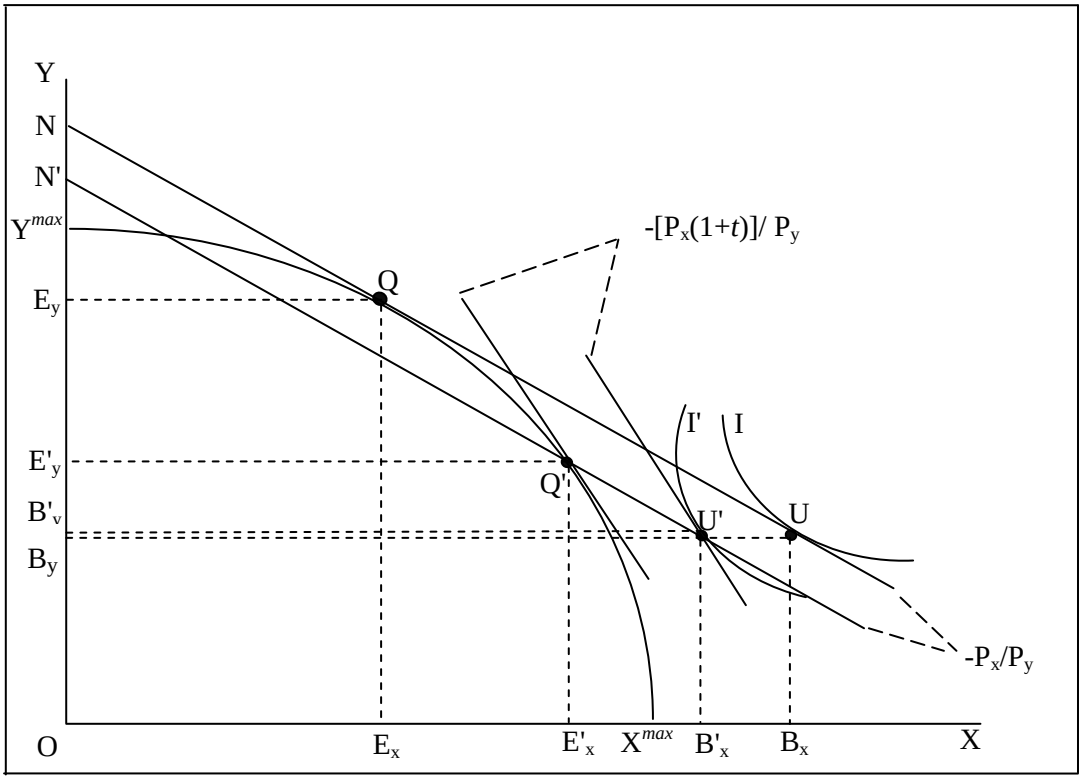
The need to liberalize trade barriers has been a prominent component of policy advices to developing countries for the last two decades because economists claim that there are significant benefits of being open to the flow of world trade (Winters, 2004). Conventional trade theory predicts that trade liberalization leads to the efficient allocation of domestic resources and thus promotes economic growth and social welfare. Under this scenario, resources flow to economic activities in which production is valued more highly according to world market prices (Jensen et al., 2004), which ultimately leads to an unambiguous increase in the opportunity to specialize and to expand the production of goods that provide the nation with comparative advantage in the world market.

Figure 3.1 offers a graphical depiction of these effects. Assume that the economy produces and consumes two goods **X** and **Y**. To produce these goods, producers face a constant return production function in a perfectly competitive market. The economy is assumed to be small, which means that variation in the demand for imports or in the supply of exports will not affect world market prices (i.e., the country is a price taker). The production possibility frontier (PPF) is given as $\mathbf{X}^{max}$ and $\mathbf{Y}^{max}$, and the trade pattern of the economy is such that it exports **Y** and imports **X** with world market prices $\mathbf{P_y}$ and $\mathbf{P_x}$, respectively. The economy's optimal production level in the pre-tariff situation is at production point **Q**, where the relative price line $\mathbf{-P_x/P_y}$ (this line also defines the budget constraint of the economy) is tangent to PPF. Furthermore, consumers maximize their utility at point such as **U**, where the relative price line $\mathbf{–P_x/P_y}$ is tangent to the indifference curve **I**.

[19] Although "tariff liberalization" is a much narrower term than "trade liberalization", these terms are used interchangeably in this chapter.

If the government levies an *ad valorem* tariff ***t*** on imported good **X**, the domestic price of **X** will rise to $\mathbf{P_x(1+t)}$. This indicates that consumers and producers in the domestic market face a price that is above the world market price of good **X**. The relative price line therefore becomes equal to the slope of $\mathbf{-[P_x(1+t)]/P_y}$. Domestic producers will respond to this price alteration and the economy's optimal production level tends to move around the PPF curve to a point such as **Q'**, where the new relative price line $\mathbf{-[P_x(1+t)]/P_y}$ is tangent to PPF. In short, the tariff makes it seem that good **X** is more valuable than it actually is, and this inflation encourages domestic producers to produce more of the good **X**. In addition, consumers will also respond to the price change by moving their optimal level of consumption to point **U'**, where the new relative price line ($\mathbf{-[P_x(1+t)]/P_y}$) is tangent to the indifference curve **I'**.

FIGURE 3.1: General equilibrium effects of import tariffs



Source: Markusen et al. (1995)

Several inferences about the effects of tariff can be made based on Figure 3.1. First, a new consumption point **U'** ($\mathbf{B'_xB'_y}$) lies on an indifference curve **I'**, which is lower than **I**, where pre-tariff consumption point **U** ($\mathbf{B_xB_y}$) lies. This indicates that eliminating tariff (extreme case of trade liberalization) would improve the level of consumers' welfare. Second, the post-tariff level of output **Y** (**X**) is lower ($\mathbf{E'_y < E_y}$) (higher ($\mathbf{E'_x > E_x}$)) than the pre-tariff level, which indicates that removing trade barrier would actually cause more specialization in the production of good **Y—**a good in which the economy has a comparative advantage in the

world market. Third, in the absence of tariff, the economy's foreign trade turnover is higher (($\mathbf{E_yB_y} + \mathbf{E_xB_x}$) > ($\mathbf{E'_yB'_y} + \mathbf{E'_xB'_x}$)), such that the country exports more ($\mathbf{E_yB_y} > \mathbf{E'_yB'_y}$) and also imports more ($\mathbf{E_xB_x} > \mathbf{E'_xB'_x}$). This indicates that tariff restriction on imports not only limits imports but also creates anti-export bias. Fourth, the value of real national output is higher without tariff (**ON** > **ON**').

The neoclassical model of trade theory that is based on the Heckscher-Ohlin paradigm predicts that following trade liberalization a country will specialize in the production of goods that make intensive use of the factors of production that are abundant in that country (due to (relatively) lower cost of these factors). From this perspective, one can conclude that there should be a comparative advantage in the production of capital-intensive goods where the supply of capital is higher, whereas the production of labor-intensive goods should be advantageous for labor abundant countries (Carnerio and Arbache, 2003). In general, developing countries have abundant labor, whist developed countries have abundant capital. Thus, the essential prediction from the Heckscher-Ohlin model for developing countries is that reducing barriers to trade will shift the production composition from capital-intensive economic activities toward labor-intensive economic activities. However, it is worth noting that the standard result is valid under perfectly functioning markets and under free mobility of production factors.

Although the aforementioned gains from trade liberalization may take many years to fully materialize, they are considered as "static" or "one-time" benefits, in the sense that as an outcome of trade liberalization economy moves to a new and different steady state situation. In addition, trade openness may also contribute to faster growth in investment and productivity. These are the frequently cited important sources of long-term "dynamic" gains from trade liberalization (Miller et al., 1997; Thirlwall, 2000; El-Wassal, 2012). Liberalization of trade barriers may increase incentives for investments by reducing the import costs of capital and intermediate goods (Epifani, 2003; Duncan and Quang, 2003). Trade liberalization may also increase industrial productivity by the adaptation of more advanced technologies (Navas-Ruiz and Sala, 2007; Bustos, 2011; Stoyanov, 2013) and by the reallocation of resources towards more productive producers (within industry reallocation) (Melitz, 2003; Bernard et al., 2003). The growth in investment and productivity may in turn expand domestic industries, in which the country enjoys a comparative advantage, thereby promoting economic growth and improving social welfare.

In line with the view of economic theory reviewed above, several empirical studies have

attempted to investigate whether the theoretically predicted gains from liberalization in trade barriers have materialized in practice. The most influential study of *ex-post* evidence concerning such gains was conducted by Bernhofen and Brown (2004, 2005) in the case of Japan. The researchers used the data set from a 19th century trade liberalization episode as a natural experiment to investigate the economic consequences of trade liberalization. Their analysis provides evidence that the trade patterns in Japan were governed by the logic of comparative advantage after reductions in barriers to trade. In addition, they estimated that the overall gain from Japan's transition from a relatively closed economy to an open economy was reflected in an increase in its real income of about 8 to 9 percent of GDP. Manni and Afzal (2012) attempted to assess the impacts of trade liberalization on the Bangladeshi economy between 1970 and 2010. They conclude that trade openness has had a favorable effect on economic development of the country. The authors also found that the real export and import volumes increased considerable as a consequence of the liberalization in trade barriers. In a separate study, Herath (2010) evaluated the extent to which trade liberalization influenced economic growth in Sri Lanka from 1960 to 2007. The study used a rich trade dataset from the trade regimes in the pre- and post-liberalization periods. The findings of this study confirm that there is a positive and significant relationship between trade liberalization and economic growth. Further on, Clarke and Kulkarni (2010) used a detailed dataset for Malaysia and Singapore to evaluate impacts of trade openness on specialization. Both countries joined the ASEAN (Association of Southeast Asian Nations) free trade area in 1992 and this was accompanied by broad reductions in the import tariffs in both countries. The authors conclude that the both countries gained significantly from the trade openness. Regarding the specialization they found that the Heckscher-Ohlin model's prediction is generally accurate; Singapore as a capital abundant country exports more capital-intensive goods, whereas Malaysia, a country with abundant labor, exports more labor-intensive goods now that the free trade area agreement is in place. While analyzing the trade liberalization episode in Japan, Bernhofen and Brown (2011) also concluded that Heckscher-Ohlin model's presumption is fairly accurate. Using a micro-level data, Iacovone (2012) examined the impact of NAFTA (North American Free Trade Agreement) on Mexico and found that a 1 percent reduction in tariffs spurred productivity growth between 4 and 8 percent on average. Pavcnik (2002) also found strong evidence that liberalization of trade barriers leads to considerable productivity gains. The author focused on trade liberalization episode in the 1970s and 1980s in Chile. In order to analyze the impact of trade liberalization on technological diffusion, Collins (2013) used the data from Mexico. In particular, the author

used the data that for period 1984-1990, during which large-scale trade liberalization occurred and conclude that liberalization in trade barriers led to technological upgrading in the economy.

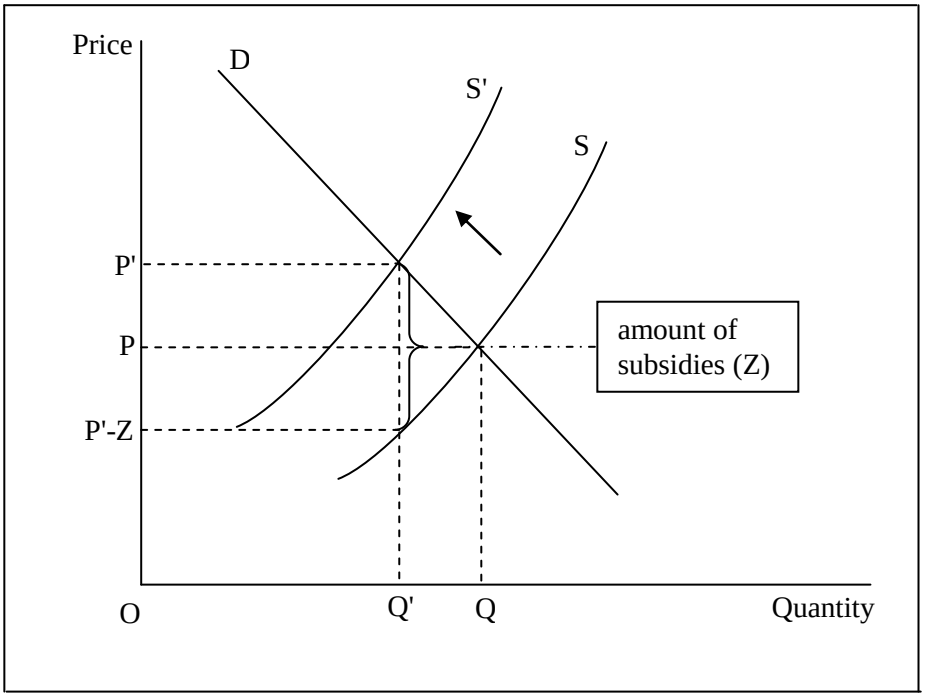
In summary, there is strong theoretical and empirical evidence that liberalizing trade barriers enhances economic growth and improves social welfare.

3.2 Economics of agricultural subsidy reforms

Large-scale subsidies directed to the agriculture sector are common feature of socio-economic development policies in both developing and developed economies. Above all, these subsidies are indented to insure fair living standards for agricultural producers and also to deliver a sufficient quantity of stable and safe food supply at reasonable prices for all consumers. An economic analysis of reforms related to these subsidies is undertaken in this subsection.

In accordance with the norms of basic microeconomic theory, reducing a host of production-related agricultural subsidies will adversely affect performance of the agricultural sector. Figure 3.2 provides a graphical illustration of production and price effects of a reduction in subsidies in the agricultural sector.

FIGURE 3.2: Production and price effects of lowering subsidies in the agricultural sector



Source: Adapted from Dorward (2009) with own modification

Suppose that, prior to subsidy reduction, the agricultural sector produces a quantity **Q**, with

the corresponding market equilibrium price **P**, where the supply curve **S** intersects with the downward sloping demand curve **D**. If the government decides to cut the subsidy payments to the agricultural sector—say by amount of **Z** per unit output—this will influence equilibrium price and supply quantity in the agricultural market. Assuming that there are no market failures, the immediate effect of reducing subsidies will be to decrease the effective producer price under the market price by amount of **Z**.[20] In turn, this will reduce the incentive of the producers (through reducing their profitability) to undertake this particular activity and thus will generate an upward shift in the market price supply curve from **S** to **S'**. Under the condition of fixed demand curve **D**, this will lead to a contraction in supply quantity from **Q** to **Q'** and an increase in market equilibrium price from **P** to **P'**. Clearly, consumers would lose from consuming less at a higher price **P'** instead of the original price **P**. The shape of the demand and supply curves determines the size of the impacts. Through these market effects subsidy reforms might also affect agricultural trade.

The effects depicted above are only relevant for the agricultural market. In reality, however, the agriculture sector is strongly linked (through backward and forward linkages) to the rest of the economy. Thus, changes in agricultural price and supply quantity induced by subsidy reforms might in turn affect the performance of other economic activities. Nevertheless, the extent to which reforms in the agrarian policy affects the non-agricultural sectors' performance and hence the economy as a whole largely depends on the relative size of agriculture sector in the national economy and the size of policy shock itself.

A number of empirical studies have evaluated *ex-post* outcomes of agricultural subsidy reforms in different countries. For instance, Olhan (2006) analyzed the impacts of agricultural policy reforms during the late 1990s and early 2000s in Turkey. The author concluded that abolishing agricultural subsidies that were directly linked to the production process caused a structural adjustment throughout the economy that led to a decline in the domestic agricultural production. Further on, a reduction in subsidies also caused a decline in agricultural GDP and affected Turkey's foreign trade patterns in agricultural sector. The country lost its position as a net exporter of agricultural commodities and instead became a net importer of those commodities. In a similar study, Hanjra and Culas (2011) examined the impacts of agricultural policy reforms that occurred from 1960 to 2008 in Zambia, placing a special emphasis on the input subsidy programs for maize. The researchers determined that

[20] If there are market failures then a subsidy cut will decrease effective producer price under the market price by more than **Z**.

eliminating subsidies led to significant reductions in subsidized agricultural production (maize production) in the post-reform period. Another perhaps more infamous example in the literature comes from New Zealand, where large-scale agricultural subsidies were gradually phased out during the 1980s. Vitalis (2007) stated that after the reforms agriculture sector experienced a downturn and the most dramatic negative change triggered by the reforms was to the sheep farming, which were important agricultural subsector before the reforms.

In sum, theoretical and empirical evidence suggests that the reduction in agricultural subsidies (production-related) will have a negative impact on the performance of the agriculture sector. However, how other economic activities and ultimately trends of national economy will be affected following the agricultural policy reforms is an empirical issue.

3.3 Trade liberalization and poverty links

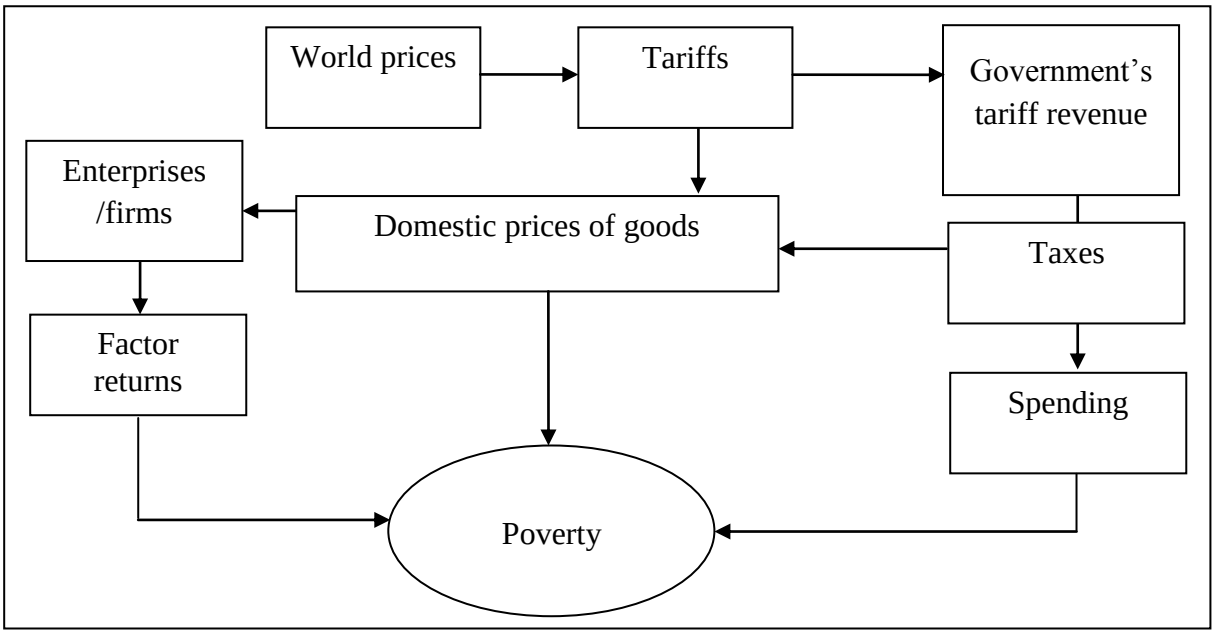
The poverty effects of trade liberalization have been extensively discussed by researchers and policy-makers in the recent past. Accordingly, vast body of theoretical and empirical literature has focused on identifying the causal links between the liberalization of trade barriers and the impact of such policy movements on the well-being of a poor population. Winters (2002) developed a consistent theoretical framework that links trade liberalization with poverty, emphasizing that the linkages operate primarily through the following three distinct channels: (i) price changes in commodity markets, (ii) changes in factor returns (or prices), and (iii) changes in government revenue and spending. These are the most direct links between trade and poverty. Figure 3.3 summarizes the pathways through which trade liberalization affects the poverty.

The first direct link between trade liberalization and poverty occurs through price changes in consumption goods. If a country undergoes trade liberalization by lowering its tariffs, the immediate impact of this change will be a reduction in the prices of imported goods and this will keep the prices of domestic substitutes also lower. In turn, lower prices will expand the feasible set of affordable goods for all consumers, including the poor, and thus will improve their welfare. However, the net effect of the reforms in trade barriers on the consumption patterns of the poor largely depends on both the size of the price changes and the goods to which these changes apply. For instance, the poor will benefit most if the price decline applies to products that are critical to the poor, such as food products and clothing.

The following mechanism through which trade liberalization might affect a well-being of the poor population is changes in factor prices. The changes in commodity prices in domestic

market that accompany trade liberalization could alter production patterns of enterprises/firms and hence their demand on factors of production. Accordingly, this would lead to changes in economy-wide returns to production factors, thereby affecting the (factor) income of the population, including the poor.

FIGURE 3.3: Trade liberalization and poverty – the causal linkage



Source: Adapted from Winters (2002) with own modification

According to the Stolper-Samuelson theorem returns to the factors that are relatively abundant in the economy will increase following trade liberalization, whereas the returns to other (scarce) factors will decrease. For instance, in the two-factor model with labor and capital (or skilled and unskilled labor), the return to labor (or the return to unskilled labor) in the form of wages will increase, whereas the return to capital (or the return to skilled labor) is likely to decrease if the economy is labor abundant (or unskilled labor abundant). Developing countries are supposed to have relatively large supplies of labor (particularly unskilled labor) and poor are presumed to have abundant labor (particularly unskilled labor). Thus, trade liberalization might be expected to affect the poor positively in developing countries by increasing their factor incomes. Notice that the Stolper-Samuelson theorem depends on assuming that the factors of production are perfectly mobile within the country and the remunerations to factors are therefore equalizes across economic activities. Consistently with the predictions of the theorem, Porto (2006) and Chiquiar (2008) have found empirical evidence that trade liberalization increases wages in certain labor abundant developing countries. However, the predictions based on this theorem have been challenged by other studies (Banerjee and Andrew, 2004; Kremer and Maskin, 2006; Amiti and Cameron, 2012).

Agenor (2004) gives a reasonable explanation for this controversy and argues that trade openness is typically associated with the introduction of high-level technologies, which require skilled labor. This implies that along with trade openness, demand for skilled labor will increase (this will bid up the return to skilled labor) and demand for unskilled labor will decrease (this will bid down the return to unskilled labor)—even in unskilled labor abundant economies. In turn, this might hurt the poor. Overall, although the message of the Stolper-Samuelson theorem is simple and powerful, there seems to be no hope for generalization of this theorem.

The final channel through which trade liberalization might influence a welfare level of poor is changes in government revenue and spending. It is generally presumed that reduction in tariff barriers will lead to decrease in government revenues from tariffs. In reaction to revenue losses associated with the tariff liberalization, government might squeeze its spending on various social programs. Given that there are strong negative relationship between the level of social expenditures and poverty (Caminada et al., 2012), this scenario might hurt the poor. Alternatively, the government could levy new taxes or raise the existing tax rates to replace lost tariff revenues and the net effect of such taxes on poor depends mostly on the type and size of the revenue replacement taxes. For instance, increase in value-added tax (or sales tax) rate will raise the domestic prices of commodities, which in turn might adversely affect welfare of the poor. On the other hand, imposing higher (income) tax rates on the wealthy people is unlikely to affect the poor. Further on, McCulloch et al. (2001) noted that the poor in countries with a lower proportion of tariff revenues in their government budget are less likely to experience significant hardship as a result of tariff liberalization.

On the whole, one can conclude that the trade-induced price changes in commodity market are likely to have a direct and positive effect on the welfare level of the poor, whereas other changes (changes in factor returns and changes in government revenues and spending) may have positive or negative (indirect) effects. Hence, the total effects of trade liberalization on poverty are ambiguous. This theoretical ambiguity is reflected in the country-specific *ex-post* empirical studies. Goldberg and Pavcnik (2007) examined the poverty effects of unilateral trade liberalization episode between 1984 and 1995 in Colombia, following its accession to the WTO/GATT in 1981. Using detailed household level data from before and after the reform period, they found no evidence that trade liberalization reduces poverty. In a similar vein, Khan and Bashir (2012) attempted to estimate whether there was a significant relationship between trade liberalization and poverty in Pakistan during the years 1975-2010.

Their results indicate that trade liberalization had no significant effect on poverty. Topalova (2007, 2010) examined the effects of trade liberalization reforms on poverty in India from 1987 to 1997 and found that trade liberalization led to an increase in the poverty level during the analyzed period. Conversely, in analyzing the trade reforms associated with Argentina's entry into the MERCOSUR (Mercado Común del Sur) free trade area during the 1990s, Porto (2006) found that lowering trade barriers caused a reduction in the poverty level. Nicita (2004) also concluded that trade liberalization occurred between 1989 and 2000 in Mexico has had a direct effect on reducing poverty. Similar conclusions were drawn by Borraz et al. (2012), where they used a detailed dataset to quantify the impact of widespread trade liberalization episodes between 1991 and 2006 on Brazilian poverty level. In addition, depending on the geographical location of poor, trade liberalization may affect their welfare quite differently (e.g., it may affect rural poverty *vis-à-vis* urban poverty differently). For instance, Castilho et al. (2012) estimated the effects of tariff cuts on household income and poverty from 1987 to 2005 across Brazilian states. Their results suggest that trade reforms increased poverty in urban areas and reduced poverty in rural areas. By contrast, according to Topalova's estimation, poverty increased in rural districts as the result of trade liberalization in India. Although methodological differences between these studies may account for the differences in their findings, the unique socio-economic situation of any given country (e.g., its market size, its import and export structure and the characteristics of the poor, among others) may also account for the diversity of outcomes for the poor that trade liberalization policies have generated.

Altogether, the economic literature has arguable failed to provide any conclusive evidence of the impacts of trade liberalization on poverty; there is neither theoretical nor empirical support for strong positive or negative causal relationships between trade liberalization and poverty. Hence, the impact of trade openness on poverty is ultimately an empirical question.

3.4 Agricultural subsidies and poverty links

It is widely accepted that growth in the agricultural sector is closely linked to the incidence of poverty in developing economies (Loayza and Raddatz, 2010; Cervantes-Godoy and Dewbre, 2010). In a detailed examination of the importance of growth in the agricultural sector to the pace of poverty alleviation in developing countries, de Janvry and Sadoulet (2010) found that growth that originates in agriculture can be three times more effective in reducing poverty than growth originating in other sectors of the economy. Given that the government

interventions may play an important role in agricultural development (Razack et al., 2009; Grewal and Abdullahi, 2011), many developing countries employ agricultural subsidies in order to (indirectly) contribute to poverty eradication, in particular poverty in rural areas. As one of the most recent and cited papers in this area, Dorward and Chirwa (2011) evaluated the socio-economic outcomes of Malawi's large-scale agricultural input subsidy program that was implemented during the 2005-2009 period. The authors found that this program significantly contributed to growth in the agriculture sector, which in turn led to an overall reduction in the poverty level.

On the contrary, one might reasonably expect that dismantling or reducing the agricultural subsidies might have an adverse effect on poverty. In general, reduction in subsidies might affect poverty through multiple channels, as discussed by McCulloch et al. (2001). First, as noted in section 3.2, lowering agricultural subsidies will trigger the rise of prices in agricultural products and higher agricultural prices will keep the domestic prices of staple foods also high because of the strong linkages between these economic activities. In the end, these price inflations will lessen the purchasing power of all consumers. Because poor consumers typically spend a larger share of their consumption budget on food and agricultural products, even small increases in the prices for these products might seriously affect the ability of poor to meet their basic needs.

Second, as mentioned further up, theoretically cutting subsidies will shrink production level in agriculture sector. The resulting effect will be a decrease in the demand for the production factors that are intensively utilized by this sector. In turn, this will drive down remunerations to those production factors. Because the agriculture sector presumed to be unskilled labor-intensive in developing countries, stagnation in this sector will cause a reduction in wage rate for unskilled labor. Given that the poor individuals are typically unskilled laborers, reduction in wage rate for unskilled labor might lower the income level of poor and hence deteriorate their welfare.

Third, a reduction in subsidy payments of all kinds is likely to have revenue implications for the government's budget. In particular, the government savings will increase when subsidies are reduced and these financial resources can be used, for instance, to finance various social assistance programs. This might effectively contribute to poverty alleviation. However, the government can also spend these financial funds elsewhere. Alternatively, the government might reduce tax rates, e.g., value-added tax or sales tax rates. In turn, this might create a beneficial condition for all groups of people, including the poor. The net effect of the reforms

depends on the size of the overall subsidies distributed to agricultural producers.

In sum, it is obvious that the subsidy-cut-induced price changes in commodity and factor markets have negative effects on the welfare level of the poor. However, the changes in government revenues and spending due to subsidy reductions may have positive or negative poverty effects.

From an empirical point of view, the poverty impact of agricultural subsidy reforms is not particularly well explored. Thus, there is little *ex-post* evaluations on these matters. Firdausy (1997) evaluated the effects of eliminating input subsidies on the incidence of poverty in Indonesia during the 1980s. The author founds that removing agricultural subsidies contributed to an increased incidence of poverty. Amjad and Kemal (1997) evaluated impacts of the Structural Adjustment Programs on the level of poverty in Pakistan during the 1963-1993 period. As part of this economy-wide reform policy, the government withdraws input subsidies on agriculture. They came to the conclusion that withdrawal of subsidies has had adverse impacts on poverty in the country. In another study, Vitalis (2007) found that after implementation of agricultural subsidy reforms during the 1980s in New-Zealand many small farmers went out of business and that a large number of laborers became unemployed, particularly in rural areas.

On the whole, the economic literature suggests conclusive evidence regarding the impact of agriculture subsidy reforms on poverty. In particular, lowering domestic support measures directed to agriculture is most likely to increase the incidence of poverty.

3.5 Dutch disease and WTO-imposed reforms

Unlike in the majority of the countries that wish to join the WTO, Azerbaijan's contemporary economic development has been sustained by its natural resource (particularly crude oil and natural gas) extraction and exports. This sector contributed approximately 59 percent of Azerbaijan's GDP and more than 89 percent of its total exports in 2013. Economic theory would predict that such a high concentration of economic activity may threaten sustainable long-term economic growth and may thereby worsen the living standards of the population (Sachs and Warner, 1997; Auty, 2001; Gylfason and Zoega, 2002; Boyce and Herbert, 2011). The economic explanation for this phenomenon is that the increasing foreign currency inflows associated with surging natural resource exports tends to appreciate the real effective exchange rate (i.e., nation's currency gets stronger in comparison to that of other nations). In turn, the appreciation undermines the competitiveness of traditional manufacturing and

agricultural sectors in the local and international markets, therewith leading to a crowding out of these production sectors within the economy (de-industrialization). Because manufacturing and agricultural sectors are often the major employers in developing economies (Wiebelt et al., 2011) stagnation in these sectors may cause widespread unemployment and poverty. This phenomenon is referred to as Dutch disease in the economic literature.[21]

Despite the wealth of literature that addresses the issue of Dutch disease, only a few studies have investigated the extent to which Azerbaijan's economy is contracted Dutch disease. Using the econometric tools for the period from 1991 to 2006, Egert (2009) was the first who conclude that the Azerbaijan's economy is "infected" by the Dutch disease. Later on, Hasanov (2010, 2012) independently drew the same conclusion using a different time frame (quarterly data between 2000-2007) and a different methodological approach. It is worth mentioning that this syndrome may become increasingly more significant in the future because the government recently announced that it has discovered large natural gas deposits that it plans to exploit in the coming years in addition to continuing its crude oil extraction.[22]

The awareness of this syndrome has caused policy-makers to be concerned about whether WTO membership of Azerbaijan would help to lessen or aggravate the Dutch disease. Therefore, when discussing the consequences of policy changes that would likely result from WTO accession, it is important to consider this country-specific issue.[23]

Theoretically, lowering the barriers to trade might mitigate the negative effects of Dutch disease and thus might boost production in the traditional manufacturing and agricultural sectors (Liu and Yang, 2001; Brahmbhatt et al., 2010). The economic reasoning behind this practice is that trade liberalization stimulates the demand for imports, thereby reducing net foreign exchange inflow. In turn, this depreciates the real effective exchange rate (i.e., nation's currency gets weaker in comparison to that of other nations) and thus increases the competitive position of manufacturing and agricultural sectors in the local and international markets. These insights have been reiterated in the Azerbaijani context by Rosenberg and Saavalainen (1998), where the authors proposed that the negative effects of Dutch disease

[21] This expression was first coined by *The Economist* in 1977 based on the experience of the Netherlands. The country discovered natural gas deposits during the 1960s, which led to sharp decline in production of non-resource tradables and thus contributed to the country's de-industrialization.

[22] See an announcement of the State Oil Company of Azerbaijan (SOCAR): http://www.anspress.com/index.php?a=2&lng=az&nid=244578, (last accessed: 20.05.2013).

[23] Among others, the Institute for Research on Economic Reforms of the Ministry of Economy and Industry of Azerbaijan has called for an analysis of Azerbaijan's WTO accession in connection with the significant dependency of the country's economy on natural resource extraction and exports.

could be partially countered by lowering the trade barriers.

It is widely believed that supporting domestic production in traditional manufacturing and agricultural sectors through various (mainly) cost-reducing subsidies is an effective policy option to neutralize the negative effects of the Dutch disease in short- to medium-term (Usui, 1997; Ross, 1999; Wiebelt et al., 2011). This form of support measures allows these sectors to maintain their competitiveness in domestic and international markets despite appreciation in real exchange rate. However, as previously stated, WTO accession would obligate Azerbaijan to reduce its subsidies to the agriculture sector. Clearly, such a movement in agricultural policy regime might render negative effects of Dutch disease even more acute in the agricultural sector.

3.6 Concluding remarks

The principal aim of this chapter was to present theoretical and empirical evidence of how the policy reforms that would likely come along with Azerbaijan's accession to the WTO might affect the nation's economic performance and social environment. Although there are strong theoretical and empirical indications that liberalizing trade barriers enhances economic growth and improves social welfare, there is no consensus regarding the impact of trade liberalization on poverty. Further on, theoretical and empirical evidence suggests that lowering agricultural subsidies will hit agriculture sector severely and also increase the poverty incidence.

The economy of Azerbaijan is contracted Dutch disease and liberalization in trade barriers might minimize the negative effects of Dutch disease, thereby helping traditional agricultural and manufacturing sectors to attain their competitiveness.

Although theoretical and empirical evidence reviewed in this chapter offers valuable insights into the likely effects of reforms in tariff and agriculture policy regimes, in order to make high-quality predictions and plausible conclusions, the effects of policy changes need to be examined within a comprehensive analytical framework grounded in economic theory and reliable data.

4 THE CGE MICRO-SIMULATION MODEL

The principal aim of this chapter is to provide information on the CGE micro-simulation model that is set up specifically to quantitatively investigate the economic and social consequences of policy reforms that will accompany Azerbaijan's expected WTO accession.

Toward that end, we initiate a brief discussion on the importance of a CGE approach in addressing the research objectives of the current study, review the most relevant literature on the application of this approach, and then continue with the development of a multi-sectoral static CGE model for the Azerbaijani economy while underlying its structure, describing the behavioral functions chosen for the model, and outlining the employed assumptions. In the sequel, we provide brief information on a micro-simulation modeling framework and then continue with discussion of the main features of a developed multi-household micro-simulation model with endogenous poverty line as a complement of the CGE model. Further on, we also review the most relevant literature on the application of the CGE-linked micro-simulation approach. The chapter ends with the description of adopted linking mode between two stand-alone models (CGE and micro-simulation) as well as chosen methods for accounting the welfare and poverty impacts.

4.1 Computable General Equilibrium approach

The existing economic literature suggests that the *ex-ante* evaluation of policy proposals in general can rely either on partial or general equilibrium approaches (Gilbert and Wahl, 2002; Karami et al., 2012; Sajadifar, 2012). A partial equilibrium technique focuses on the equilibrium in one part of the economy (e.g., in a particular industry or market) while assuming that the impacts of the policy changes on other subsections of the economy are either nonexistent (*ceteris paribus* assumption) or small enough to be ignored in the analysis. Therefore, this class of models is appropriate when the policy changes to be investigated are anticipated to have an effect on a specific part of the economy or when the underlying research interest lies on a particular part of the economy. Although in terms of time and data requirements, using the partial equilibrium approach is relatively simple for assessing the likely effects of policy changes, this approach might not lead to accurate results due to ignoring economy-wide feedback effects (Adelman and Robinson, 1986; Babiker et al., 2004; McGregor et al., 2010). In contrast, the general equilibrium approach is better equipped to

capture the economy-wide feedback effects of any policy reforms because it is able to incorporate a complex set of interactions among production sectors, markets, and institutions. Given that the specific interest of the current study is to evaluate economy-wide effects of policies, it becomes essential to employ a general equilibrium approach. Furthermore, this approach is appropriate to complement the preceding chapter's theoretical discussion, which postulates that the expected policy changes from Azerbaijan's WTO accession will more than likely have effects on more than the subsection of the economy in which the policy reforms are being applied.

Computable or applied general equilibrium models translate the concept of general equilibrium into a realistic representation of specific economies. More precisely, the CGE is a numerical model that stems from Walrasian general equilibrium theory. The model takes cross-sectional data from a single base period, applies exogenous shocks (e.g., changes in policy, technologies, or other external factors) to this underlying data, and then monitors the adjustment in the endogenous variables. The modern paradigm of CGE modeling began with Johansen (1960), who developed a model incorporating 20 cost-minimizing production sectors and one utility-maximizing consumer to identify sources of economic growth in Norway. Johansen's model was linear and easily solved by elementary methods in linear algebra. Later on, drawing on the mathematics of existence theorem, Scarf (1967) developed an algorithm that made it feasible to compute the equilibrium of the competitive economies in a more complex, nonlinear setting. In turn, this allowed the modeller to escape from the narrow confines of linear equations (Piermartini and Teh, 2005).[24] Such development led to wide use of policy-oriented applied general equilibrium models in the subsequent years, including trade and agriculture policy-related reforms.[25]

Among the most recent and most relevant studies, Jensen et al. (2004) applied a static CGE model in the case of the Russian economy, where they attempted to investigate the consequences of Russian WTO accession on its economy. Among other changes in Russian economic policy environment, the authors argued that WTO membership would lead to liberalizations in import tariffs. They estimated that the welfare gains to the economy would be 1.3 percent of consumption (or 0.6 percent of GDP) following the reductions in currently applied tariff rates. Furthermore, Jensen and colleagues also found that the sectors such as

[24] For a comprehensive review of general equilibrium theory and its development path, refer to Shoven and Whalley (1992) and Cardenete et al. (2012).

[25] For an extensive review of CGE studies applied to diverse issues, see Dixon and Jorgenson (2012).

ferrous and non-ferrous metals and chemicals are likely experience the most remarkable expansion in production, whereas machinery and equipment, food and light industry, and construction materials are likely experience the most notable decline in production. In a closely related study, Pavel and Tochitskaya (2004) estimated the economy-wide impacts of WTO accession for another former Soviet Union member, the Belarusian economy. The policy changes that the country would undertake as a result of expected WTO membership would include liberalization of tariffs and domestic tax reforms. Their estimation results indicate that following the liberalization in tariffs, consumer welfare in the country would rise by about 0.4 percent and that GDP would also rise by about 0.3 percent. According to industry-specific results, it appears that timber, pulp and paper, and light industries would experience the largest decline in output, whereas metallurgy and machine-building sectors would experience the largest increase in output after the expected WTO membership. Movchan (2007) has also used the CGE model to estimate the potential economic outcome of WTO accession for another candidate state, Ukraine. The policy changes the country will face as a consequence of accession are likely to be the liberalization in tariffs, among other policy changes. According to the study's estimates, the membership will be beneficial for the country as a whole, bringing an additional 0.8 percent growth in real GDP and 1.1 percent increase in overall welfare. As for sectoral level effects, the modeling exercise shows that metal and chemical production sectors will benefit the most, as will industries supplying inputs for these sectors. At the same time, significant contraction is found to occur in the food processing and automotive industries. Lastly, again using the general equilibrium approach, Doanh and Heo (2009) investigated the impact of Vietnam's WTO commitments in reducing tariff rates on the nation's economy. They estimated that the country's GDP from the reduction in tariffs would increase as high as 0.35 percent. Furthermore, the authors also found that the country would likely experience a positive welfare gain from the reduction in tariffs by 0.45 percent. The impact of tariff reforms on sectoral level production shows that the ceramic, machinery, and equipment sectors are likely to be the largest expanding sectors in the economy. On the contrary, the mining industry, paddy, and forestry sectors are likely to be the largest contracting sectors as a result of the reforms.

Besides trade-related issues, reforms in agricultural policies are also the focus of many CGE studies. Gelan and Schwarz (2006) evaluated the impacts of decoupling single-farm payments on agriculture and non-agriculture sectors in Scotland while employing the CGE model. Their estimation results show that the Scottish agriculture sector would encounter a substantial

decline in output by more than 14.5 percent following the decoupling single farm payments. However, non-agriculture sectors would be marginally (but positively) affected in terms of output changes (0.23 percent). In another study, de Miguel and Manresa (2008) analyzed the importance of agriculture subsidies for the Extremadura state economy (Spain) while relying also on the CGE modeling framework. For this purpose, the authors simulated the removal of production-related agriculture subsidies and determined the outcome of this scenario. In general terms, they concluded that removal of the subsidies without modifying any other compensating transfers to agriculture producers would cause a reduction in activity level in agriculture sector by more than 3.5 percent. The sectors that are strongly linked to agriculture would also experience a relatively remarkable contraction in their production level (e.g., in food processing sectors with a 4.4 percent decline in output). Further on, elimination of subsidies would cause a welfare loss for consumers ranging between 0.1 to 9.3 percent, depending on consumers' characteristics. A similar study conducted by Kristkova and Habrychova (2011) examined the likely consequences of complete removal of direct payments in the agriculture sector on the economy of the Czech Republic. According to their estimation results, such a movement in agriculture policy would have the most severe effect to the agriculture sector, decreasing its value-added by around 10 percent, suggesting that direct payments play an important role in agricultural development in the Czech Republic. They also found that removal of subsidies would cause a slight decline of around 0.11 percent in domestic gross output and around 0.1 percent in GDP.

Despite the fact that CGE models have been widely applied in *ex-ante* evaluation of policies, to the best of our knowledge, there is no CGE model developed and used in the case of the Azerbaijani economy. Therefore, the CGE model that is developed for Azerbaijan in this chapter can be considered the first country-specific application.

4.1.1 The CGE model for the Azerbaijani economy

The CGE model for Azerbaijan developed in this chapter—named as AzCGE model—follows closely the neoclassical-structural modeling tradition presented in Dervis et al. (1982). The behavior of each agent represented in the model is directed by means of conventional microeconomic theory, i.e., agents in the model optimize their supply and demand decisions either by minimizing their costs (equivalently maximizing their profit) or by maximizing their utility. Further on, it is assumed that production in all sectors takes place under constant return to scale technology and producers operate in a perfectly competitive

environment. This entails that the marginal revenue of producers is equal to marginal cost of their output. In accordance with other CGE models, the AzCGE model also depicts the real side of the economy and assumes money neutrality. In other words, the model does not explicitly capture the role of monetary supply and demand as well as any financial movements in the economy. In its current version, the AzCGE model is static in a sense that no inter-temporal decision making is involved in the model. Therefore, the AzCGE model evaluates the likely effects of policies from the short- to medium-term perspective while leaving out the long-term (dynamic) effects.

The following notational conventions are used for the model elements. The lowercase Greek letters determine parameters, which are exogenous to the model, while lower and uppercase Latin letters determine variables, which are assigned to be either exogenous or endogenous to the model (throughout the following subsections, we will discuss which variable is defined as exogenous/endogenous). Moreover, the indices presented as lower case subscript i and j refer to production sectors or activities, subscript d refers to trading partners, subscript h refers to households, and subscript f refers to labor categories. Because the model assumes that each producer produces a single homogenous commodity, the subscript i also refers to commodities.

4.1.1.1 Production environment and technology

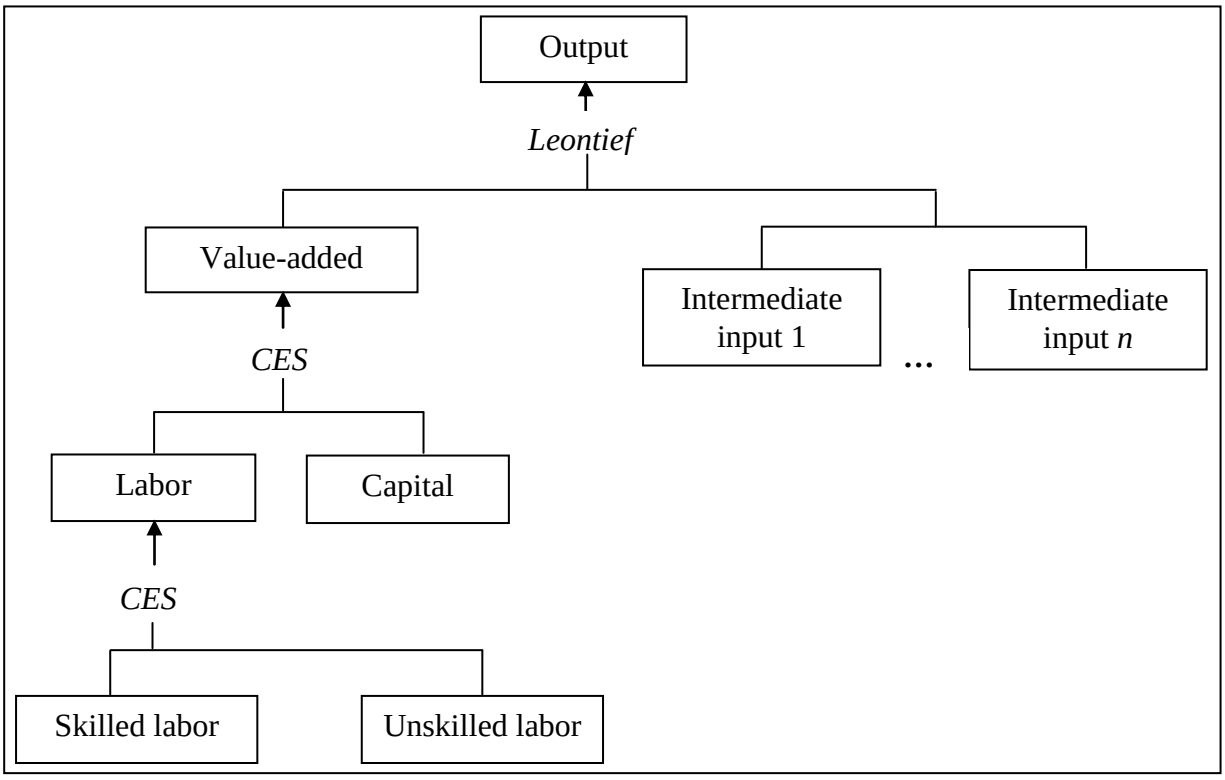
The production process in the model is determined through a multi-level nested structure, where the producers combine intermediate inputs and primarily factors to produce a final output. Notice that in line with other general equilibrium models, the AzCGE model does not consider individual producer but rather group of similar producers aggregated into sectors (economic activities). The schematic representation of nested production structure is illustrated in Figure 4.1.

At the upper level of the nest, gross output, XD_i, is a Leontief aggregator of value-added (VA_i) and intermediate inputs $(DI_{i,j})$. The Leontief technology implies that intermediate input bundles and primary factor bundles (or value-added) are combined in fixed proportions to the level of final output. The mathematical description of producer's behavior therefore is:

$$XD_i = \min\left\{\frac{DI_{1,j}}{aij_{1,j}},...,\frac{DI_{n,j}}{aij_{n,j}},\frac{VA_i}{v_i}\right\}, \quad i,j \in \{1,...n\} \qquad (4.1)$$

where v_i denotes the share coefficient of value-added in production of good i, $aij_{i,j}$ is the input-output coefficients which determines the sector j's output that is used for production of good i.

FIGURE 4.1: The nested structure of production



Source: Author's representation

At the second level of the nest, to obtain a value-added, VA_i, producer i chooses an optimal level of composite labor (L_i) and capital (K_i) demand while minimizing the total cost on added value subject to a Constant Elasticity of Substitution (CES) production function. The mathematical description of optimization problem takes the following form:

$$\min_{\{K_i, L_i\}} \quad pva_i \cdot VA_i = r_i \cdot K_i + w \cdot L_i, \quad i \in \{1, ...n\} \qquad (4.2)$$

$$\textit{subject to} \quad VA_i = \varphi_i^F \cdot \left[\gamma_i^F \cdot K_i^{\frac{\sigma_i^F - 1}{\sigma_i^F}} + (1 - \gamma_i^F) \cdot L_i^{\frac{\sigma_i^F - 1}{\sigma_i^F}} \right]^{\frac{\sigma_i^F}{\sigma_i^F - 1}} \qquad (4.3)$$

where γ_i^F is the share parameter of capital in production of good i, with $0 < \gamma_i^F < 1$ (accordingly $1 - \gamma_i^F$ is the share parameter of labor in production of good i), σ_i^F is the elasticity of substitution between labor and capital for production of good i, with

$0 < \sigma_i^F < \infty$, r_i is the return to capital in sector i, w is the wage rate of composite labor (economy-wide return to labor), pva_i is the price of value-added, and φ_i^F is the efficiency parameter (with $\varphi_i^F > 0$) that determines how efficient is sector i in using primary factors of production.

Solving the above stated optimization problem yields the following demand functions for labor (4.4) and capital (4.5):

$$L_i = \left(\frac{XD_i}{\varphi_i^F}\right) \cdot \left(\frac{1-\gamma_i^F}{w}\right) \cdot \left((\gamma_i^F)^{\sigma_i^F} \cdot r_i^{1-\sigma_i^F} + (1-\gamma_i^F)^{\sigma_i^F} \cdot w^{1-\sigma_i^F}\right)^{\frac{\sigma_i^F}{1-\sigma_i^F}} \qquad (4.4)$$

$$K_i = \left(\frac{XD_i}{\varphi_i^F}\right) \cdot \left(\frac{\gamma_i^F}{r_i}\right) \cdot \left((\gamma_i^F)^{\sigma_i^F} \cdot r_i^{1-\sigma_i^F} + (1-\gamma_i^F)^{\sigma_i^F} \cdot w^{1-\sigma_i^F}\right)^{\frac{\sigma_i^F}{1-\sigma_i^F}} \qquad (4.5)$$

The CES technology allows the factors of production to be smoothly substitutable in the production process. Thus, the equations (4.4) and (4.5) imply that the producers can vary their input ratio between composite labor and capital in response to changes in their corresponding price ratios (w and r_i).

Finally, at the bottom level of the nest, to obtain a composite labor, L_i, producer i chooses an optimal level of skilled and unskilled labor demand ($LD_{i,f}$) while minimizing total labor costs.[26] The CES technology is used to model this optimization problem and this can be set up as:

$$\min_{\{LD_{i,f}\}} \quad w \cdot L_i = \sum_f w_f^{LD} \cdot LD_{i,f}, \; i \in \{1,...n\} \text{ and } f \in \{sl, ul\} \qquad (4.6)$$

$$\textit{subject to} \quad L_i = \varphi_i^{FD} \cdot \left[\sum_f \gamma_{i,f}^{FD} \cdot LD_{i,f}^{\frac{\sigma_i^{FD}-1}{\sigma_i^{FD}}}\right]^{\frac{\sigma_i^{FD}}{\sigma_i^{FD}-1}} \qquad (4.7)$$

[26] In general, depending on availability of the data and the purpose of the research, CGE models can be segmented by different labor types on the basis of skill level. In turn, this may improve the accuracy of model's estimates. For instance, it is well-known that the dominant endowment of the poor people is unskilled labor and estimation of changes in wage rate for unskilled labor rather than wage rate for composite labor (skilled and unskilled) would certainly improve accuracy of the welfare impact of policies on poor. Given that we are also interested in analyzing the welfare impact of the policies on the well-being of the poor people, it is reasonable to split labor further into different skill types.

where w_f^{LD} is the wage rate for labor type f (regardless of the sector), $\gamma_{i,f}^{FD}$ is the share parameter of labor type f for production of good i, with $0<\gamma_{i,f}^{FD}<1$, σ_i^{FD} is the elasticity of substitution between labor categories, with $0<\sigma_i^{FD}<\infty$, and φ_i^{FD} is the efficiency parameter (with $\varphi_i^{FD}>0$), which indicates how efficient is production sector *i* in using different types of labor.

The demand function for each category of labor resulting from above defined optimization problem gets the following form:

$$LD_{i.f} = \left(\frac{L_i}{\varphi_i^{FD}}\right)\cdot\left(\frac{\gamma_{i,f}^{FD}}{w_f^{LD}}\right)\cdot\left[\sum_f (\gamma_{i,f}^{FD})^{\sigma_i^{FD}}\cdot(w_f^{LD})^{\frac{\sigma_i^{FD}-1}{\sigma_i^{FD}}}\right]^{\frac{\sigma_i^{FD}}{\sigma_i^{FD}-1}} \qquad (4.8)$$

where the relative wage rates (w_f^{LD}) determine the optimal demand for each labor type.

4.1.1.2 Foreign sector

In the AzCGE model, simultaneous exports and imports at the sectoral level is allowed (two-way trade), in order to incorporate the country's foreign trade pattern. As mentioned in Chapter 2, Azerbaijan does not impose any tariffs for the imports originating from the CIS countries. Therefore, we distinguish two groups of trade partners in the model: CIS and non-CIS or rest of the world (ROW). Likewise, this will allow us to incorporate different trade regimes in the model and perform trade liberalization analysis more accurately.

To account a foreign trade, the AzCGE model adopts double-nested CES and Constant Elasticity of Transformation (CET) specifications, which is going to be discussed in detail below. Figure 4.2 provides an illustrative representation of the structure of foreign trade.

Exports and domestic supply

In the preceding subsection, we discussed how representative producers in the model use inputs in the most cost efficient way to produce an output, XD_i. In this subsection, however, we will discuss how much of optimal level of output each producer should allocate across markets in order to maximize its overall profit.

At the first level of the output allocation nest, producer *i* allocates its total output, XD_i,

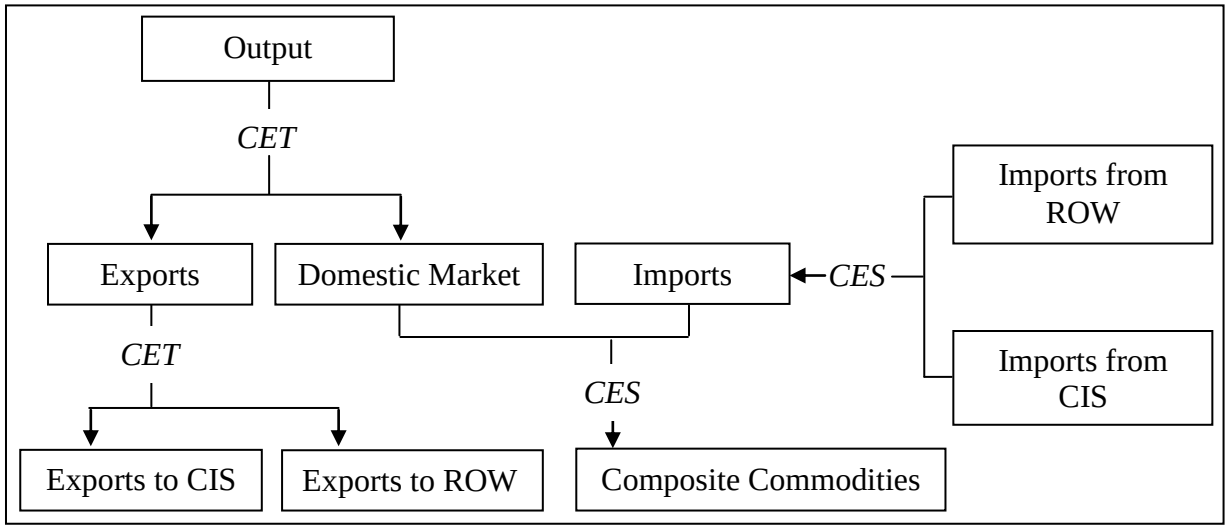
between domestic (XDD_i) and foreign markets (E_i) while maximizing its overall profit. This is modeled according to the CET aggregator function. Employing the CET aggregator reveals that exported and domestically supplied goods are imperfectly substitutable. Producer's optimization problem can be presented as follows:

$$\max_{\{E_i, XDD_i\}} \quad pt_i \cdot XD_i = pe_i \cdot E_i + pdd_i \cdot XDD_i \quad i \in \{1,...n\} \qquad (4.9)$$

$$\textit{subject to} \quad XD_i = \varphi_i^T \left[\gamma_i^T \cdot E_i^{\frac{1+\sigma_i^T}{\sigma_i^T}} + (1-\gamma_i^T) \cdot XDD_i^{\frac{1+\sigma_i^T}{\sigma_i^T}} \right]^{\frac{\sigma_i^T}{1+\sigma_i^T}} \qquad (4.10)$$

where pt_i is the output price of good i (including taxes), pe_i is the (composite) export price of good i (in domestic currency), pdd_i is the price of local good i sold on the domestic market, γ_i^T is the export share parameter for good i, with $0 < \gamma_i^T < 1$ (accordingly, $1-\gamma_i^T$ is the share parameter of local good i sold on the domestic market), σ_i^T is the elasticity of transformation between exports and domestic sales for good i, with $-\infty < \sigma_i^T < 0$, and φ_i^T is the scale parameter of output transformation for good i, with $\varphi_i^T > 0$.

FIGURE 4.2: The structure of foreign trade



Source: Author's representation

The supply functions of exported (4.11) and domestically-sold goods (4.12) defined by solving the above stated optimization problem are: [27]

[27] Total output is passed directly to domestic market, if the commodity is not exported.

$$E_i = \left(\frac{XD_i}{\varphi_i^T}\right)\cdot\left(\frac{\gamma_i^T}{pe_i}\right)^{\sigma_i^T}\cdot\left((\gamma_i^T)^{\sigma_i^T}\cdot pe_i^{1+\sigma_i^T}+(1-\gamma_i^T)^{\sigma_i^T}\cdot pdd_i^{1+\sigma_i^T}\right)^{\frac{\sigma_i^T}{1+\sigma_i^T}} \qquad (4.11)$$

$$XDD_i = \left(\frac{XD_i}{\varphi_i^T}\right)\cdot\left(\frac{1-\gamma_i^T}{pdd_i}\right)^{\sigma_i^T}\cdot\left((\gamma_i^T)^{\sigma_i^T}\cdot pe_i^{1+\sigma_i^T}+(1-\gamma_i^T)^{\sigma_i^T}\cdot pdd_i^{1+\sigma_i^T}\right)^{\frac{\sigma_i^T}{1+\sigma_i^T}} \qquad (4.12)$$

These supply functions indicate that the realization of sector i's output between domestic and export markets depend on the relative prices in these markets (pe_i and pdd_i).

In the next level of the output allocation nest, producer i allocates its total export supply, E_i, between export destinations CIS and ROW $(ET_{i,d})$ while attaining the similar optimization problem as above (utilizing the CET aggregator function), which is given as:

$$\max_{\{ET_{i,d}\}} \quad pe_i\cdot E_i = \sum_d pet_{i,d}\cdot ET_{i,d}, \quad i\in\{1,...n\} \text{ and } d\in\{row,cis\} \qquad (4.13)$$

$$\textit{subject to} \quad E_i = \varphi_i^{TR}\left[\sum_d \gamma_{i,d}^{TR}\cdot\left(ET_{i,d}\right)^{\frac{1+\sigma_i^{TR}}{\sigma_i^{TR}}}\right]^{\frac{\sigma_i^{TR}}{1+\sigma_i^{TR}}} \qquad (4.14)$$

where $pet_{i,d}$ is the export price of good i in destination d (in domestic currency), $\gamma_{i,d}^{TR}$ is the export share parameter of good i for destination d, with $0<\gamma_{i,d}^{TR}<1$, σ_i^{TR} is the elasticity of transformation between export destinations for good i, with $-\infty<\sigma_i^{TR}<0$, and φ_i^{TR} is the scale parameter of export transformation for good i, with $\varphi_i^{TR}>0$.

The solution to the above stated maximization problem yields the supply function for exports disaggregated across trading regions:

$$ET_{i,d} = \left(\frac{E_i}{\varphi_i^{TR}}\right)\cdot\left(\frac{\gamma_{i,d}^{TR}}{pet_{i,d}}\right)^{\sigma_i^{TR}}\cdot\left(\sum_d\left(\gamma_{i,d}^{TR}\right)^{\sigma_i^{TR}}\cdot pet_{i,d}^{1+\sigma_i^{TR}}\right)^{\frac{\sigma_i^{TR}}{1+\sigma_i^{TR}}} \qquad (4.15)$$

The equation (4.15) indicates that the relative prices in the export markets $(pet_{i,d})$ determine the optimal allocation of exports across trading destinations.

Imports and domestic demand

The commodities that are consumed domestically, X_i, are composite of locally produced

commodities (XDD_i) and imported commodities (M_i). At the uppermost level of the nest, domestic consumers minimize their costs choosing between locally produced and imported goods. This is modeled according to the CES type of aggregator function. Employing the CES function implies that domestically produced goods are imperfect substitutes for imported goods. In other words, it is assumed that the goods are differentiated across regions of their origin (well known Armington (1969) assumption). The mathematical expression of the optimization problem takes the following form:

$$\min_{\{M_i, XDD_i\}} \quad p_i \cdot X_i = pm_i \cdot M_i + pdd_i \cdot XDD_i \quad i \in \{1,...n\} \qquad (4.16)$$

$$\textit{subject to} \quad X_i = \varphi_i^A \cdot \left[\gamma_i^A \cdot M_i^{\frac{\sigma_i^A - 1}{\sigma_i^A}} + (1-\gamma_i^A) \cdot XDD_i^{\frac{\sigma_i^A - 1}{\sigma_i^A}} \right]^{\frac{\sigma_i^A}{\sigma_i^A - 1}} \qquad (4.17)$$

where p_i is the price of composite good i (or price of good i faced by domestic consumers), pm_i is the (composite) import price of good i (in domestic currency), σ_i^A is the elasticity of substitution between domestic and imported good i, with $0 < \sigma_i^A < \infty$, γ_i^A is the import share parameter for good i, with $0 < \gamma_i^A < 1$ (accordingly, $1-\gamma_i^A$ is the share parameter for domestically produced good i that is sold in local market), and φ_i^A is the scale parameter of substitution between domestic and imported good i, with $\varphi_i^A > 0$.

The solution to the above minimization problem yields the optimal demand functions for imported (4.18) and domestically produced goods (4.19), which are defined as:

$$M_i = \left(\frac{X_i}{\varphi_i^A} \right) \cdot \left(\frac{\gamma_i^A}{pm_i} \right)^{\sigma_i^A} \cdot \left(\left(\gamma_i^A\right)^{\sigma_i^A} \cdot pm_i^{1-\sigma_i^A} + (1-\gamma_i^A)^{\sigma_i^A} \cdot pdd_i^{1-\sigma_i^A} \right)^{\frac{\sigma_i^A}{1-\sigma_i^A}} \qquad (4.18)$$

$$XDD_i = \left(\frac{X_i}{\varphi_i^A} \right) \cdot \left(\frac{1-\gamma_i^A}{pdd_i} \right)^{\sigma_i^A} \cdot \left(\left(\gamma_i^A\right)^{\sigma_i^A} \cdot pm_i^{1-\sigma_i^A} + (1-\gamma_i^A)^{\sigma_i^A} \cdot pdd_i^{1-\sigma_i^A} \right)^{\frac{\sigma_i^A}{1-\sigma_i^A}} \qquad (4.19)$$

The optimal demand depends on the relative prices between domestic (pdd_i) and imported goods (pm_i).

At the second level of the nest, domestic consumers choose their optimal level of import

demand on good *i* between import origins ROW and CIS $(MT_{i,d})$. The similar modeling technique as in the first level of the nest is used to model this optimization problem; i.e., minimizing the costs subject to the CES function:

$$\min_{\{MT_{i,d}\}} \quad pm_i \cdot M_i = \sum_d pmt_{i,d} \cdot MT_{i,d} \quad i \in \{1,...n\} \text{ and } d \in \{row, cis\} \qquad (4.20)$$

$$\textit{subject to} \quad M_i = \varphi_i^{AR} \cdot \left[\sum_d \gamma_{i,d}^{AR} \cdot \left(MT_{i,d}\right)^{\frac{\sigma_i^{AR}-1}{\sigma_i^{AR}}} \right]^{\frac{\sigma_i^{AR}}{\sigma_i^{AR}-1}} \qquad (4.21)$$

where $pmt_{i,d}$ is the import price of good *i* from import origin *d*, inclusive import tariffs (in domestic currency), σ_i^{AR} is the elasticity of substitution between import origins for good *i*, with $0 < \sigma_i^{AR} < \infty$, $\gamma_{i,d}^{AR}$ is the share parameter for good *i* between import origins, with $0 < \gamma_i^{AR} < 1$, and φ_i^{AR} is the scale parameter for good *i* between import origins, with $\varphi_i^{AR} > 0$.

The demand function for imports disaggregated across trading regions resulting from the above stated minimization problem are given by:

$$MT_{i,d} = \left(\frac{M_i}{\varphi_i^{AR}}\right) \cdot \left(\frac{\gamma_{i,d}^{AR}}{pmt_{i,d}}\right)^{\sigma_i^{AR}} \cdot \left(\sum_d \left(\gamma_{i,d}^{AR}\right)^{\sigma_i^{AR}} \cdot pmt_{i,d}^{1-\sigma_i^{AR}}\right)^{\frac{\sigma_i^{AR}}{1-\sigma_i^{AR}}} \qquad (4.22)$$

where the import demand choice between trading regions depends on relative import prices of goods in each region $(pmt_{i,d})$.

4.1.1.3 Institutions

The AzCGE model includes four types of institutions: households, government, saving-investment (financial agent), and corporate enterprises. The behaviors of each institution are extensively discussed below.

Households' behavior

The households own primary factors of production, such as capital and labor (including skilled and unskilled labor) and supply them to production sectors. In return, they receive income in the form of wages and capital rents. In addition, households receive net transfer incomes (non-factor incomes) from the government, from other households (inter-household

transfers), and from abroad (remittances). Hence, total income of household h can be expressed as:

$$Y_h = \lambda_h^H \cdot \sum_i (r_i \cdot KT_i) + \sum_f (w_f^{LD} \cdot LS_{h,f}) + TRF_h + HHTR_h + \sum_d TRH_{h,d} \qquad (4.23)$$

where λ_h^H is the fraction of capital endowed by household h,[28] KT_i is the total capital supply of the economy to sector i, $LS_{h,f}$ is the household h's total supply of labor type f, TRF_h is the household h's transfer incomes received from the government, $HHTR_h$ is the household h's transfer incomes received from other households, and $TRH_{h,d}$ is the remittances received by household h from foreign country group d.

Likewise, households use their total income to pay direct taxes, make transfers to other households, save for future consumption, and consume various goods and services. The household h pays income taxes to the government (TRY_h) with an effective rate of its total income (τ_h^Y):

$$TRY_h = \tau_h^Y \cdot Y_h \qquad (4.24)$$

In the AzCGE mode, household h saves a fixed fraction of its disposable income (total income adjusted by taxes):

$$SH_h = mps_h \cdot (1 - \tau_h^Y) \cdot Y_h \qquad (4.25)$$

where SH_h is the total savings of household h and mps_h is the household h's marginal propensity to save.

Following Loefgren et al. (2002), transfer expenditures to other households are modeled as a fixed fraction of total income of household h, net of taxes and savings. This can be formulated as:

$$HHTR_h = ihtr_h \cdot (1 - \tau_h^Y) \cdot (1 - mps_h) \cdot Y_h \qquad (4.26)$$

where $ihtr_h$ stands for inter-household transfer shares.

[28] Notice that labor in the model is endowed only by households, whereas capital is endowed by households and by corporate enterprises.

The income of household h that remains after taxes, savings, and transfers to other households, $CBUD_h$, is allotted for consumption purposes:

$$CBUD_h = Y_h - TRY_h - SH_h - HHTR_h \quad (4.27)$$

It is assumed that each household h maximizes its utility, U_h^H, by choosing the goods and services to be consumed under its consumption budget constraint. Like the most other general equilibrium models, in the AzCGE model, the preferences of households are represented by a standard Cobb-Douglas function. The optimization problem of households is then mathematically expressed as:

$$\max_{\{C_{i,h}\}} \quad U_h^H = \prod_i C_{i,h}^{\alpha_{i,h}^H}, \quad i \in \{1,...n\} \quad (4.28)$$

$$\textit{subject to} \quad \sum_i p_i \cdot C_{i,h} = CBUD_h \quad (4.29)$$

where $C_{i,h}$ represents household h's demand for commodity i and $\alpha_{i,h}^H$ is the preference parameter for household h's consumption for commodity i, with $\sum_i \alpha_{i,h}^H = 1$.

The demand function for household h resulting from the above defined optimization problem takes the following form:

$$C_{i,h} = \frac{\alpha_{i,h}^H \cdot CBUD_h}{p_i} \quad (4.30)$$

The equation (4.30) states that the household h's consumption of certain commodity i is a fixed proportion of its total consumption budget.

All transfer incomes of households (government transfers, inter-household transfers, and remittances) are assumed to be exogenous to the model in nominal terms and therefore remain fixed (transfers in real terms, however, can vary with variations in (consumption) prices). Given that the largest fraction of government's social assistance programs are financed indirectly via State Oil Found of Azerbaijan[29] (Ciarreta and Nasibov, 2012), exogenously

[29] The Oil Fund of Azerbaijan is a special purpose state organization with independent structure. The primary goal of the Fund is to ensure collection and proper management of revenue flows from country's oil and gas resources.

fixed government transfers in the model seems to be a plausible assumption.[30] More explicitly, we assume that contraction in financial funds available for various social assistance programs—e.g., due to revenue losses from lowering tariffs—will be compensated by an equivalent increase in transfers to government budget from the State Oil Found. The assumption of exogenously fixed inter-household transfers and foreign remittances stems from the data constraint. As we will see in the following chapter, our database does not allow us to distinguish which household makes/receives a transfer to/from which household. Also, it is impossible to distinguish received remittances from CIS and non-CIS countries (ROW) for each individual household. In addition, assuming exogenously fixed remittances allows us to control any welfare implications from abroad.

Government behavior

Government in the model represents central and regional public institutions, and draws its revenues from indirect taxes on production ($TIP = \sum_i \tau_i^p \cdot pd_i \cdot XD_i$, where τ_i^p is the tax rate for sector i's output), import duties on imported goods ($TRMT = er \cdot \sum_i \sum_d \left(\tau_{i,d}^m \cdot pwm_{i,d} \cdot MT_{i,d} \right)$, where $\tau_{i,d}^m$ is the tariff rate for imported good i from destination d), and direct taxes on households income (see equation (4.24)) and enterprises profit ($TDF = \tau^f \cdot YF$, where τ^f is the tax rate for corporate enterprises). The total government budget (TG) is therefore given by:

$$TG = \sum_h TRY_h + TDF + TIP + TRMT \qquad (4.31)$$

where TDF is the collected corporate (enterprises) taxes, TIP is the collected indirect (production) taxes, and $TRMT$ is the collected import tariffs. The model postulates assumption that all taxes and tariffs are at fixed *ad valorem* rates.

As for expenditures, government uses its total income to make transfer payments to households in the form of social security and other welfare payments, consume an exogenous amount of goods and services, and save. It is assumed that government demand is a Cobb-

[30] For instance, according to the official statistics in 2013, State Oil Found transferred by around AZN 10 bln to government budget aiming to finance various social programs and infrastructural projects, which made up more than the half of the entire government budget.

Douglass composite of different goods and services and this can be expressed as:[31]

$$G_i = \frac{\alpha_i^G \cdot GBUD}{p_i} \quad (4.32)$$

where G_i is the consumption demand of government for commodity i and α_i^G is the preference parameter of government consumption for commodity i, with $\sum_i \alpha_i^G = 1$. The consumption budget of government, $GBUD$, is obtained by subtracting transfer payments to households (TRF) from the total government revenue ($GBUD = TG - TRF$). Finally, the savings of government is defined as a residual between total government income and spending.

Saving-investment behavior

In the model, saving-investment appears as a representative financial agent, who maximizes its utility, U^I, by means of the Cobb-Douglas function while constrained by total savings (hence total investments) of the economy (S)—which made up of households savings (SH_h), foreign savings in domestic currency $(SF_d \cdot er)$, government savings (SG), and corporate enterprises savings (SFT),. The optimization problem of saving-investment can be expressed as:

$$\max_{\{IN_i\}} \quad U^I = \prod_i IN_i^{\alpha_i^I}, \quad i \in \{1,...n\} \quad (4.33)$$

$$\textit{subject to} \quad \sum_i p_i \cdot IN_i = S \quad (4.34)$$

where

$$S = \sum_h SH_h + er \cdot \sum_d SF_d + SFT + SG \quad (4.35)$$

In the utility function, IN_i is the demand of commodity i for investment purposes and α_i^I is

[31] Within the economy it is hard to consider government as being a utility maximizing actor and a common practice in many CGE studies is to fix government consumption at benchmark levels (e.g., see Loefgren et al. (2002) and Akkemik and Oğuz (2011), among others). Accordingly, we have also fixed (exogenized) government consumption in the AzCGE model. At the same time, this will allow us to account a pure impact of the policy shocks on welfare level of consumers.

the share of commodity i in total investment expenditure, with $\sum_i \alpha_i^I = 1$.

Following the maximization problem stated above the optimal demand function for investment is obtained as:

$$IN_i = \frac{\alpha_i^I \cdot S}{p_i} \qquad (4.36)$$

Owing the nature of the static model, investment demand decisions in the AzCGE model do not have any impact on overall capital stock formation in the economy.

Corporate enterprises

The behavior of corporate enterprises—as an intermediate agent in the model—is relatively simple. In contrast to above discussed institutions, the corporate enterprises do not consume any goods and services, but accumulate income from corporate capital supply, pay corporate taxes, and save for investment purposes. Total income of enterprises, YF , is defined as:

$$YF = \lambda^F \cdot \sum_i (r_i \cdot KT_i) \qquad (4.37)$$

where λ^F is the fraction of capital endowed by corporate enterprises[32].

The savings of enterprises is defined as a gross income of enterprises net of corporate taxes.

4.1.1.4 Price system

The price system in the AzCGE model is fairly rich, mainly due to the assumed differences among goods and services of different geographical origins and destinations (imports, exports, and domestic output sold domestically), and also due to introduced tax system on production. Most of the price relationships in the AzCGE model have been already defined in preceding subsections. Thus, in this subsection, we will define the remaining price definitions.

The export price of good *i* faced by domestic producers in the foreign market *d* $(pet_{i,d})$ is the exchange rate adjusted world export price of that good in export destination *d* $(pwe_{i,d})$. This can be expressed as follows:

$$pet_{i,d} = er \cdot pwe_{i,d} \qquad (4.38)$$

[32] Note that $\lambda^F + \lambda_h^H = 1$.

The domestic import price of good i from foreign market d ($pmt_{i,d}$) is the tariff and exchange rate adjusted world import price of that good in trading destination d ($pwm_{i,d}$), which is expressed as:

$$pmt_{i,d} = (1 + tm_{i,d}) \cdot er \cdot pwm_{i,d} \qquad (4.39)$$

The AzCGE model retains a small country assumption of classical trade theory, which implies that Azerbaijan's imports have perfectly elastic world supply and also its exports face a perfectly elastic world demand. To ensure this assumption, world import and export prices ($pwm_{i,d}$ and $pwe_{i,d}$) are exogenously fixed in our model. Because Azerbaijan's trade turnover in overall world trade is very negligible (e.g., according to the WTO and the AzSTAT statistics it accounted less than 0.2 percent in 2013), adopting the small country assumption is reasonably plausible.

The government applies indirect taxes on production, which in turn increases the unit price of good i. This is expressed in the following equation:

$$pt_i = (1 + tp_i) \cdot pd_i \qquad (4.40)$$

Further on, in order to detect overall movement in consumption prices of goods and services as a result of external shocks to the model, following Vaz (2012) we also use a Laspeyres price index. In mathematical term Laspeyres price index ($pixcon$) can be defined by the following formulation:

$$pixcon = \frac{\sum_i p_i \cdot \sum_h C_{i,h}^0}{\sum_i p_i^0 \cdot \sum_h C_{i,h}^0} \qquad (4.41)$$

where p_i^0 is the initial consumption price (before the policy shock) of good i, p_i is the new consumption price (after the policy shock) of good i, and $C_{i,h}^0$ is the initial (before the policy shock) consumption level of household h for good i.

4.1.1.5 Equilibrium conditions

In addition to the behavioral equations specified in preceding subsections, the model's general equilibrium setting creates a necessity to assign a number of various equilibrium conditions. In general, the AzCGE model includes four types of equilibrium conditions (or system

constraints in mathematical terms): equilibrium in the commodity market, equilibrium in the factor market, equilibrium in saving-investment, and equilibrium in the foreign sector (external balance). The equilibrium in the commodity market requires that the total domestic demand for each commodity—composed of household demand, government demand, investment demand, and intermediate demand by production sectors—must equal to its corresponding total supply:

$$X_i = C_i + IN_i + G_i + \sum_j (io_{i,j} \cdot XD_j) \quad (4.42)$$

The equation (4.42) ensures that the commodity market is effectively cleared by adjusting the consumption prices for each commodity (p_i).

The equilibrium in the labor market requires that the economy's total demand on labor type f (across production activities) must equal to the economy's total supply of labor type f:

$$\sum_i LD_{i,f} = \sum_h LS_{h,f} \quad (4.43)$$

The model assumes that the total supply of each labor type f is fixed at the national level $(\sum_h LS_{h,f})$ (i.e., inelastic supply of labor). The model further assumes that each type of labor is fully employed and perfectly mobile across economic activities (consistent with the neoclassical assumption for the labor market), but not countries. Accordingly, the factor market for each type of labor is effectively cleared by adjusting the economy-wide wage rates (w_f^{LD}). The assumption of full employment in the AzCGE model does not necessarily mean that there is zero unemployment in the Azerbaijani economy; rather it means that unemployment is determined as exogenous to the model.[33] Given that the model is static in nature, in contrast to labor, capital stock is assumed to be sector-specific (i.e., immobile between sectors) because it is difficult to convert capital from one production sector to another in the short-term following external policy shocks.[34] Therefore, remuneration rates to capital are defined as being sector-specific (r_i).

[33] According to the official statistics, unemployment rate in Azerbaijan is not very high (e.g., in 2013 unemployment rate accounted less than 5 percent) and due to this fact exogenous unemployment in the model seems to be a persuasive assumption.

[34] In the long-run, however, capital can move between sectors via depreciation (without replacement in one sector and new investment in other sector). Likewise, the assumption of mobile capital across sectors is more plausible in dynamic models.

The equilibrium in external balance requires that the foreign inflow and outflow of financial funds in the economy must be in equilibrium. More rigorously, overall import demand must equal to the overall export supply plus foreign remittances and foreign savings (all in foreign currency). The following equation maps this relationship:

$$\sum_i \sum_d MT_{i,d} \cdot pwm_{i,d} = \sum_i \sum_d ET_{i,d} \cdot pwe_{i,d} + \sum_d SF_d + \sum_h \sum_d TRH_{h,d} \qquad (4.44)$$

Finally, with regard to the equilibrium condition in the saving-investment, total investment is chosen to equal total savings of the economy. This relationship is already defined in the equation (4.35). The adjustment mechanism in equations (4.35) and (4.44) will be discussed in the following subsection.

4.1.1.6 The macroeconomic closure rules and numéraire

As customary in general equilibrium models, we also need to specify a set of macroeconomic closure rules and numéraire. The closure rules provide a mechanism for maintaining macroeconomic balances in order to achieve consistency at the macroeconomic level. As with the other general equilibrium models, the AzCGE model embodies three macroeconomic closure rules: closure rule in external balance, closure rule in government balance, and closure rule in saving-investment balance.[35] Although the choice of closure rules has no influence on benchmark/reference variables, it may have a substantial impact on the outcome variables of the counterfactual policy experiments (Psaltapoulos et al., 2011). Thus, they should be chosen with care in order to reflect the characteristics of the study area economy as precisely as possible.

Regarding the closure rule in external balance, it is assumed that the foreign savings (or current account surplus/deficit) is fixed and exogenous to the model. Accordingly, the country's external balance is maintained by adjusting the flexible exchange rate.[36] This assumption is interpreted to mean that the compensation for any changes in domestic demand following external shocks (e.g., tariff liberalization) will not be financed by changing foreign capital inflow (no "free lunch" effect). The Central Bank of Azerbaijan implemented both floating and fixed (not fixed in the strict sense but rather managed) exchange rate regimes

[35] For an extensive elucidation of various macroeconomic closure rules used in applied general equilibrium models, readers can refer to Loefgren et al. (2002).

[36] Alternatively, one can fix the real exchange rate. In this case, external balance would be maintained through changes in foreign savings.

over the last two decades (Hasanov, 2012), however, the bank announced recently that it will increase the degree of flexibility of an exchange rate regime.[37] Therefore, the flexible exchange rate regime adopted in the AzCGE model seems to be a reasonable assumption.

As regards the closure rule in government balance, it is assumed that the level of direct and indirect tax rates are exogenous to the model, and government savings is determined to be endogenous to the model. This implies that the government savings endogenously adjust to equate government receipts and expenditures following external shocks to the economy. Given the current socio-political climate in the country, adopting this closure rule seems to be more realistic outlook and preferred to closure of endogenous tax rates and fixed government savings—as it could be an alternative option for closure rule in government balance.

The last closure rule refers to defining saving-investment balance. Although closure rules for external and government balance can be approximated based on the government's current economic and social policy, to select an appropriate closure rule for saving-investment balance is less obvious. Nevertheless, as our model belongs to the group of neoclassical models, the closure rule in saving-investment balance is selected accordingly. In particular, it is assumed that the propensities to save of all non-government institutions are fixed and investment adjusts to the *ex-post* level of savings to ensure that economy-wide investments and savings are equal. Thus, in its current version our model is savings-driven.[38]

Given that all prices are relative in the AzCGE model, it is necessary to choose a numéraire, which will allow us to have a comparable data between the baseline and post-shock state. The consumption price index (*pixcon*) is chosen as a numéraire. Thus, all price movements in the model are relative to this price index. Because the AzCGE model only considers the real side of the economy, as stated earlier, the choice of numéraire has no impact on the quantity and real model variables following external shocks to the economy.

Finally, the model fulfills all the necessary conditions to generate a unique solution of the squared system of equations. The AzCGE model is implemented using GAMS (General Algebraic Modeling System) software, employing the constrained non-linear system solver

[37] See recent announcement of CBA: http://www.azernews.az/analysis/45716.html, (last accessed: 11.12.2013).

[38] Alternatively, one could assume that total investment is fixed, and that the savings rate of institutions presented in the model adjust endogenously to assure the balance in saving-investment. In this case, the model is called investment-driven.

(CNS/Conopt3) while running the model.[39]

4.2 Micro-simulation approach

To capture the whole picture of policy effects on study-relevant social variables, notably on household level welfare and poverty, the AzCGE model developed above is complemented by the micro-simulation model. The micro-simulation models operate at the individual decision-making unit by utilizing cross-sectional data at a given point of time. This makes it possible to give a precise statement about the likely impact of policies on the status and manners of individual units, such as households or individuals. The idea of the micro-simulation approach was introduced to social science by Orcutt (1957) and Orcutt et al. (1961) about half a century ago. However, the extensive use of this class of models in economics started only recently because of growing availability of datasets for individual units, improving ability of software programs to deal with large-scale datasets, and increasing demand of policy-makers for more detailed projections of policy impacts.

In general, the micro-simulation models can be distinguished between behavioral and arithmetic (or non-behavioral) models. The latter approach does not allow individuals to adjust their behaviors in response to the policy changes under scrutiny. In other words, non-behavioral micro-simulation models assume that individuals have the identical behaviors before and after policy reforms (e.g., individuals retain their pre-reform employment /unemployment status or occupation in the post-reform period). In contrast, behavioral micro-simulation models capture the potential behavioral reactions (through using structural econometric estimates) of the individual agents to the changes in policies (e.g., reforms may affect individual's decision to enter the labor market, fall into unemployment, or change occupation). Bourguignon and Spadaro (2005) pointed out that the assumption of unchanged behaviors is not as restricted as it would appear and employing the non-behavioral approach is actually a good approximation of the behavioral approach if individuals are thought to operate in a perfect market. Later, Herault (2010) shared a similar view. Hence, in the present study, we rely on the non-behavioral micro-simulation model, which is a good combination of simplicity and consistency.

A description of the static micro-simulation model that is set up specifically to compliment

[39] GAMS is a software package that is used for mathematical programming as well as for solving different optimization problems in economics, among others, developed by World Bank experts. For more information see http://www.gams.com/. The GAMS code of the AzCGE model is available upon request by author.

the AzCGE model is relatively straightforward. Our partial equilibrium micro-simulation model incorporates multiple "real" households, thereby allowing a maximum level of heterogeneity between them.[40] In the same way as in the AzCGE model, each household in our micro-simulation model maximizes its monetary welfare following the Cobb-Douglass utility function under a given budget constraint. Therefore, each household in our micro-simulation model has income and expenditure functions that are similar to the AzCGE model, namely equations from (4.23) to (4.30). However, in contrast to the AzCGE model, in the micro-simulation model the equations are parameterized on the household level information. In other words, contrary to AzCGE model that includes only a single household at a highly aggregated level ($h \in \{1\}$), the micro-simulation model includes multiple households at a highly disaggregated level ($h \in \{1,...M\}$). As in the AzCGE model, all transfer incomes received by households are also exogenously fixed in our micro-simulation model. Furthermore, in line with non-behavioral formulation of the model, the factor endowments of each household are exogenously fixed.

Consequently, our micro-simulation model makes it possible to determine the changes in household-specific incomes and expenditures due to policy reforms. In turn, this will enable us to undertake a comprehensive distributional analysis over the entire population as well as over different groups within a population (e.g., one can aggregate the results into income or expenditure deciles or quintiles). The micro-simulation model is also implemented by means of GAMS software.

4.3 Linking the models

Once the study-specific CGE and micro-simulation models are developed, in this subsection, we discuss how these two stand-alone models are linked. The economic literature suggests two general alternatives to merge the CGE model with the micro-simulation model with different degrees of integration: the fully integrated approach and the layered approach. Under the fully integrated approach, the micro-simulation model with a large number of households is directly integrated into the CGE model, which can be seen as an extension of the standard CGE model from one or few representative households to multiple households. However, this approach suffers from two principal shortcomings. First, the numerical resolutions might be challenging in the implementation stage of the modeling (Chen and Ravallion, 2004); second,

[40] As we will see in the following chapter, all households that are found in the nation-wide households survey are integrated into our micro-simulation model.

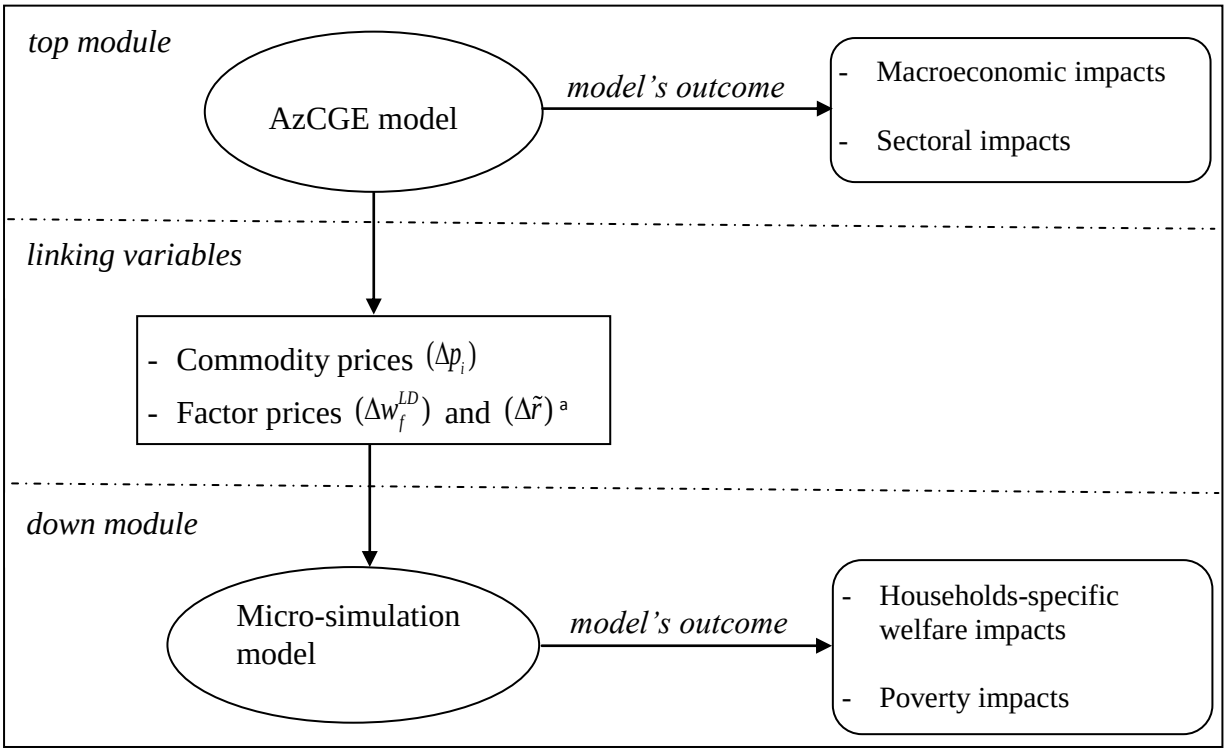
the data reconciliation process could be another crucial difficulty (Rutherford and Tarr, 2008).[41] On the other hand, the layered approach links the models in a sequential fashion (also called a top-down approach). Under this approach, the top-level model, CGE, is used to estimate the linking variables as a result of policy reforms, which are then fed into the bottom/down-level micro-simulation model without any further interaction between the models. The lack of feedback effects from the micro-simulation model back to the CGE model is the main criticism of the top-down approach. Nevertheless, while comparing the estimation outcomes produced by different linking approaches, Bourguignon and Savard (2007) concluded that the loss of information could be relatively minor when feedback effects are not taken into account. A similar conclusion was also drawn by Rutherford and Tarr (2008). In this study, we rely on the top-down approach for linking the models, as we also faced the challenges while implementing the fully integrated approach, such as those raised by Chen and Ravallion. Moreover, as mentioned above, the top-down approach can be considered a good approximation of the fully integrated approach. The overall schematic structure of our modeling framework is illustrated in Figure 4.3. The percentage changes in the vector of consumption and factor prices are the linking variables that are transmitted to the micro-simulation model as a result of policy shocks from the AzCGE model.

Chen and Ravallion (2004) were the first to properly present the top-down approach while assessing the welfare impacts of trade reforms (that would accompany China's WTO accession) across households in China. The authors used the estimated linking variables (prices of commodities and factors) from Ionchovichina and Martin (2004). According to their estimates, an overall welfare gain of about 1.5 percent of the mean income of households would occur in China due to expected trade reforms. Further on, they also found that welfare impact differs considerably between households living in different regions within China; rural households tend to lose, whereas urban households tend to gain. Regarding the poverty impacts of trade reforms, they found a negligible impact. In the similar way of assessment,

[41] Although Cockburn (2002) and Cororaton and Cockburn (2007) were able to easily integrate large number of households into their CGE models, it should be noted that these studies employed relatively fewer households (3,373 and 24,729 households, respectively) and production sectors (14 and 15 sectors, respectively). Handling relatively small numbers of households and production sectors might not be complicated within the CGE framework. On the other hand, Chen and Ravallion (2004) and Rutherford and Tarr (2008) worked with a relatively larger number of households (85,000 and 55,089 households, respectively) and production sectors (25 and 35 sectors, respectively) in their general equilibrium models. Thus, it was problematic to integrate and deal with such a large number of agents within the CGE framework. By increasing the number of households and sectors, the model dimensions increase as well, which can lead to an infeasible solution (i.e., technically, it is not possible solve the model with highly extraordinary dimensions). Moreover, increasing the number of households and production sectors can also lead to various data reconciliation problems.

Cling et al. (2009) evaluated the potential distributive impact of Vietnam's WTO accession. For Vietnam, this meant a reduction in tariffs and a raise in the export demand for textiles. Among many other interesting insight provided, their analysis reveals that the policy changes

FIGURE 4.3: CGE micro-simulation framework



Note: [a]As a linking variable in the micro-simulation model, we use the changes in weighted average rate of return to capital, not the sector-specific rates, which actually would be more suitable within our modeling framework because we assume a sector-specific capital in the AzCGE model. This particular shortcoming stems from the fact that the information collected on households in the survey does not differentiate their income from capital by production sectors, as we will see in the next chapter.
Source: Author's representation

resulting from WTO accession would cause a reduction in the poverty incidence at the national level that is estimated to be as large as 0.8 percent under a flexible labor market assumption and 1.7 percent under a rigid labor market assumption. Furthermore, they also found that the poverty in urban areas would decrease faster (3.4 percent) than in rural areas (0.6 percent). In a similar study, Kyophilavong et al. (2010) evaluated the effects of tariff reductions in Laos following its accession to the WTO. Although they found an overall welfare loss of around 1.1 percent, they concluded that, in terms of poverty impacts, the country would benefit from tariff reductions. In particular, according to their estimates, the country would exhibit a 4.5 percent decline in its national poverty level. Another interesting application of the CGE micro-simulation model was done in the case of Mali. Boccanfuso and Savard (2007) investigated the impacts of lowering agricultural subsidies (among others) in developed countries on poverty incidence in one of the poorest countries in the world, Mali.

They concluded that lowering agriculture subsidies in developed countries by half would lead to a 2.3 percent decline in the poverty rate in Mali. Disaggregating the result across regions, the authors found that the urban poverty would rise by around 3.30 percent, whereas rural poverty would experience a decline of around 3.20 percent.

4.4 Welfare measurement

Throughout the current study, the changes in households' welfare are measured as Hicksian equivalent variation (EV). In particular, EV measures how much more money a consumer would pay before a price increase in order to avoid this increase. The household-specific EV that captures both the consumption price and income effects in association with the Cobb-Douglass utility function can be compiled as follows:

$$EV_h = \prod_i \left(\frac{p_i^0}{p_i} \right)^{\alpha_{i,h}^H} \cdot Y_h - Y_h^0 \quad h \in \{1,...M\}, \quad i \in \{1,...n\} \quad (4.45)$$

where EV_h stands for equivalent variation for household h; p_i^0 and p_i are the initial (before policy shock) and new consumption price (after policy shock) of good i, respectively; and Y_h^0 and Y_h are the initial (before policy shock) and new (after policy shock) level of household h's income, respectively. If the outcome of policy shock shows that $EV_h > 0$ $(EV_h < 0)$, this would mean a welfare improvement (deterioration). Similarly to Ruterford and Tarr (2008), we also favor to measure the welfare effects in terms of the percentage changes in households' initial consumption level.[42]

4.5 Endogenous poverty line and poverty measurement

In order to carry out a full poverty impact assessment, the study uses the most accepted money-metric Foster-Greer-Thorbecke (FGT) poverty indices (Foster et al., 1984). As a class of additive decomposable poverty measures, FGT can be expressed as:

[42] More formally, EV is divided to the initial consumption level of household $(C_{i,h}^0)$ and multiplied by 100 to obtain percentage change: $\left(\left(EV_h \Big/ \sum_i (C_{i,h}^0) \right) \cdot 100 \right)$.

$$FGT_{\alpha} = \frac{1}{\sum_{id=1}^{K} w_{id}} \sum_{id=1}^{q} w_{id} \left(\frac{z - y_{id}}{z} \right)^{\alpha} \qquad (4.46)$$

where FGT_{α} is the poverty measurement, z is the money-metric poverty line, α is the parameter that defines the degree of poverty aversion, y_{id} is the income (net of transfers, taxes, and savings) of the individual id (per adult equivalent),[43] w_{id} is the sampling weights for individual id, K is the total number of individuals, and q is the number of individuals below the poverty line. When $\alpha = 0$, FGT_{α} becomes the standard headcount ratio or poverty rate, which represents the proportion of the population below the poverty line. Further on, in order to measure the extent to which the poor fall below the poverty line, we make use of a poverty gap/depth measure while setting $\alpha = 1$. Lastly, to measure the severity of poverty, we set $\alpha = 2$. This index measures inequality among the poor.

The money-metric poverty line, z, includes the minimum consumption level of essential food (that requires a minimal daily calorie intake of 2,200 Kilocalories) and non-food items (clothing, housing, and access to basic services). The share of food items (non-food items) contributes approximately 70 (30) percent of the indicators defining the poverty line. Because the consumption prices are endogenously determined in the model, the poverty line also becomes endogenous and changes following the variations in consumption prices. The money-metric poverty line is endogenized following Dartanto (2013) with a slight modification:

$$z^{new} = \theta \cdot z^{base} \left(1 + \frac{\Delta p_{fd}}{p_{fd}^{0}} \right) + (1 - \theta) \cdot z^{base} \left(1 + \frac{\Delta p_{nf}}{p_{nf}^{0}} \right), \quad fd, nf \subseteq i \qquad (4.47)$$

where z^{base} and z^{new} are the initial (before the policy shock) and new (after the policy shock) poverty line, respectively; θ and $1-\theta$ are the proportion of food and non-food commodities in poverty line, respectively; p_{fd}^{0} is the initial price of food product fd; Δp_{fd} is the change

[43] Generally, to measure poverty, disposable income of households needs to be calculated at per adult (individual) equivalent living in a household. This makes it possible to take into account a scale effect of households that constitute more than one person. In particular, disposable income of each household is divided by the number of adult equivalents living in this household. In order to calculate adult equivalents, we use the Oxford (also called old OECD) equivalence scale, similarly to the AzSTAT, which computes the number of adult equivalents living in the particular household by assigning the value of 1 for the first household member, of 0.7 to each additional adult, and of 0.5 to each child under the age of 18.

in price of food product fd; p_{nf}^{0} is the initial price of non-food product nf; and Δp_{nf} is the change in price of non-food product nf. Given that our model operates in the static framework, the study assumes that the composition and quantity of goods and services in the poverty line remains constant (invariant) as policy changes.

The poverty analysis is performed using the software called DAD (Distributive Analysis/ Analyse Distributive), which was developed by Araar and Duclos (2009) specifically for poverty and inequality estimations.[44]

4.6 Concluding remarks

The central aim of this chapter was to provide information on the model that was set up specifically to evaluate the economic and social consequences of policy reforms that will come along with Azerbaijan's WTO membership. In particular, we have developed a country-specific, multi-sectoral static CGE model (called AzCGE model) that is complemented by the multi-household micro-simulation model with the endogenous poverty line. The top-down approach was chosen as the linking mode between the CGE and micro-simulation models.

Using the AzCGE model, we will be able to trace the likely effects of policy reforms on macroeconomic and sectoral level variables. The micro-simulation model, however, will allow us to estimate the likely impacts of policies on welfare level of the individual households and poverty.

The Hicksian equivalent variation (as a percentage of household consumption) and FGT poverty indices were chosen to account the household level welfare and poverty effects, respectively.

[44] For more information, see http://www.dad.ecn.ulaval.ca/.

5 DATA AND DESCRIPTIVE STATISTICS

A range of economy-wide statistical information is required to implement an empirical analysis based on the model outlined in the preceding chapter. Hence, in this chapter, an attempt is made to compile a comprehensive database for use in our CGE micro-simulation model. Generally, three foremost types of datasets are required for the empirical implementation of the CGE micro-simulation model: (i) a Social Accounting Matrix, (ii) a various behavioral parameters, and (iii) a detailed survey on households budget. The first two are the basis for the realization of the CGE model, whereas the latter is necessary for the implementation of the micro-simulation model.

Because the survey on households budget is important element for the compilation of the SAM, we start with a description of this database. We then continue with a description of the process of constructing a SAM for Azerbaijani economy while discussing various sources of data and how they are used in the compilation process. Further on, we also discuss how the behavioral parameters for the model have been obtained. The chapter ends with the presenting a descriptive statistics revealed in the survey of households budget and in the SAM, which provides essential background information on the major characteristics and specificities of Azerbaijan's socio-economic system for the reference year. This information will be helpful in interpreting the results derived from the modeling exercise in the following parts of the study.

5.1 Household Budget Survey of Azerbaijan

As mentioned further up, to perform the micro-simulation part of our modeling exercise, complete information on income sources and consumption patterns of households are required. The statistical authorities of nearly all countries conduct surveys on households' living standards, usually on an annual basis, and Azerbaijan is no exception. The core purpose of these surveys is to bring together comparable data about a population's general well-being. Although the national statistical agency in Azerbaijan has a long history in the collection of information on households income and expenditure patterns, a more reliable survey using a new methodology was introduced in 2001 with technical assistance from the World Bank. The survey employs a quarterly rotation panel, meaning that each household is interviewed every three months over four calendar quarters and every quarter, 25 percent of the sample is

replaced by new households. This procedure minimizes any measurement errors that may be caused by seasonal fluctuations in income and expenditure of households. Furthermore, to design the sample, the survey employs a multistage random sampling method, where at the first stage the sampling of settlement areas and at the second stage the sampling of households within the selected settlements is carried out. This employed procedure assures that all social strata across the regions have an equal chance of being randomly selected for the survey.

The present study makes use of the Household Budget Survey conducted in 2006[45] by the AzSTAT, where 15,062 households and 58,924 individuals participated. It contains detailed data on different sources of income and patterns of expenditure for each household. The 2006 HBS also provides rich socio-demographic information such as the size of households; the age, gender, and the education level of each household member; as well as the number of working individuals in each household; among others. Additionally, through the sample weights assigned to each contributing household, the survey is nationally representative.[46]

For the purpose of this study, there are several issues concerning the way in which the HBS data is collected that impede the use of them directly. Therefore, we need to reorganize and reconcile the survey data.

The consumption expenditures in the HBS are recorded on a household level and the collected consumption data for a large number of commodities are classified based on the UN Classification of Individual Consumption According to Purpose (COICOP) code and contain 524 expenditure lines for different goods and services. These expenditure lines have been aggregated into 40 expenditure categories to make the data compatible with the SAM, which we will construct in the following section.[47] Moreover, the survey contains a vector of information on the expenditures of each household on tax payments and on transfers to other households (non-consumption expenditures). It is worthwhile noting that the survey does not provide detailed information on inter-household transfers, i.e., there is no information on which household makes a transfer to which household.

Further on, the survey contains information on all income sources for each household and also for each individual household member. As it appears in the national accounts and also in the SAM—which we will build in the next section—we have classified the income of households

[45] The reason for choosing 2006 as a reference year for our analysis will be clear in the following section.
[46] The 2006 HBS Azerbaijan is not available from the author due to confidentiality restrictions. However, it is possible to obtain it from the AzSTAT upon request.
[47] The exact mapping the expenditure lines from the HBS into the SAM is presented in Appendix I.

into six major categories; such as income received from skilled labor, from unskilled labor, from capital, from other households, from abroad (remittances), and from the government. The values on received income from the main and additional jobs, as well as the payments for any jobs received in kind, have been aggregated to determine the labor income of each working household member. As the HBS also provides information on the level of education for each working household member, we have categorized the labor income of individuals as received either from skilled or unskilled labor. Those with a graduate or undergraduate level of education (master's, bachelor's, college, or technical school level education) are counted as skilled laborers, while the rest are simply categorized as unskilled laborers (secondary, basic, primary, or no education). Once we have defined the labor income of each working household member as being from either skilled or unskilled labor, we compute the labor income of each household derived from skilled and unskilled labor (sum of working individuals' income from the skilled and unskilled labor). Furthermore, the values on received income from dividends, interests on bank deposits, self-employment,[48] and renting property or real estate have been added together to map the capital income of each household. Beyond the income received from factors of production that households supply to the factor market, the survey also contains information on income transfers received from the government, from other households, and from abroad (non-factor incomes). Various kinds of social transfers received by households from the public institutions have been aggregated to determine the income transfers of households received from the government. In the HBS, households reported their received transfer incomes from other households as well as from abroad in an aggregated form without differentiating the origins of those transfers (i.e., without defining from which household and from which country). Finally, as the savings of each household are not reported explicitly in the HBS, the values of savings are imputed as after-tax household income, minus the sum of associated expenditures.

In what follows, we focus on the reconciliation of the survey data. In the HBS, around 35 percent of households reported their total income as being below their total expenditure. In other words, they reported a negative savings. Because we rely on an analytical framework that determines the state of the economy in a general equilibrium setting, we need to reconcile the HBS data to ensure that the incomes and expenditures of each household in the survey are

[48] Although income from self-employment also contains labor income that is used in own business, it is extremely difficult to decompose self-employment income into labor and capital income components. Thus, self-employment is usually assigned as a capital income in many studies (see e.g., Mendoza et al., 1994; Slemrod, 2007; Cockburn et al., 2010, among others).

balanced. In general, negative savings is a commonly observed phenomenon in surveys on households budget (Annabi et al., 2005; Rausch et al., 2011) and such an inconsistency can occur due to under-reporting of incomes or over-reporting of expenditures by surveyed households. It is a widely held view that data on expenditures is more accurate and reliable in such surveys because the data on expenditures is usually reported more recent (Deaton, 1997; Iradian, 2005). Murray and Evans (2003) pointed out that this is especially true in developing countries. Accordingly, we assume that the data on expenditures is reported accurately in the 2006 HBS Azerbaijan and focus on the income data to reconcile the survey. By and large, there is no universal approach to data reconciliation in household surveys. However, we follow the mainstream literature (see e.g., Fofana and Cockburn, 2003; Annabi et al., 2005; Cockburn et al., 2010) and assume that data inconsistency in the 2006 HBS Azerbaijan is due to failure of the survey to properly capture inter-household transfers. In other words, we assume that transfer incomes of households received from other households are under-reported in the HBS. In this context, to reconcile the data, in-transfers are increased for households with negative reported savings by just enough to bring their savings to zero. These in-transfers are then financed through a proportional increase in out-transfers from households whose income exceeds their expenditure in the survey (households with positive reported savings). It is worthwhile mentioning that the adopted adjustment mechanism allows us to conserve the original structure of households' income from the various factors of production, which is something crucially important for our welfare assessment.[49]

5.2 Social Accounting Matrix for Azerbaijan

A SAM is a pool with a large amount of economic information represented in a squared matrix form, which captures transactions and transfers between all economic agents in the national economic system (Pyatt and Round, 1985; Reinert and Roland-Holst, 1997). As a single entry accounting system, each account in the matrix is represented by a column for outgoing amounts and a row for incoming amounts. In other words, the columns within the SAM indicate who make an expenditure and where, whereas the rows indicate who receives an income and from where. The SAM usually includes data for one specific calendar year and uses a double-entry bookkeeping approach, which implies that the sums of the corresponding rows and columns in a square matrix must be equal to each other—a condition in which the

[49] As mentioned in Chapter 4, inter-household transfers are treated as exogenous to the model, whereas income from production factors is endogenous to the model. Thus, conserving the original structure of households' income from the various factors of production will allow us to account a welfare analysis accurately.

SAM is called balanced. This is a fundamental law of general equilibrium setting, as the sum of incomes and expenditures for each economic agent has to be in equilibrium.

The initial matrix of social accounting was pioneered by Stone (1962), who developed a SAM for the United Kingdom economy. However, general development of the SAM framework was done by Pyatt and Thorbecke (1976) and later by Pyatt and Round (1977, 1979). Although the more general and standardized structure of the SAM is given in the new chapter XX of the 1993 System of National Accounts (SNA) provided by the UN, the classification of accounts in the SAM are very flexible, depending on the study area of the researchers, the data availability, and the specific policy concerns of the particular study.

Although the SAMs have been constructed for a growing number of developing countries (e.g., International Food Policy Research Institute compiled the SAMs for a large number of developing countries), there is no known published or unpublished statistical document or academic paper that includes ready-made SAM for the Azerbaijani economy. Therefore, for the purposes of the current research demand, we need to proceed with the building of a SAM as a first attempt for the Azerbaijani economy.

5.2.1 Construction of the SAM

The construction of an entirely new SAM is highly data intensive. In general, the SAM can be constructed according to one of two main approaches: top-down or bottom-up. The top-down approach takes macroeconomic figures—typically from the SNA—and first constructs a highly aggregated SAM, which can be then used as an aggregated control totals while disaggregating the corresponding matrix accounts. Conversely, bottom-up approach starts directly with the building of a disaggregated SAM. This can be then aggregated to provide a highly aggregated SAM, from which it is possible to derive important macroeconomic figures for the economy.[50] The latter approach allows for the identification and elimination of discrepancies in statistical information at the micro-level, thereby emphasizing the accuracy of the data (European Commission, 2003; Zhang et al., 2013). Therefore, we follow this approach in building a unique SAM for the Azerbaijani economy.

The year 2006 is chosen for the construction of the matrix, as being the latest year for which almost all of the necessary statistical information is available. To build the SAM for Azerbaijan, datasets are consolidated from four principal sources that include both published

[50] In the literature, an aggregated SAM is also referred to as a "macro-SAM", whereas a disaggregated SAM is referred to as a "micro-SAM" (see e.g., Kerwat et al., 2009; Zhang et al., 2013).

and unpublished statistical documents: Input-Output (IO) table, government budget statistics, balance of payment (BoP) statistics, and the HBS. IO table is the core database for the development of our SAM. The table contains information about the utilization of commodities across production activities, the structure of final consumption, value-added, and trade flows, along with the whole economy separated into 86 production sectors/activities (provided by Ministry of Economy and Industry of Azerbaijan).[51] The table includes 58 industries and 27 service sectors, with agriculture counting as a single sector.[52] As another important data source, government budget statistics provides detailed information on government income sources and expenditure patterns within a single year (provided by the Ministry of Finance of Azerbaijan). Furthermore, the BoP statistics document all the economic transactions between Azerbaijan and its foreign trade partners at a detailed level (provided by the AzSTAT). Lastly, the HBS, as described in the previous section, is another important data source for the compilation of the SAM (provided by the AzSTAT). Although aforementioned statistical documents provided by domestic institutions are the main data sources for our SAM development, whenever necessary we will also use supplementary data sources provided by international institutions—as we will describe later.

The schematic structure of the SAM, which we will follow while constructing the matrix for Azerbaijan is presented in Table 5.1. It includes accounts of production activities, commodities, factors of production, enterprises, households, government, savings-investments, and the rest of the world. Technically speaking, construction of the SAM means that all cells in the matrix with a textual description (or non-shaded cells) are needed to be replaced by the corresponding values from the above stated statistical documents. Each of these accounts is described in more detail below.

Activities account

In the *activities account* (row 1 – column A), the column entries indicate expenditures for production sectors, while the row entries report receipts derived from sales. In particular, the column entries in the *activities account* include intermediate input purchases (cell A2), payments to primary factors of production (cell A3), and indirect (production) taxes (cell A6),

[51] The 2006 IO table for Azerbaijan is not published officially, but it is available upon request from the Ministry of Economy and Industry of Azerbaijan.

[52] The fact that the table includes only one aggregated agricultural sector will limit our ability to assess the outcome of policy reforms within the agriculture subsectors. Unfortunately, there was no alternative source of information from which a detailed data on agriculture subsectors could be obtained.

TABLE 5.1: The structure of the SAM for Azerbaijan

Accounts ⇨ / ⇩		Activities	Commodities	Factors of production	Households	Enterprises	Government	Savings-investments	Rest of the World	TOTAL
		A	B	C	D	E	F	G	H	
Activities	**1**		Domestic sales (40x40)						Exports (2x40)	Domestic production (1x40)
Commodities	**2**	Intermediate demand (40x40)			Households consumption (1x40)		Government consumption (1x40)	Investments (1x40)		Total domestic demand (1x40)
Factors of production	**3**	Value-added payments (40x3)								Factor earnings (1x3)
Households	**4**			Factor income to households (3x1)	Inter-household transfers (1x1)		Social transfers (1x1)		Remittances (2x1)	Income of households (1x1)
Enterprises	**5**			Factor income to enterprises (3x1)						Income of enterprises (1x1)
Government	**6**	Indirect taxes (40x1)	Import tariffs (40x1)		Income taxes (1x1)	Corporate taxes (1x1)				Income of government (1x1)
Savings-investments	**7**				Households savings (1x1)	Enterprises savings (1x1)	Government savings (1x1)		Foreign savings (2x1)	Aggregate savings (1x1)
Rest of the World	**8**		Imports (40x2)							Foreign exchange outflow(1x2)
TOTAL		Cost of production (40x1)	Total domestic supply (40x1)	Factor expenditures (3x1)	Expenditure of households (1x1)	Expenditure of enterprises (1x1)	Government expenditures (1x1)	Aggregate investments (1x1)	Foreign exchange inflow (2x1)	

Note: This is an aggregated outline of the SAM, where some cells in the matrix consists of corresponding sub-matrices (cells A2, A3, B2, B8, H1) and vectors (cells A6, B6, C4, C5, D2, F2, G2, H4, H7).
Source: Author's representation, based on Robinson et al. (1999) and Round (2003)

while the row entries include domestic sales (cell B1) and exports (cell H1). The majority of the relevant data for the column and row entries in this account are drawn from the IO table. In addition, data from the HBS and the BoP statistics are used to obtain more detailed information on payments to primary factors of production and export patterns of the economic activities.[53]

This account is decomposed into 40 production sectors/activities. A list of these activities is presented in Table 5.2. While some of the sectors from the IO table have been directly mapped onto the SAM, others have been aggregated into a single sector. More specifically, we have aggregated small-scale and insignificant activities (e.g., coal and peat mining sector, which do not exist in Azerbaijan or investigation and security services, which is a less-important sector).[54] While determining the classification of the economic activities in the SAM, we attempt to follow the well-known Global Trade Analysis Project (GTAP)[55] sectoral classification. Therefore, some of the sectors in our SAM are classified similarly to those found in the GTAP database, however, some sectors are grouped differently principally due to differences in sectoral classifications in the original IO table.[56]

Commodities account

The *commodities account* (row 2 – column B) reports the components of total supply of the economy in the column and the components of the total demand of the economy in the row. Because there is a one-to-one correspondence between economic activities and commodities in the original IO table—meaning that each production activity produces only one commodity—the *commodities account* also contains 40 elements in the SAM.[57] The column entries include domestic sales (cell B1), imports (cell B8), and collected tariffs (cell B6). The data on imports are drawn from two sources: the IO table and the BoP statistics. Unfortunately, the IO table for Azerbaijan does not contain information on collected tariffs. This will make it impossible to derive applied rates of tariffs for each of the imported good presented in the SAM, which is crucially important to our trade policy analysis. To overcome

[53] Further details on the documentation of prior constructed SAM are given in Appendix II.
[54] The sectoral mapping between the IO table and the SAM are provided in Appendix III.
[55] GTAP is the worldwide network of researchers who conduct quantitative analysis on various economic policies. The project is coordinated by the Center for Global Trade Analysis, Purdue University, USA, and maintains its own global multi-sectoral applied general equilibrium model and its relevant database. For more information see https://www.gtap.agecon.purdue.edu/.
[56] The correspondence between sectoral classifications in the GTAP and the SAM are given in Appendix III.
[57] In the SAM, production activities can also produce more than one commodity.

this problem, the study makes use of the Market Access Map (MacMap) database, which is created and maintained jointly by the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) and the International Trade Centre (ITC).

TABLE 5.2: Production sectors in the SAM for Azerbaijan

Number	Acronym[a]	Description of sectors	Groups of sectors
1	AGR	Agriculture	Agriculture (1)
2	FRS	Forestry	Natural resources (4)
3	FSH	Fishery	
4	OAG	Oil and gas extraction	
5	OMN	Other minerals	
6	MPR	Meat and meat products	Food sectors (7)
7	AVF	Animal and vegetable oils/fats	
8	SGR	Sugar	
9	VAF	Prepared and preserved fruits/ vegetables	
10	MIL	Dairy products	
11	OFD	Other food products	
12	BVR	Beverages	
13	TBC	Tobacco products	Non-food manufacturing sectors (14)
14	TEX	Textiles	
15	CAF	Clothing and furs	
16	LEA	Leather products	
17	LUM	Lumber	
18	PPP	Paper and paper products, including publishing	
19	OPR	Oil processing	
20	RAP	Rubber and plastic	
21	CHM	Other chemical products	
22	NMM	Non-metallic minerals	
23	FMT	Ferrous metals	
24	NFM	Non-ferrous metals	
25	MAE	Machinery and equipments	
26	OIP	Other industrial products, including recycling	
27	EGS	Electricity, gas and steam	Service sectors (14)
28	WTR	Water supply	
29	CNS	Construction	
30	TRD	Trade	
31	TRS	Transportations	
32	CMN	Post and communication	
33	RAD	Research and development	
34	EDU	Education	
35	FIN	Financial services	
36	RES	Real estate and business services	
37	PAD	Public adminstration	
38	ISR	Insurance and pension funds	
39	HTL	Health and social assistance	
40	OSR	Other services	

Note: [a]Acronyms will be used in the following chapters.
Source: Author's elaboration.

The MacMap database provides *ad valorem* equivalent measures for all forms of tariffs.[58] The database estimates applied tariffs for almost all countries while taking into account currently active preferential free trade agreements.[59]

In the row, the *commodities account* comprises intermediate demand (cell A2) and final demand that includes households demand (cell D2), government demand (cell F2), and investment demand (cell G2). The data on demand components of the economy along the lines of commodities have been extracted explicitly from the IO table—except the data on households demand. Although the IO table provides information on consumption vector of households, we prefer to use the data from the HBS in SAM building, for the reason that we aim to keep the households consumption vector in the SAM consistent with the HBS data.

Factors of production account

The *factors of production* account (row 3 – column C) are divided into three subaccounts: capital, skilled labor, and unskilled labor. The row of this account describes the production factors outlays of the production activities (cell A3), whereas the column entries record the distribution of factor remunerations between households (cell C4) and enterprises (cell C5). Using the information contained by IO table, we were able to decompose the row of the production factors account into capital and labor components for the activities represented in the SAM. Unfortunately, the IO table does not contain information on labor compensation by skill level for the economic activities. Thus, supplementary information from the HBS and GTAP database is used to further decompose the row of the *labor account* into skilled and unskilled labor components. The data on column entries are obtained from the IO table and HBS.

Households account[60]

The *households account* (row 4 – column D) records the income components of households in the row. This includes income from production factors that households supply to production activities (cell C4), transfers received from other households (cell D4), transfers received

[58] Most of the multi-regional CGE models, including the well-known GTAP (Dimeranan, 2006; Narayanan and Walmsley, 2008; Narayanan et al., 2012) and MIRAGE (Modeling International Relationships in Applied General Equilibrium) models (Decreux and Valin, 2007) use the MacMap dataset on applied tariffs for trade policy evaluations.

[59] For more information on the MacMap database and also the estimation methodologies, see Bouet et al. (2004) and Boumellassa et al. (2009).

[60] This account refers to private consumption of residents.

from the government (cell F4), and transfers received from abroad (cell H4). The column of this account records expenditures that include households' consumption of goods and services (cell D2), transfers to other households (cell D4), tax payments (cell D6), and savings (cell D7). The SAM includes only one representative household (aggregated at the national level). All the relevant data for the column and row entries in *households account* are extracted explicitly from the HBS.

Enterprises account[61]

The earnings and expenditures of corporate enterprises are recorded in the *enterprises account* (row 5 – column E). The row entries include income paid by factors of production (cell C5), while the column records the expenditures of this account, including corporate taxes (cell E6) and savings (cell E7). Using the information contained by IO table, HBS, and government budget statistics, we have derived all the necessary data for this account.

Government account

In the *government account* (row 6 – column F), the column shows components of the central government's expenditure, whereas the row shows components of the government's income. In particular, the column entries records government's consumption expenditure (cell F2), social transfers to households (cell F4), and savings of government, whereas the row of this account records indirect taxes (cell A6), direct taxes (cells D6 and D7), and import duties (cell B6). The data for column and row entries of this account are taken from the various sources, including the IO table, HBS, MacMap database, and government budget statistics.

Savings–investments account[62]

In the *savings–investments account* (row 7 – column G), the column gives information about private and public investments in the economy (cell G2), while the row introduces the savings of different institutions in the economy—including households savings (cell D7), enterprises' savings (cell E7), government savings (cell F7), and foreign savings (cell H7). The information contained by IO table, HBS, government budget, and BoP statistics made it possible to derive all the required data for the *savings-investments account*.

[61] The enterprises account sometimes is merged with households account in SAMs. However, in order to increase the accuracy of the SAM for the Azerbaijani economy, we specify enterprises account as a separate economic agent.

[62] In the literature *savings-investments account* sometimes referred as *capital formation account*.

Rest of the world account

The *rest of the world account* (ROW) (row 8 – column H) reports all transactions between the domestic economy and its foreign trading partners. The row in this account shows categories of income for the ROW, which simultaneously represents the expenditures of the domestic economy, such as imports (cell B7). On the other hand, the column in this account shows the components of the ROW expenditure, which includes exports (cell H1), remittances (cell H4), and current account balance or foreign savings (cell H7). For reasons already mentioned in Chapter 4, the ROW account is divided into two subaccounts: group of CIS and non-CIS countries.[63] The data on trade flows are mainly obtained from the IO table. However, given that the IO table does not differentiate exports and imports across foreign trade partners at the sectoral level, supplementary information from the BoP statistics is used to decompose this account into two subaccounts. The data on remittances received by households from abroad are obtained from the HBS. However, the HBS records the aggregated level remittances, without making any distinction as to where they originated (i.e., from which country). Therefore, we have used the information from a survey conducted by the European Bank for Reconstruction and Development (2007) to split the foreign remittances into remittances received from CIS and non-CIS countries.

5.2.2 Balancing the SAM

As the data predominantly comes from diverse sources, it is inevitable that there are some discrepancies between the row and column totals of corresponding accounts in the compiled primary SAM. Nonetheless, to produce a consistent database for our modeling framework, the matrix has to be balanced. Various techniques have been proposed in the literature for the balancing the matrix where the most common and relatively straightforward method is minimizing quadratic differences or least squares method, which our balancing procedure follows.[64] This approach is discussed extensively by Round (2003) and applied appropriately in Cockburn et al. (2010), Colombo (2010), Rausch and Mowers (2014), and Zhang et al. (2013), among other recent studies.

[63] Russia, Georgia, Armenia, Tajikistan, Uzbekistan, Moldova, Kazakhstan, Ukraine, Kyrgyzstan, Turkmenistan, and Belarus are grouped together as CIS countries, whereas other than these countries are grouped as non-CIS countries.

[64] Apart from the least squares method, there are other alternatives such as the RAS and Cross Entropy methods to balance the SAM. For a detailed discussion on various balancing techniques, see Robilliard and Robinson (2003) and Fofana et al. (2005).

The idea behind the balancing procedure is very intuitive and can be described as follows. Let the SAM characterize as a matrix **A** with elements $a_{i,j}$ (*i,j = 1, ...n*) that represent a payment from an account in column *j* to an account in row *i*. Hence, the idea is to estimate non-zero $a_{i,j}$'s by minimizing the sum of squared deviations between the new estimated matrix $\mathbf{A^1}$ with elements $a^1_{i,j}$ and the prior constructed matrix $\mathbf{A^0}$ with elements $a^0_{i,j}$, which must satisfy the condition that each sum of rows must be equal to the corresponding column's sum in absolute terms. This principle of minimization problem can be expressed in the following mathematical form:

$$\min H = \sum_{i}^{n} \sum_{j}^{n} \left[\frac{a^1_{i,j} - a^0_{i,j}}{a^0_{i,j}} \right]^2 \qquad (5.1)$$

$$\textit{subject to} \quad \sum_{j}^{n} a^1{}_{i,j} = \sum_{j}^{n} a^1{}_{j,i} \qquad (5.2)$$

The explicit application of the least squares method to the unbalanced (primary) SAM for Azerbaijan involves a set of additional constraints. First, in order to achieve full consistency between the balanced SAM and the household survey aggregates, row and column elements of the *households account* are fixed to their initial levels. As a result, income and consumption patterns of households are constrained to their original values as they appear in the HBS. This is crucially important for an accurate welfare analysis. Second, because we will be dealing with the tariff liberalization issues in the following chapters of the study, the applied tariff rates are also bound to their initial rates as they appear in the MacMap database.

Overall, the least squares approach is applied to 89x89 matrix and all computations used to balance the matrix are performed under the GAMS software environment.[65] After obtaining the balanced disaggregated SAM, we have aggregated it to 8x8 matrix in order to provide a consistent macroeconomic picture of the economy. This is presented in Table 5.3. This matrix will be used in descriptive statistics part of this chapter.

[65] The balanced disaggregated SAM for Azerbaijan can be provided upon request.

TABLE 5.3: The balanced aggregated 2006 SAM for Azerbaijan, in mln AZN

Accounts ⇨ / ⇩	Activities	Commodities	Factor of productions	Households	Enterprises	Government	Savings-Investments	Rest of the World	TOTAL
Activities		15660.3						11272.1	26932.4
Commodities	10412.3			5527.9		1550.3	5803.2		23293.6
Factor of productions	16082.9								16082.9
Households			4797.7	465.2		741.2		419.5	6423.5
Enterprises			11285.3						11285.3
Government	437.2	377.4		292.4	1263.5				2370.5
Savings-Investments				138.1	10021.8	79.0		-4435.6	5803.2
Rest of the World		7255.9							7255.9
TOTAL	26932.4	23293.6	16082.9	6423.5	11285.3	2370.5	5803.2	7255.9	

Note: Clearly, the balancing procedure evolves the structure of the prior constructed SAM. We compare some important macroeconomic figures from the balanced final SAM with the corresponding figures that are observed in the unbalanced SAM, in order to check whether there are large discrepancies or not. As a result of those comparison, we found that differences are not large and do not exceeds 7 percent (e.g., we observe a 4.1 percent deviation in GDP, a 0.8 percent deviation in total imports, a 6.5 percent deviation in total exports, and a 4.8 percent deviation in overall domestic output).

Source: Author's estimation

5.3 Parameters for the model

In addition to the above defined datasets, behavioral parameters of the model are also needed to be specified. In general, there are two sets of behavioral (functional) parameters in the model: first, the share and scale or efficiency parameters (φ_i^F, φ_i^{FD}, φ_i^T, φ_i^{TR}, φ_i^A, φ_i^{AR}, γ_i^F, $\gamma_{i,l}^{FD}$, γ_i^T, $\gamma_{i,d}^{TR}$, γ_i^A, $\gamma_{i,d}^{AR}$, $\alpha_{i,h}^H$, α_i^G, α_i^I), and second, various elasticity parameters (σ_i^F, σ_i^{LD}, σ_i^A, σ_i^{AR}, σ_i^T, σ_i^{TR}). The parameters belonging to first set have been calibrated using the information from the (balanced) SAM and the HBS. The calibration procedure of these parameters is provided in Appendix IV. The econometric estimation techniques based on time series data are needed in order to determine the second set of the parameters. However, the simultaneous estimation of elasticity parameters within the present study would require an unrealistically large number of data that rarely, if ever, exist. Therefore, following mainstream CGE studies, we have adopted values for elasticity parameters exogenously from the relevant existing literature. In particular, the study relies on the elasticity parameters used in the CGE model developed for Kazakhstan by Jensen and Tarr (2007).[66] These elasticity parameters are presented in Table 5.4.

TABLE 5.4: Elasticity parameters for the AzCGE model

Parameters	Values	Description
σ_i^F	1.5	Elasticity of substitution between capital and labor
σ_i^{LD}	1	Elasticity of substitution between skilled and unskilled labor
σ_i^A	5	Armington elasticity of substitution between imports and domestic goods
σ_i^{AR}	10	Armington elasticity of substitution between import origins
σ_i^T	3	Elasticity of transformation between domestic production and exports
σ_i^{TR}	6	Elasticity of transformation between export destinations

Source: Jensen and Tarr (2007)

Unfortunately, their model does not contain information on the Armington elasticities of substitution between import origins (σ_i^{AR}) and the elasticities of transformation between export destinations (σ_i^{TR}). Thus, following the logic of the GTAP model, these elasticity values are set as double the Armington elasticity of substitution between imports and

[66] To best our knowledge, there is no empirical literature that estimates trade related elasticity parameters in the case of the Azerbaijani economy.

domestic goods ($\sigma_i^{AR} = 2 \cdot \sigma_i^{A}$) and the elasticity of transformation between domestic supply and exports ($\sigma_i^{TR} = 2 \cdot \sigma_i^{T}$).[67]

It is worthwhile to note that the choice of values for elasticity parameters is likely to have an impact on the outcome of the modeling exercise (Belgodere and Vellutini, 2011). Therefore, the last chapter of the study will conduct a sensitivity analysis, considering the alternative values for the elasticity parameters to determine the dependency of the model results on those parameters.

5.4 Descriptive statistics

In view of the assembled datasets, the remainder of this chapter will focus on descriptive statistics of reference year. In particular, the salient features of the HBS and the SAM will be discussed extensively in terms of characteristics of households and structure of the economy.

5.4.1 Income sources and consumption patterns of the households

This subsection presents the structure of households' income sources and expenditure patterns in Azerbaijan, based on the HBS. To get a sense of the characteristics of different households, particularly poor ones, we have separated households into ten income deciles, where decile 1 comprises the poorest 10 percent and decile 10 comprises the richest 10 percent of the population. Each decile is further divided into urban and rural households.

Table 5.5 shows how these household deciles obtain their income from diverse sources. It is apparent that the sources of income vary substantially across the household deciles. Factor earnings are a primary source of income for all households belonging to different deciles. While income from labor earnings are relatively less important as a source of income for the poorest population decile—accounting for only 17.5 percent of their total income—its share increases over the deciles until it accounts for 38.1 percent of the income of the richest household decile. Furthermore, within the labor earnings, a strong shift in the importance of skilled labor earnings is observed while moving from the poorest to the richest decile. Specifically, households in the poorest decile draw 46.3 percent of their labor income from skilled labor, whereas households in the richest decile earn 76.8 percent of their labor income from skilled labor. In contrast, unskilled labor income as a share of the total labor income of

[67] This method of assigning the elasticity parameters—called "the rule of two" in the economic literature—was proposed by Jomini et al. (1994) and later retained in the GTAP model (see Dimaranan et al., 2006).

TABLE 5.5: Income sources of households, in percentage

	Decile 1 (0-10%)	Decile 2 (11-20%)	Decile 3 (21-30%)	Decile 4 (31-40%)	Decile 5 (41-50%)	Decile 6 (51-60%)	Decile 7 (61-70%)	Decile 8 (71-80%)	Decile 9 (81-90%)	Decile 10 (91-100%)
Overall households										
Labor income	17.5	21.4	23.5	26.7	26.9	28.7	30.1	32.2	35.3	38.1
- *Skilled*	46.3	46.6	47.1	56.6	58.4	58.6	65.8	65.8	72.1	76.8
- *Unskilled*	53.7	53.4	52.9	43.4	41.6	41.4	34.2	34.2	27.9	23.2
Capital income	36.7	41.3	44.3	42.2	44.5	45.1	45.1	45.0	43.5	43.0
Remittances from abroad	9.7	8.3	6.3	7.1	6.0	6.2	5.4	5.0	4.3	5.1
Government transfers	19.4	17.8	16.0	14.8	13.0	12.3	12.1	11.4	10.5	8.5
Inter-household transfers	16.6	11.1	10.0	9.3	9.6	7.7	7.4	6.4	6.4	5.3
Rural households										
	Decile 1 (0-10%)	Decile 2 (11-20%)	Decile 3 (21-30%)	Decile 4 (31-40%)	Decile 5 (41-50%)	Decile 6 (51-60%)	Decile 7 (61-70%)	Decile 8 (71-80%)	Decile 9 (81-90%)	Decile 10 (91-100%)
Labor income	10.0	14.5	16.4	17.1	17.5	18.4	17.7	19.6	20.2	18.9
- *Skilled*	34.1	36.6	41.8	46.0	41.7	37.7	39.0	38.3	52.6	68.3
- *Unskilled*	65.9	63.4	58.2	54.0	58.3	62.3	61.0	61.7	47.4	31.7
Capital income	44.7	49.4	51.4	53.7	55.9	56.8	58.8	59.9	59.8	62.5
Remittances from abroad	11.3	8.9	6.3	6.8	5.7	6.3	5.4	3.2	3.5	4.5
Government transfers	20.7	18.6	17.8	15.7	14.2	12.7	12.7	12.6	12.1	10.6
Inter-household transfers	13.2	8.7	8.1	6.8	6.7	5.8	5.3	4.8	4.5	3.4
Urban households										
	Decile 1 (0-10%)	Decile 2 (11-20%)	Decile 3 (21-30%)	Decile 4 (31-40%)	Decile 5 (41-50%)	Decile 6 (51-60%)	Decile 7 (61-70%)	Decile 8 (71-80%)	Decile 9 (81-90%)	Decile 10 (91-100%)
Labor income	24.3	30.5	31.9	37.0	36.1	37.6	40.1	40.9	43.7	46.8
- *Skilled*	50.9	52.8	50.4	61.8	66.2	67.6	75.5	74.9	77.1	78.3
- *Unskilled*	49.1	47.2	49.6	38.2	33.8	32.4	24.5	25.1	22.9	21.7
Capital income	29.4	30.6	35.7	29.8	33.5	35.0	33.8	34.7	34.4	34.2
Remittances from abroad	8.2	7.6	6.2	7.3	6.2	6.1	5.3	6.3	4.8	5.4
Government transfers	18.3	16.9	13.9	13.9	11.8	11.9	11.6	10.5	9.6	7.5
Inter-household transfers	19.8	14.3	12.3	12.0	12.3	9.4	9.1	7.5	7.5	6.1

Source: Author's elaboration based on data from HBS 2006

households substantially decreases as households become richer. The poorest households derive 53.7 percent of their labor income from unskilled labor, whereas the corresponding figure is only 23.2 percent for the wealthiest households. Furthermore, reliance on capital income is relatively higher among the upper middle-income deciles, with the largest share in total income from this source observed in 6^{th} and 7^{th} deciles, at the level of 45.1 percent. Conversely, reliance on capital income is relatively smaller in the poorest households, accounting for 36.7 percent of their total income.

In addition to factor incomes, households also receive income from other sources (non-factor incomes); namely, transfers from the government, from other households (inter-household transfers), and from abroad (remittances). As revealed in Table 5.5, non-factor incomes are relatively important sources of income for households belonging to the lowest income decile, but when households become richer, they rely less on those incomes. In particular, government transfers, inter-household transfers, and remittances from abroad, respectively, constitutes 19.4, 16.6, and 9.7 percent of the total income of the poorest households, but only 8.5, 5.3, and 5.1 percent of the total income of the richest households.

Similar patterns in income formation have been observed in urban and rural households when we move across deciles. Nevertheless, there are several distinguishing features between urban and rural households. In particular, it appears that over deciles rural households rely more on capital income than do urban households. On the contrary, reliance on labor income is higher among urban households than their rural counterparts. In terms of within labor income, as expected, rural households mainly rely on unskilled labor income, while urban households have higher dependence on skilled labor income in all deciles. As of received non-factor incomes, it appears that over deciles rural households rely more on transfers from the government and from abroad (remittances) than do urban households. However, urban households draw a larger share of their income from inter-household transfers contrary to rural households.

Having looked at the sources of households' income, we now turn to explore the consumption patterns of households. Table 5.6 summarizes the information on households' consumption expenditures on various goods and services over income deciles and according to place of their residence (urban/rural). The four major categories of items in the households' consumption basket are agricultural products, food products, non-food manufacturing goods,

TABLE 5.6: Consumption patterns of households, in percentage

Overall households										
Sectors	Decile 1 (0-10%)	Decile 2 (11-20%)	Decile 3 (21-30%)	Decile 4 (31-40%)	Decile 5 (41-50%)	Decile 6 (51-60%)	Decile 7 (61-70%)	Decile 8 (71-80%)	Decile 9 (81-90%)	Decile 10 (91-100%)
Agriculture	**15.7**	**14.8**	**14.9**	**14.3**	**13.8**	**13.7**	**12.7**	**12.0**	**12.0**	**10.6**
Fishery	1.5	1.6	1.9	1.8	1.9	2.0	1.9	1.9	1.9	1.7
Meat and meat products	14.4	14.6	14.8	15.0	14.5	14.4	13.7	13.0	12.6	10.5
Animal and vegetable oils/fats	5.9	5.6	5.4	5.5	5.2	4.9	4.6	4.6	4.3	3.7
Sugar	3.5	3.5	3.4	3.2	3.0	2.8	2.7	2.5	2.2	1.7
Prepared and preserved fruits/vegetables	0.4	0.5	0.4	0.5	0.4	0.5	0.5	0.5	0.5	0.5
Dairy products	2.2	2.1	2.2	2.3	2.1	2.0	2.1	2.0	2.1	1.9
Other food products	13.4	12.8	12.4	11.9	11.4	11.5	11.0	10.6	9.7	8.3
Beverages	0.8	0.9	1.0	1.0	1.0	0.9	1.0	0.9	0.9	0.9
Food products	**42.1**	**41.5**	**41.6**	**41.3**	**39.5**	**39.1**	**37.5**	**36.0**	**34.2**	**29.3**
Tobacco	2.1	2.1	2.0	1.9	2.0	1.8	1.9	1.9	1.7	1.5
Textiles	1.1	1.2	1.5	1.5	1.5	1.4	1.3	1.5	1.3	1.3
Clothing and furs	4.4	5.1	5.1	4.9	5.3	4.9	5.4	5.3	5.5	5.6
Leather products	1.8	1.7	1.7	2.0	1.9	2.0	2.0	2.1	2.4	2.6
Lumber	0.3	0.8	0.7	0.9	0.8	1.0	0.9	0.8	0.7	0.7
Paper and paper products, including publishing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oil processing	0.9	0.8	0.8	1.0	0.9	1.2	1.3	1.8	2.1	2.4
Other chemical materials	4.2	4.5	4.5	4.7	4.5	4.6	4.5	4.5	4.4	4.4
Non-metallic minerals	0.6	0.4	0.7	0.8	0.7	0.6	0.9	0.9	0.7	0.7
Ferrous metals	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.1	0.1	0.0
Non-ferrous metals	0.5	0.8	0.6	0.5	0.7	0.5	0.6	0.5	0.5	0.8
Machinery and equipments	1.3	1.3	1.5	1.6	2.1	1.6	2.0	2.6	2.4	4.5
Other industrial products, including recycling	4.1	3.3	2.7	2.9	3.2	3.5	3.6	3.4	3.8	4.5
Non-food manufatured products	**21.4**	**22.1**	**21.6**	**22.7**	**23.7**	**23.2**	**24.4**	**25.3**	**25.6**	**29.1**
Electricity, gas and steam	3.1	3.1	3.1	3.0	3.0	2.9	2.9	2.8	2.7	2.5
Water supply	0.6	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.5	0.5
Construction	2.4	2.2	1.7	1.3	1.7	1.7	1.9	2.2	2.5	3.2
Trade	5.1	5.7	6.2	6.0	6.2	6.2	6.8	7.6	7.9	8.6
Transportations	3.3	3.1	3.4	3.3	3.7	3.6	3.9	3.7	3.9	3.8
Post and communication	1.7	2.0	1.9	2.1	2.2	2.4	2.4	2.5	2.6	3.1
Education	1.1	0.9	1.2	1.2	1.0	1.2	1.4	1.6	1.7	1.4

Table 5.6 continues

Real estate and business services	0.1	0.0	0.2	0.1	0.1	0.5	0.7	0.4	0.4	1.3
Health and social assistance	1.2	1.5	1.3	1.5	1.4	1.9	1.8	1.8	2.4	2.6
Other services	2.2	2.7	2.6	2.8	3.2	3.2	3.1	3.5	3.7	3.9
Services	**20.7**	**21.6**	**21.9**	**21.7**	**23.0**	**24.0**	**25.4**	**26.7**	**28.2**	**31.1**
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Rural households										
Sectors	Decile 1 (0-10%)	Decile 2 (11-20%)	Decile 3 (21-30%)	Decile 4 (31-40%)	Decile 5 (41-50%)	Decile 6 (51-60%)	Decile 7 (61-70%)	Decile 8 (71-80%)	Decile 9 (81-90%)	Decile 10 (91-100%)
Agriculture	**14.6**	**13.9**	**13.8**	**13.1**	**12.2**	**12.4**	**11.1**	**10.7**	**10.3**	**8.5**
Fishery	1.7	1.5	2.0	1.9	1.8	2.1	2.2	2.1	2.1	1.8
Meat and meat products	14.6	14.4	14.5	14.6	14.1	14.1	13.3	12.6	12.4	10.3
Animal and vegetable oils/fats	5.7	5.3	5.0	5.3	4.6	4.7	4.4	4.4	4.1	3.6
Sugar	4.3	4.1	3.9	3.7	3.5	3.5	3.4	3.2	2.9	2.3
Prepared and preserved fruits/vegetables	0.5	0.5	0.4	0.5	0.4	0.4	0.4	0.4	0.4	0.3
Dairy products	1.3	1.5	1.4	1.2	1.2	1.2	1.2	1.2	1.1	1.0
Other food products	13.9	12.7	12.2	12.1	11.3	11.6	11.4	10.7	10.0	8.6
Beverages	0.9	1.0	0.9	1.1	1.0	1.0	1.1	1.0	1.0	0.9
Food products	**42.9**	**41.0**	**40.3**	**40.6**	**38.0**	**38.5**	**37.4**	**35.5**	**33.9**	**28.8**
Tobacco	2.3	2.2	2.2	2.1	2.2	1.9	2.0	1.9	2.0	1.6
Textiles	1.2	1.2	1.6	1.7	1.7	1.4	1.0	2.1	1.6	1.6
Clothing and furs	4.4	5.4	5.5	5.2	5.8	5.3	6.1	5.7	6.1	5.9
Leather products	2.1	1.6	1.7	2.1	2.0	1.9	2.0	2.2	2.6	2.4
Lumber	0.7	1.4	1.2	1.7	1.6	2.0	1.8	1.6	1.6	2.0
Paper and paper products, including publishing	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oil processing	0.6	0.7	0.9	1.0	0.9	1.1	1.2	2.0	1.9	2.2
Other chemical materials	4.6	5.0	4.8	5.2	5.2	5.0	5.3	5.2	4.9	4.8
Non-metallic minerals	0.7	0.5	0.8	0.9	0.9	0.6	1.0	1.4	0.9	0.8
Ferrous metals	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.1	0.2	0.1
Non-ferrous metals	0.2	0.8	0.9	0.4	1.1	0.6	0.6	0.4	0.6	0.8
Machinery and equipments	1.9	1.3	1.9	2.1	2.0	2.3	2.2	2.9	3.2	5.9
Other industrial products, including recycling	4.1	3.9	3.3	2.9	3.4	4.1	3.9	4.0	4.7	5.7
Non-food manufatured products	**22.6**	**24.1**	**24.9**	**25.5**	**26.8**	**26.4**	**27.2**	**29.6**	**30.2**	**33.8**
Electricity, gas and steam	3.2	3.0	3.1	3.1	3.1	3.0	3.2	2.8	2.9	2.9
Water supply	0.3	0.2	0.2	0.2	0.3	0.2	0.3	0.3	0.3	0.3
Construction	2.8	2.4	1.5	1.5	1.9	1.8	2.0	2.5	2.4	3.4

Table 5.6 continues

Trade	5.5	6.2	6.4	6.5	6.6	6.0	7.3	7.2	7.5	8.2
Transportations	2.8	3.0	3.1	3.1	3.2	3.4	3.3	3.1	3.4	3.3
Post and communication	1.1	1.6	1.7	1.7	1.8	2.1	2.1	2.1	2.2	2.8
Education	0.8	0.9	1.1	0.9	1.1	1.2	1.2	1.0	1.1	1.0
Real estate business services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Health and social assistance	1.3	1.3	1.6	1.2	1.7	1.7	1.8	1.7	2.5	3.0
Other services	2.0	2.5	2.3	2.7	3.3	3.2	3.1	3.4	3.3	4.0
Services	**19.8**	**21.0**	**20.9**	**20.8**	**23.0**	**22.7**	**24.3**	**24.1**	**25.6**	**28.9**
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Urban households

Sectors	Decile 1 (0-10%)	Decile 2 (11-20%)	Decile 3 (21-30%)	Decile 4 (31-40%)	Decile 5 (41-50%)	Decile 6 (51-60%)	Decile 7 (61-70%)	Decile 8 (71-80%)	Decile 9 (81-90%)	Decile 10 (91-100%)
Agriculture	**16.7**	**15.9**	**16.2**	**15.4**	**15.2**	**14.8**	**13.9**	**12.8**	**12.8**	**11.5**
Fishery	1.4	1.6	1.8	1.7	2.0	1.9	1.8	1.8	1.7	1.7
Meat and meat products	14.1	14.8	15.2	15.4	15.0	14.7	14.0	13.2	12.8	10.6
Animal and vegetable oils/fats	6.0	6.0	5.9	5.7	5.7	5.0	4.8	4.7	4.4	3.7
Sugar	2.8	2.8	2.8	2.7	2.5	2.3	2.2	2.1	1.9	1.5
Prepared and preserved fruits/vegetables	0.4	0.4	0.5	0.4	0.5	0.6	0.5	0.6	0.6	0.5
Dairy products	3.0	2.9	3.2	3.4	2.9	2.8	2.8	2.6	2.7	2.3
Other food products	12.9	12.8	12.6	11.7	11.5	11.4	10.7	10.5	9.6	8.2
Beverages	0.7	0.8	1.0	1.0	0.9	0.9	0.9	0.8	0.8	0.9
Food products	**41.4**	**42.2**	**43.0**	**42.0**	**41.0**	**39.6**	**37.5**	**36.3**	**34.4**	**29.5**
Tobacco	1.9	1.8	1.7	1.6	1.8	1.7	1.8	1.8	1.6	1.5
Textiles	1.1	1.3	1.3	1.3	1.4	1.5	1.5	1.0	1.2	1.2
Clothing and furs	4.5	4.7	4.5	4.6	4.8	4.6	4.8	5.0	5.2	5.5
Leather products	1.6	1.9	1.7	1.8	1.8	2.1	2.1	2.1	2.3	2.7
Lumber	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2
Paper and paper products, including publiching	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Oil processing	1.1	0.9	0.7	1.0	0.8	1.3	1.5	1.6	2.2	2.5
Other chemical materials	3.8	3.9	4.1	4.2	4.0	4.2	4.0	4.1	4.2	4.2
Non-metallic minerals	0.6	0.4	0.5	0.6	0.5	0.6	0.7	0.5	0.6	0.7
Ferrous metals	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0
Non-ferrous metals	0.7	0.7	0.3	0.7	0.4	0.3	0.6	0.6	0.4	0.8
Machinery and equipments	0.8	1.2	1.0	1.1	2.1	1.0	1.8	2.3	2.0	3.9
Other industrial products, including recycling	4.2	2.7	2.0	2.8	3.0	3.0	3.3	2.9	3.3	4.0

Table 5.6 continues

Non-food manufatured products	**20.4**	**19.6**	**17.8**	**19.9**	**20.8**	**20.6**	**22.3**	**22.4**	**23.2**	**27.1**
Electricity, gas and steam	3.1	3.2	3.1	3.0	2.9	2.8	2.7	2.9	2.5	2.4
Water supply	0.8	0.7	0.7	0.7	0.7	0.6	0.7	0.8	0.7	0.6
Construction	2.1	2.0	2.0	1.2	1.5	1.5	1.9	2.0	2.5	3.1
Trade	4.8	5.1	5.9	5.4	5.9	6.3	6.5	7.9	8.1	8.7
Transportations	3.7	3.3	3.7	3.4	4.0	3.9	4.3	4.0	4.1	4.1
Post and communication	2.1	2.5	2.0	2.4	2.5	2.7	2.6	2.9	2.8	3.3
Education	1.3	0.9	1.3	1.6	1.0	1.2	1.5	2.0	2.0	1.6
Real estate and business services	0.1	0.1	0.5	0.3	0.2	0.9	1.2	0.6	0.6	1.9
Health and social assistance	1.2	1.7	0.9	1.9	1.1	2.0	1.8	1.8	2.3	2.5
Other services	2.4	3.0	2.9	2.8	3.0	3.1	3.0	3.5	3.9	3.9
Services	**21.5**	**22.4**	**23.0**	**22.7**	**23.0**	**25.0**	**26.2**	**28.5**	**29.6**	**32.0**
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: Author's elaboration based on data from HBS 2006

and services.[68] As expected, food products together with agricultural products are much more important element of consumption expenditure for the households belonging to the poorest decile. In line with Engel's Law the share of expenditures on these products in the overall consumption budget shrink as households become richer. Specifically, food and agricultural products together accounts for more than 57.8 percent of consumption expenditure of the households in the 1st decile, but the same figure is only 39.9 percent in the 10th decile. In contrast, increasing upward trend is observable in expenditures on services and non-food manufacturing products, as we move from the poorest to the richest decile. In particular, for the poorest households, non-food manufacturing products and services accounts for 21.8 and 21.2 percent of their total consumption expenditure, respectively, compared with 29.1 and 31.1 percent for the wealthiest households.

The same general patterns in consumption expenditures also hold in rural and urban households when we move along the deciles. However, due to the fact that rural households have direct access to agricultural products, they have a relatively lower share of expenditure on agricultural products than do those living in urban areas. Regarding the expenditure share on food products, there are only marginal differences between rural and urban households over the deciles. Lastly, rural households spend a larger share of their consumption budget on manufacturing non-food items than do urban households, whereas urban households spend a larger share of their consumption budget on various services than do their rural counterparts.

5.4.2 Poverty profile

The overall picture of poverty in Azerbaijan for the reference year reveals that, around 18.4 percent of the country's population lives below the national poverty line set by the AzSTAT at AZN 57 per capita per month. This constitutes the two dollars-a-day poverty line, widely used by the World Bank. The individuals living in rural areas have a higher risk of being poor than do urban dwellers. In particular, the poverty rate is 9.0 percent in urban areas, whereas it reaches 29.3 percent in rural areas. One of the major causes of pervasive poverty in rural areas is the fact that nearly one million refugees as a consequence of military conflict with neighboring Armenia have been provisionally relocated in rural areas and have limited employment opportunities. However, the survey shows that the majority of poor people live fairly close to the poverty line, with the national level of poverty gap/depth being only 2.9 percent. This fact indicates that even marginal changes in the real income of the poor can push

[68] Given the large number of commodities, we have categorized these commodities into four main groups.

them above the poverty line. The poverty gap is shallower in urban areas, only 1.2 percent, in comparison to 4.9 percent in rural areas. Finally, turning to the last FGT index—poverty severity—it appears that the inequality among the poor is quite moderate, at only 0.8 percent (national level). Nonetheless, there is a large contrast in the inequality among the poor living in urban and rural areas. More specifically, the poverty severity index is 1.3 percent in rural areas and only 0.2 percent in urban areas.

5.4.3 Structure of production and external trade

This section presents the contribution of various production sectors to Azerbaijan's gross domestic output and foreign trade as found in the compiled final SAM, as shown in Table 5.7. The nation's economy appears to be dominated by the oil and gas extraction and oil processing sectors. The contribution of these two sectors accounts for more than 44.2 percent of the nation's gross domestic output. Most of the revenue gained from these sectors is used to finance various infrastructure projects. In turn, this increased the economic importance of the construction sector, making it the second largest contributor to gross domestic output, with a figure of 13.2 percent. The next important contributor to total domestic output is the agricultural sector, with a 5.4 percent share. The contribution of other sectors to domestic output is relatively small and ranges from 0.01 to 5.2 percent.

In terms of trade flows, the data shows that Azerbaijan is highly dependent on foreign trade, with 42.0 percent of the total domestic output destined for export markets. Meanwhile, of the total goods and services available in the domestic market, 32.0 percent is imported. There are considerable differences in imports and exports across sectors. As revealed in Table 5.7, Azerbaijan has a low degree of export diversification; more than 90.0 percent of total exports are concentrated in the oil and gas extraction and oil processing sectors. These two sectors also post the highest overall export intensity ratios, with 88.9 and 85.6 percent of the total output of the oil processing and oil and gas extraction sectors being exported. Neither of the remaining sectors, by itself, represents more than 1.7 percent of total exports. Other important export-intensive sectors of the economy include beverages, tobacco products, animal and vegetable oils/fats, and machinery and equipments, with 64.4, 57.0, 53.9, and 48.6 percent, respectively, of the output being exported.

On the import side, around 63.9 percent of total imports are concentrated in machinery and equipments, representing almost 94.1 percent of domestic demand (import intensity). This is because growth in the oil and gas extraction/processing industries as well as in the

construction services requires high-tech machinery and equipments, which are mainly imported. Other import sectors in order of importance are agriculture, clothing and furs, other industrial products (including recycling), and oil processing, with figures of 4.4, 3.4, 3.4, and 3.1 percent, respectively. Obviously, imports are more diversified than exports.

TABLE 5.7: Foreign trade and production, in percentage

Sectors	Output	Exports		Imports	
	share	share	intensity[a]	share	intensity[b]
Agriculture	5.4	1.6	12.1	4.4	20.0
Fishery	0.4	0.0	0.3	0.0	1.3
Oil and gas extraction	37.8	77.0	85.6	1.0	5.0
Other minerals	0.1	0.0	12.5	0.7	63.1
Meat and meat products	1.1	0.0	0.7	0.5	11.3
Animal and vegetable oils/fats	0.1	0.1	53.9	1.2	82.2
Sugar	0.3	0.0	0.0	1.8	61.4
Prepared and preserved fruits/vegetables	0.2	0.2	41.5	0.2	33.1
Dairy products	0.8	0.0	0.0	0.0	0.0
Other food products	3.3	0.2	2.8	0.8	6.2
Beverages	0.7	1.0	64.4	0.3	25.7
Tobacco products	0.1	0.2	57.0	1.5	85.5
Textiles	0.3	0.1	19.1	0.8	49.1
Clothing and furs	0.1	0.0	20.7	3.4	83.0
Leather products	0.0	0.0	2.9	1.3	81.3
Lumber	0.0	0.0	9.4	0.9	82.7
Paper and paper products, including publishing	0.2	0.0	5.7	0.6	50.0
Oil processing	6.4	13.6	88.9	3.1	53.3
Rubber and plastic	0.1	0.0	7.4	0.4	40.8
Other chemical products	0.9	0.6	31.8	2.7	53.2
Non-metallic minerals	0.7	0.0	2.1	1.2	30.7
Ferrous metals	0.9	0.0	0.0	1.7	32.4
Non-ferrous metals	0.8	0.2	9.3	0.0	1.4
Machinery and equipments	1.1	1.3	48.6	63.9	94.1
Other industrial products, including recycling	0.1	0.1	41.1	3.4	82.3
Electricity, gas and steam	1.9	0.1	2.9	1.3	16.3
Water supply	0.1	0.0	0.0	0.0	0.0
Construction	13.2	0.3	1.1	0.3	0.7
Trade	4.5	1.4	12.8	0.5	3.1
Transportations	5.2	1.7	13.9	0.4	2.3
Post and communication	1.7	0.0	0.0	0.1	1.2
Research and development	0.0	0.0	0.0	0.8	84.0
Education	2.0	0.0	0.0	0.0	0.0
Financial services	0.8	0.0	0.0	0.0	1.5
Real estate and business services	1.0	0.0	0.2	0.5	12.7
Public adminstration	3.1	0.0	0.0	0.0	0.0
Insurance and pension funds	0.1	0.0	0.0	0.0	0.5
Health and social assistance	1.5	0.0	0.0	0.0	0.0
Other services	2.8	0.0	0.0	0.2	1.6
TOTAL	**100**	**100**	**42.0**	**100**	**32.0**

Note: [a]Export intensity refers to the sector's export as a percentage of total domestic production. [b]Import intensity is the percentage share of import in total domestic consumption.

Source: Author's elaboration based on SAM 2006

Other than machinery and equipments sector that possesses the highest import intensity ratio in the economy—as we saw above—there are also high import intensity ratios in sectors such as tobacco products, research and development, clothing and furs, and lumber, with the figures of 85.5, 84.0, 83.0, and 82.7 percent, respectively.

Trade flows with CIS and non-CIS countries as well as applied tariff rates at *ad valorem* equivalence are presented in Table 5.8. It appears that Azerbaijan trades mostly with non-CIS countries, with 90.0 percent of its total exports going to these countries (export intensity to non-CIS countries), of which oil and gas extraction sector accounts for 81.1 percent and products of oil processing sector accounts for 14.4 percent. No other sectors account for more than a 1.5 percent share of total non-CIS exports. On the other hand, exports to CIS countries are amounted to a relatively lower 10.0 percent of total exports (export intensity to CIS countries), of which more than 39.8 percent constitutes oil and gas extraction sector. Furthermore, agriculture, machinery and equipments, and beverages are the next most important sectors, with 12.9, 10.0, and 9.9 percent shares in total exports to CIS countries. In terms of the export intensity ratio by trading destinations, the CIS countries claim the largest share of total export in the other minerals (99.4 percent), the clothes and furs (98.0 percent), the paper and paper products, including publishing (97.9 percent), and the animal and vegetable oils/fats (97.6 percent) sectors, whereas the largest shares of total exports in leather products (99.5 percent), non-ferrous metals (99.4 percent), oil processing (95.4 percent), and oil and gas extraction (94.8 percent) sectors goes to the non-CIS countries.

On the import side, more than 65.0 percent of Azerbaijan's total imports come from the non-CIS countries (import intensity from non-CIS countries), of which about 66.9 percent are the products of machinery and equipments sector. The next most important components in total imports from non-CIS countries are clothing and furs, other industrial products (including recycling), and other chemical products, with the shares of 5.1, 5.0, and 3.0 percent, respectively. Only 35.0 percent of total imports come from the CIS countries (import intensity from CIS countries). Machinery and equipments is by far also the largest element of imports from CIS, accounting for more than 58.4 percent of the total imports. Agriculture and oil processing sectors have the next largest shares of total imports from CIS, with figures of 9.6 and 6.8 percent, respectively. The CIS countries accounted for the largest share of total imports in oil and gas extraction (91.7 percent), lumber (82.4 percent), and oil processing (78.1 percent), whereas the largest share of total imports in clothing and furs (96.3 percent), leather products (96.0 percent), and other industrial products, including recycling (95.9

percent) are imported from non-CIS countries.

TABLE 5.8: Structure of trade by regions and applied tariff rates, in percentage

Sectors	Tariff rates	Exports to CIS		Exports to non-CIS		Imports from CIS		Imports from non-CIS	
		share	intensity	share	intensity	share	intensity	share	intensity
Agriculture	13.8	12.9	82.2	0.3	17.8	9.6	76.5	1.6	23.5
Fishery	7.6	0.0	81.2	0.0	18.8	0.0	75.9	0.0	24.1
Oil and gas extraction	0.0	39.8	5.2	81.1	94.8	2.7	91.7	0.1	8.3
Other minerals	2.9	0.4	99.4	0.0	0.6	0.7	33.0	0.7	67.0
Meat and meat products	14.9	0.2	82.8	0.0	17.2	0.3	22.7	0.6	77.3
Animal and vegetable oils/fats	13.0	1.3	97.6	0.0	2.4	1.5	44.4	1.0	55.6
Sugar	11.7	0.0	0.0	0.0	0.0	0.8	15.4	2.3	84.6
Prepared and preserved fruits/vegetables	14.5	1.3	71.6	0.1	28.4	0.4	71.4	0.1	28.6
Other food products	14.5	1.2	52.6	0.1	47.4	1.5	65.6	0.4	34.4
Beverages	33.1	9.9	96.0	0.0	4.0	0.7	75.8	0.1	24.2
Tobacco products	6.7	0.3	18.9	0.2	81.1	1.9	44.6	1.3	55.4
Textiles	13.1	0.8	68.8	0.0	31.2	0.4	18.4	1.0	81.6
Clothing and furs	15.0	0.3	98.0	0.0	2.0	0.4	3.7	5.1	96.3
Leather products	15.0	0.0	0.5	0.0	99.5	0.1	4.0	1.9	96.0
Lumber	12.3	0.0	40.2	0.0	59.8	2.1	82.4	0.2	17.6
Paper and paper products, including publishing	10.1	0.2	97.9	0.0	2.1	0.6	30.3	0.7	69.7
Oil processing	12.5	6.3	4.6	14.4	95.4	6.8	78.1	1.0	21.9
Rubber and plastic	7.8	0.1	27.9	0.0	72.1	0.3	31.5	0.4	68.5
Other chemical products	12.0	4.9	76.0	0.2	24.0	2.1	27.2	3.0	72.8
Non-metallic minerals	13.8	0.3	92.7	0.0	7.3	1.6	48.5	0.9	51.5
Ferrous metals	8.8	0.0	42.3	0.0	57.7	1.3	27.7	1.9	72.3
Non-ferrous metals	5.6	0.0	0.6	0.2	99.4	0.0	18.8	0.0	81.2
Machinery and equipments	4.5	10.0	78.6	0.3	21.4	58.4	32.0	66.9	68.0
Other industrial products, including recycling	14.0	1.1	89.9	0.0	10.1	0.4	4.1	5.0	95.9
Electricity, gas and steam	-	0.4	31.6	0.1	68.4	1.9	51.1	1.0	48.9
Construction	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trade	-	0.5	14.8	0.3	85.2	0.3	35.6	0.3	64.4
Transportations	-	3.4	24.5	1.2	75.5	0.5	38.3	0.4	61.7
Post and communication	-	4.2	23.9	1.5	76.1	0.7	60.0	0.2	40.0
Research and development	-	0.0	0.0	0.0	0.0	0.1	42.1	0.1	57.9
Financial services	-	0.0	0.0	0.0	0.0	0.9	38.4	0.8	61.6
Real estate and business services	-	0.0	0.0	0.0	0.0	0.1	38.2	0.0	61.8
Insurance and pension funds	-	0.0	25.6	0.0	74.4	0.6	39.1	0.5	60.9
Other services	-	0.0	0.0	0.0	0.0	0.3	38.1	0.3	61.9
TOTAL	**-**	**100**	**10.0**	**100**	**90.0**	**100**	**35.0**	**100**	**65.0**

Note: The table shows only these sectors in which imports/exports from/to the CIS and non-CIS countries occurs.

Source: Author's elaboration based on SAM 2006 and MacMap database

As to the rate of applied tariffs, it is apparent that the rates vary considerable across the

sectors, ranging from as low as 2.9 percent (for other minerlas) to as high as 33.1 percent (for beverages). Note that the tariffs apply only on imports from the non-CIS countries and tariffs on imports from the CIS countries are set to zero (due to the free trade area agreement mentioned earlier). Additionally, in contrast to other sectors, service sectors are not exposing to any tariffs.

5.4.4 Sectoral contrasts in income generation

The main contrast exists between those sectors whose production mostly generates value-added and the sectors with high intermediate use. As is shown in Table 5.9, the oil and gas extraction, education, agriculture, and health and social assistance sectors count 89.6, 75.4, 70.7, and 67.0 percent, respectively, of their production as value-added—the largest shares observed across all production sectors. Conversely, sectors such as prepared and preserved fruits/vegetables, electricity, gas and steam, tobacco products, and animal and vegetable oils/fats comprises mostly intermediate inputs, representing 84.5, 79.7, 79.1, and 78.0 percent, respectively, of their total production costs.

Furthermore, within value-added, an additional contrast can be made between payments to labor and capital. The sectors such as other minerals, sugar, textiles, and insurance and pension funds contribute the largest share of their value-added into labor, with figures of 68.7, 65.4, 55.9, and 54.2 percent, respectively. This underlines the fact that these are the most labor-intensive sectors of the economy. Unsurprisingly, the oil and gas extraction sector has the largest share of capital payments within the value-added, with a figure of 98.8 percent, highlighting this sector as a strongly capital-intensive sector of the economy. Other important capital-intensive sectors have been seen to be non-ferrous metals, other food products, and animal and vegetable oils/fats, where 94.8, 92.8, and 89.3 percent, respectively, of their value-added is generated from capital rents. It is also interesting to note that against our intuition based on the economic knowledge, the IO table for Azerbaijan classifies more than 80.7 percent of the value-added in agriculture sector to capital, which indicates that this sector could be also counted as a capital-intensive sector of the economy.[69] There are two possible explanations for this phenomenon. First, the largest share of agricultural producers in Azerbaijan (around 85 percent, according to statistics from the Ministry of Economy and Industry) are small family farmers; thus, the vast majority of labor in agriculture is self-

[69] A similar phenomenon is also observed in other former Soviet Union member states. For instance, the share of capital rent within the value-added in the agricultural sector is around 70.1 percent in Ukraine (see Frey and Olesyuk, 2011) and 73.0 percent in Russia (see Jensen et al., 2004).

TABLE 5.9: Structure of value-added and intermediate use, in percentage

Sectors	Intensity					
	Intermediate use[a]	Value-added[b]	Capital[c]	Labor[d]	Skilled Labor[e]	Unskilled Labor[f]
Agriculture	29.3	70.7	80.7	19.3	15.9	84.1
Forestry	61.1	38.9	76.2	23.8	1.8	98.2
Fishery	41.0	59.0	61.5	38.5	1.7	98.3
Oil and gas extraction	10.4	89.6	98.8	1.2	48.7	51.3
Other minerals	77.0	23.0	31.3	68.7	13.8	86.2
Meat and meat products	71.0	29.0	88.1	11.9	12.0	88.0
Animal and vegetable oils/fats	78.0	22.0	89.3	10.7	14.9	85.1
Sugar	61.7	38.3	34.6	65.4	18.2	81.8
Prepared and preserved fruits /vegetables	84.5	15.5	73.4	26.6	11.2	88.8
Dairy products	57.2	42.8	74.6	25.4	12.0	88.0
Other food products	75.4	24.6	92.8	7.2	18.2	81.8
Beverages	60.1	39.9	78.0	22.0	13.9	86.1
Tobacco products	79.1	20.9	59.9	40.1	12.9	87.1
Textiles	77.6	22.4	44.1	55.9	12.6	87.4
Clothing and furs	60.5	39.5	59.2	40.8	13.2	86.8
Leather products	60.9	39.1	82.4	17.6	12.4	87.6
Lumber	77.2	22.8	70.9	29.1	10.7	89.3
Paper and paper products, including publishing	59.0	41.0	69.3	30.7	17.6	82.4
Oil processing	69.6	30.4	85.4	14.6	16.3	83.7
Rubber and plastic	61.0	39.0	69.0	31.0	22.0	78.0
Other chemical products	69.6	30.4	49.7	50.3	20.7	79.3
Non-metallic minerals	62.0	38.0	88.6	11.4	14.0	86.0
Ferrous metals	76.2	23.8	58.2	41.8	14.4	85.6
Non-ferrous metals	71.3	28.7	94.8	5.2	14.8	85.2
Machinery and equipments	53.1	46.9	81.3	18.7	20.5	79.5
Other industrial products, including recycling	68.0	32.0	66.9	33.1	11.2	88.8
Electricity, gas and steam	79.7	20.3	55.3	44.7	48.5	51.5
Water supply	74.2	25.8	70.8	29.2	34.8	65.2
Construction	62.6	37.4	88.2	11.8	19.3	80.7
Trade	55.0	45.0	73.7	26.3	53.0	47.0
Transportations	59.2	40.8	78.2	21.8	44.7	55.3
Post and communication	47.8	52.2	66.1	33.9	56.3	43.7
Research and development	40.8	59.2	82.9	17.1	86.4	13.6
Education	24.6	75.4	74.9	25.1	85.0	15.0
Financial services	42.4	57.6	73.2	26.8	71.7	28.3
Real estate and business services	54.1	45.9	82.3	17.7	71.4	28.6
Public adminstration	42.3	57.7	67.1	32.9	71.4	28.6
Insurance and pension funds	46.2	53.8	45.8	54.2	50.8	49.2
Health and social assistance	33.0	67.0	82.0	18.0	74.4	25.6
Other services	41.8	58.2	70.4	29.6	66.4	33.6

Note: [a]Percentage share of intermediate use in output, [b]Percentage share of value-added in output, [c]Capital share in value-added, in percentage, [d]Labour share in value-added, in percentage, [e]Skilled labor share in total labor, in percentage, [f]Unskilled labor share in total labor, in percentage.

Source: Author's elaboration based on SAM 2006

employed and their compensations are classified in statistical documents as a return to capital rather than a return to labor. Second, since the IO table does not distinguish land as a separate production factor that is used mainly in the agriculture sector, remunerations to land are included in compensation to capital in the table.

Within the labor return, the data shows that the skilled labor intensity ratio is higher in service sectors. In this view, research and development, education, health and social assistance, and financial services can be counted as the most skilled labor-intensive sectors in the economy, respectively, generating 86.4, 85.0, 74.4, and 71.7 percent of their total labor compensation from skilled labor. On the other hand, sectors such as fishery, forestry, lumber, and prepared and preserved fruits/vegetables appears to be among the most unskilled labor-intensive activities in the economy, respectively, generating 98.3, 98.2, 89.3, and 88.8 percent of their total labor compensation from unskilled labor.

5.4.5 Important macroeconomic features of the economy

As mentioned above, Table 5.3 (macro-SAM) contains valuable information on macroeconomic features of the economy and some of them have been already discussed in the preceding subsections. In this subsection, however, we will discuss remaining important characteristics of Azerbaijan's economy for the reference year of our analysis. Due to the extensive supply of oil and gas extraction, and oil processing sectors' output to international markets, the country's current account balance is observed to be in surplus. This amounts to 24.7 percent of GDP. Government's total revenue is composed of 13.0 percent tariffs on imports, 17.6 percent indirect taxes on production, and 69.4 percent direct taxes on domestic institutions. Of the government budget, 65.4 percent is spent on consumption of various goods and services. The government budget balance is observed to be positive, meaning that in the reference year government made a positive savings, which amounts to 3.3 percent of its total revenue. The investment rate in the economy that includes both private and public investments is observed to be by around 45.0 percent. This extraordinary figure is largely due to investments in construction, and machinery and equipments sectors. Looking at the demand components of the economy, one can see that 55.3 percent of domestically available goods and services are consumed by the final consumers and the rest 44.7 percent is demanded by the economic activities in the form of intermediate goods. Of the economy-wide capital remunerations, 83.5 percent is distributed to the enterprises, whereas only 16.5 percent is allocated to households.

5.5 Concluding remarks

Using the variety of data sources and the most appropriate adjustment procedures, in this chapter, we have compiled a consistent database as a basis for implementation of the model outlined in Chapter 4.

In particular, for implementation of the AzCGE model, the unique SAM for the Azerbaijani economy was constructed. The constructed final SAM consists of 40 activities, 40 commodities, 3 factors of production, 1 enterprises, 1 households, 1 government, 1 savings–investment, and 2 rest of the world accounts. Further on, for realization of the micro-simulation model, the HBS data conducted by the AzSTAT was taken. This survey contains 15,062 households and 58,924 individuals. The remaining data that includes various behavioral parameters are either calibrated using the information from the SAM and the HBS (share and scale/efficiency parameters) or excerpted from the relevant economic literature (elasticity parameters). The year 2006 was chosen as the reference year because all essential data for the model were available for that year.

Lastly, in view of the assembled dataset, the descriptive statistics of reference year was presented, functional to understand the structure of the economy and characteristics of the population belonging to different social strata, in general, and the poor in particular.

6 POLICY SIMULATIONS AND EMPIRICAL RESULTS

Having developed the country-specific, multi-sectoral, and multi-household static CGE micro-simulation model with an endogenous poverty line and determined the benchmark equilibrium based on the assembled dataset, one can simulate certain policies by changing the properties of the model's exogenous variables and can quantify the direction and magnitude of the adjustments in the endogenous variables.

With this in mind, as a starting point in this chapter, we will lay out the counterfactual policy simulation scenarios based on the expected policy reforms that will accompany Azerbaijan's WTO accession. In the sequel, estimated or projected results from those simulation experiments will be discussed comprehensively. To provide the results in a structured and meaningful manner, we will trace in detail the impacts of simulation scenarios as follows: first, regarding important macroeconomic aggregates; second, regarding sectoral level variables; third, considering household level welfare; and fourth, regarding poverty incidence.

6.1 Counterfactual policy simulations

As indicated earlier in Chapter 2, tariff liberalization and agriculture subsidy reforms are policy changes that will likely accompany Azerbaijan's WTO membership and those changes in policies in fact forms the drivers of our counterfactual policy simulation scenarios. In particular, the study specifies the following simulation scenarios/experiments:

1) The first simulation scenario considers the reductions in import tariff rates $(tm_{i,d})$. Because the final commitment of reduction levels is not known with certainty at this instant of negotiations, this experiment is performed by lowering the tariff rates to half (a 50 percent reduction) of their initial levels for imports originating from non-CIS countries.[70] Azerbaijan's free trade agreement (FTA) with CIS countries will remain after WTO accession.

2) The second simulation scenario considers a reduction in domestic support measures for the agriculture sector. In the AzCGE, we do not explicitly model the subsidies and according to the model specification, subsidies are portrayed as negative (indirect)

[70] In light of the discussions from Chapter 2, in which we note that WTO working party members require Azerbaijan to undertake a considerable reduction in its tariff rates, lowering the tariff rates by half (hypothetically) could be seen as a more realistic application (approximation).

activity (production) taxes. Therefore, a reduction in agriculture subsidies is modeled as an increase in the net (indirect) activity tax rate for the agriculture sector (tp_i). Knowing the total amount of subsidies (approximately AZN 181.2 mln) and also the overall gross output in agricultural sector (AZN 1,449.9 mln) for the reference year of our analysis, it is straightforward to derive an expected reduction level in subsidies (equivalently an increase in activity tax rate). As discussed in Chapter 2, depending on the country's accession status (developing or developed), domestic agriculture policy regime would take a different reform path. Given that the question remains open regarding under which accession status Azerbaijan will join the WTO, we perform two alternative subscenarios:

- 2a) A first subscenario assumes that the country joins the WTO with developing country status. Thus, the overall subsidies to agriculture as a percent of gross agricultural output are intended to be cut by 20 percentage points from its baseline 12.5 percent level to make the level consistent with the WTO-defined 10 percent *de minimis* threshold. These reductions in support measures would bring about a new amount of net indirect taxes (approximately AZN 36.2 mln), which is equivalent to an increase in the indirect (production) tax rate for the agriculture sector from the contemporary 3.9 to the 6.4 percent level.
- 2b) A second subscenario assumes that the country joins the WTO with developed country status. This subscenario implies a relatively sharper reduction in domestic support measures to agriculture. In particular, agricultural subsidies as a percent of gross agricultural output are intended to be cut by 60 percentage points from its current 12.5 percent level to make the level consistent with the WTO-defined 5 percent *de minimis* threshold. Such a reduction would bring a relatively higher amount of new indirect taxes (approximately AZN 108.7 mln), which equivalently would mean an increase in indirect (production) tax rate for the agriculture sector from the existing 3.9 percent to the 11.4 percent level.

3) The final scenario incorporates all the previously discussed policy simulation experiments. Accordingly, we call this scenario a "full accession" simulation scenario. To account the impacts of being a WTO member under two alternative membership statuses, the study conducts following full accession scenarios:

- 3a) Full WTO accession with developing country status: combined simulation scenarios 1 and 2a.
- 3b) Full WTO accession with developed country status: combined simulation scenarios 1 and 2b.

6.2 Empirical results

The scenario-specific changes specified above have been applied as external shocks to the base run (or base year) equilibrium in the AzCGE model, for which the model has defined a new equilibrium situation for the economy.[71] The variations in the study relevant endogenous variables caused by those changes are then compared with the corresponding benchmark equilibrium variables (comparative static analysis). Because our model is static in nature, the results obtained from the simulation experiments should be interpreted as short- to medium-term impacts.

6.2.1 Macroeconomic impacts

In line with the first intention of the study, in this subsection, we discuss the impacts of the previously specified simulation experiments on major macroeconomic indicators. This provides an aggregate picture of the economy's response to policies. To present the results in a structured manner, we first discuss the outcomes of simulation scenarios 1, 2a and 2b (as different components of the WTO accession reform package) and then the outcomes of simulation scenarios 3a and 3b (as a complete package of reform policies).[72]

Table 6.1 presents the percentage changes in important macroeconomic aggregates from their corresponding base case values under the study-specified simulation scenarios. Column 1 of Table 6.1 presents the impacts of the tariff reduction scenario. As expected, this scenario immediately renders imports less expensive (i.e., import prices in domestic currency decreases), thereby stimulating the overall import demand that is estimated to increase by around 0.79 percent. Because the model excludes the "free lunch" effect in the economy by assuming that the current account balance is fixed, in reaction to increasing import demand, the real exchange rate tends to depreciate by around 0.96 percent, i.e., the domestic currency becomes cheaper in terms of the foreign currency.

[71] The zero profit conditions for all production sectors as well as the Walras's law have been accurately checked in all simulation exercises.

[72] In the following subsections, we track the same means of discussing the results.

TABLE 6.1: Macroeconomic impacts, in percentage changes

Macroeconomic aggregates	Tariff liberalization (sim 1)	Agriculture subsidy reform		WTO accession	
		Developing (sim 2a)	Developed (sim 2b)	Developing (sim 3a)	Developed (sim 3b)
GDP	0.04	0.00	-0.01	0.04	0.03
Consumer price index	-0.81	0.42	1.28	-0.39	0.46
Aggregate trade					
Overall imports	0.79	0.08	0.25	0.87	1.04
- Imports from CIS	-9.27	0.10	0.32	-9.17	-8.97
- Imports from ROW	5.90	0.07	0.21	5.97	6.11
Overall exports	0.38	0.05	0.16	0.43	0.54
- Exports to CIS	2.12	0.03	0.09	2.15	2.20
- Exports to ROW	0.19	0.06	0.17	0.24	0.35
Real exchange rate [a]	0.96	0.56	1.70	1.53	2.68
Production and demand					
Gross domestic output	0.03	0.02	0.05	0.05	0.08
Total domestic output delivered to local market	-0.28	0.00	0.01	-0.27	-0.27
Total domestic demand	0.91	-0.39	-1.18	0.52	-0.28
Total household consumption	2.27	-0.73	-2.21	1.52	0.01
Total investment	-0.78	0.30	0.88	-0.48	0.12
Return to factors					
Capital (on average across activities)[b]	0.82	0.35	1.06	1.18	1.89
Labor (on average across wage rates)	0.68	-0.03	-0.09	0.65	0.60
- Skilled labor	0.73	0.02	0.07	0.76	0.81
- Unskilled labor	0.62	-0.09	-0.26	0.54	0.38
Government revenue and savings					
Total government revenue	-5.25	1.66	5.02	-3.62	-0.30
Tariff revenue	-45.07	0.50	1.54	-44.80	-44.24
Government savings	-163.64	52.63	154.3	-106.16	4.63

Note: [a]A negative value indicates an appreciation whereas positive value means a depreciation.
[b]Given that the AzCGE model specifies capital as a sector-specific, the changes in return to capital are estimated for each of 40 production activity. However, to present economy-wide movement in return to capital, we compute a weighted average of capital returns across all production activities. Due to the fact that for our welfare assessment, we use on average return to capital rather than sector-specific capital returns (for the reason that is already discussed in Chapter 4), reporting the changes in average return to capital in the body of thesis is more suitable. Nevertheless, we also provide sectoral level changes in capital returns in Appendix V.
Source: Author's estimation based on AzCGE model

Clearly, the depreciation of the real exchange rate increases the competitive power of exports in external markets. Accordingly, aggregate export supply of the economy registers an increase, which is estimated to be as large as 0.38 percent. Given that in the base year SAM, aggregate exports are significantly higher than aggregate imports, a one-percent change in

aggregate imports leads to a less than one-percent change in aggregate exports in order to attain a balance in the economy's external account. This outlook explains why aggregate imports increase to a larger degree than aggregate exports in our simulation exercise. Further on, simulation results also shows a strong import reorientation. More specifically, due to tariff cuts, imports from CIS are estimated to decrease by 9.27 percent, whereas imports from ROW (non-CIS) are estimated to increase up to 5.90 percent. Such an outcome was expected because tariff liberalization applies only to imports from ROW, which in turn makes imports from ROW relatively cheaper compared to imports from CIS. On the other hand, exports to CIS are estimated to increase by around 2.12 percent, whereas exports to ROW are estimated to increase to a lesser extent by around 0.19 percent following tariff liberalization.

It is worthwhile to note that above finding, more explicitly, depreciation of the local currency seems to be in line with the conventional beliefs regarding the positive role of trade liberalization in the mitigation of the Dutch disease phenomenon within the economy. However, the extent to which depreciation affects the performance of economic activities (in particular, agriculture and manufacturing sectors) will be discussed extensively in the following subsection.

Meanwhile, the lower import prices resulting from cutting tariffs put the domestic producers at a disadvantage with respect to foreign suppliers in the local market. This in turn crowds domestic producers out of the local market, accordingly, total domestic output that is sold domestically decreases by approximately 0.28 percent. However, the gross domestic output is estimated to increase marginally by around 0.03 percent because the loss in domestic sales is reimbursed by a sufficiently higher rise in exports. The growing domestic output in turn contributes to higher demand for primary factors of production and under the assumption of constant nation-wide supply of those factors (i.e., inelastic capital, skilled and unskilled labor supply), an expansion in demand for production factors increases their respective prices (return to capital and labor) in the economy. In general, changes in factor returns (prices) are projected to be disproportional because of tariff liberalization. More specifically, the rate of return to capital (on average across sectors) is estimated to increase by 0.82 percent, which is more than that of the return to labor (on average across wage rates) that is estimated to increase by around 0.68 percent. It is also found that under a tariff reduction scenario, the economy-wide wage rate for skilled labor increases to a slightly higher degree than the wage rate for unskilled labor. More explicitly, according to our estimates, the wage rate for skilled labor increases by 0.73 percent, whereas the wage rate for unskilled labor increases by 0.62

percent. Such an outcome indicates that the economy absorbs skilled labor to a somewhat higher degree than unskilled labor because of lowering tariffs. Evidently, in contrast to the Stolper-Samuelson theorem, the return for all production factors increases as a result of tariff liberalization in our modeling exercise. Recalling the theorem, it was expected that the tariff liberalization would increase the return on the abundant factor in the economy (which is labor in our case), while making the other factor rewards worse off. There are at least three possible explanations for this contrasting result. First, we should keep in mind that the theorem does not hold as a general principle—as we have already seen from the discussion in Chapter 3.[73] Second, contrary to the theorem's full factor mobility assumption, we have sector-specific factors in our model, which indicates that the allocation of resources in the model is somehow limited (in post-simulation period). Third and most importantly, to represent the trade patterns of the country in a more realistic manner, we maintain the assumption of product differentiation by country of origin in domestic and export markets (i.e., we allow intra-industry trade) in contrast to the theorem's confined one-way trade property (inter-industry trade).

Reducing tariffs by half would also mean 45.07 percent less tariff revenue for the economy. Accordingly, this leads to a net revenue loss of the government, estimated to be as large as 5.25 percent. By assumption, government savings is endogenous to the model. Thus, to attain a balanced government budget, its savings (as a percentage of government's total revenue) decreases sharply by 163.64 percent.[74]

Given that the prices for domestic output that is sold domestically in combination with import prices form the domestic consumption prices in our model specification, the fall in import prices pass to domestic consumption prices. Therefore, the economy-wide consumption price index decreases by 0.81 percent. In turn, this stimulates overall domestic demand while increasing it by approximately 0.91 percent. The lower consumption prices coupled with higher factor returns result in an increase in total household consumption that is estimated to be as large as 2.27 percent. Conversely, total investment is expected to decrease by 0.78

[73] In line with the empirical literature that focuses on the *ex-post* evaluation of the Stolper-Samuelson theorem's predictions, the *ex-ante* evaluations also provide mixed results. In particular, while reviewing (briefly) the country-specific CGE studies, one can perceive that some studies found consistency with the theorem's predictions (e.g., see Cattaneo et al., 1999; Haddad et al., 2002; Bajo-Rubio and Gomez-Plana, 2005), whereas others found contrasting results (e.g., see Carneiro and Arbache, 2003; Naranpanawa et al., 2011; Acharya et al., 2012).

[74] As we have seen previously, the government savings is positive in the benchmark year (see Table 5.3) However, due to tariff liberalization its sign has changed to negative, implying that the government runs in a budget deficit.

percent because of a decline in the economy-wide total savings (according to the model's savings-driven specifications), which is primarily caused by a sharp fall in government savings. Finally, despite the negative changes in total investment, a slight improvement in overall net trade balance and a strong increase in total household consumption lead to a moderate raise in the country's overall GDP,[75] as large as 0.04 percent.

The macroeconomic impacts of lowering domestic support measures directed toward the agriculture sector under the two alternative simulation subscenarios 2a and 2b are reported in columns 2 and 3 of Table 6.1, respectively. According to the findings, subsidy cuts in the agriculture sector slightly increases gross domestic output by 0.02 (0.05) percent under simulation subscenario 2a (2b). Such an outcome indicates that an expansion in production sectors that experience growth is larger than a decline in the production of contracting sectors, primarily as a result of the allocation of resources into the more efficient sectors that are freed from contracting sectors. In turn, an expansion in domestic output requires a high-level technologies (such as various machinery and equipments[76]) and thus, imports tend to grow as large as 0.08 (0.25) percent in simulation subscenario 2a (2b). Again, under the fixed current account assumption, such a movement in the trade balance deteriorates the overall external balance of the country, which causes a depreciation in the real exchange rate by 0.56 (1.70) percent under simulation subscenario 2a (2b). In turn, this improves the competitiveness of domestic goods in international markets, thereby promoting exports. The magnitude of the expansion in aggregate exports is expected to be as large as 0.05 (0.16) percent under simulation subscenario 2a (2b).

With regard to the effects on trade flows across trading regions that are present in the model, the outcome of the simulation experiments shows that both imports and exports in all trading destinations experience a growth. In particular, imports from CIS (ROW) increase by 0.10 (0.07) percent and exports to CIS (ROW) increase by 0.03 (0.06) percent under simulation subscenario 2a. The same figures are found to be slightly higher under the implementation of simulation subscenario 2b.

Interestingly, our finding indicates that agriculture subsidy reforms could actually help to mitigate the negative effects of the Dutch disease via exchange rate depreciation. However,

[75] In the AzCGE model, the GDP from the final demand perspective is computed as follows: $GDP = \sum_i C_i + \sum_i G_i + \sum_i IN_i + \left[\sum_i E_i - \sum_i M_i \right]$.

[76] As we will see in the following subsection, machinery and equipments sector experience the largest import growth due to lowering agricultural subsidies.

how depreciation affects the performance of agriculture and manufacturing sectors will be discussed extensively in the following subsection.

As regard the adjustments in factor markets that are interesting in view of the welfare and poverty analysis, the subsidy reform scenarios produce mixed results. In particular, at the constant nation-wide supply of skilled and unskilled labor, the wage rate for skilled labor increases marginally by approximately 0.02 (0.07) percent, whereas the wage rate for unskilled labor decreases by 0.09 (0.26) percent in simulation subscenario 2a (2b). This outcome is not surprising and was expected. Due to the fact that the agriculture sector uses the significant share of its total labor demand from unskilled labor (as we have seen in Chapter 5), any negative shock to this sector would in turn most adversely affect wage rate for unskilled labor. The average wage rate across labor types is estimated to decline with the rate of 0.03 (0.09) percent in simulation subscenario 2a (2b). Further on, on average return to capital across all sectors is expected to increase by more than 0.35 (1.06) percent under simulation subscenario 2a (2b), which in turn indicates an expansion on demand for capital.

Because of the slight rise in imports collected tariff revenues are estimated to increase by 0.50 (1.54) percent under simulation subscenario 2a (2b). An increase in tariff revenues together with the savings from lifting agricultural subsidies result an increase in total revenue of the government by around 1.66 (5.02) percent under the implementation of simulation experiment 2a (2b). Since government savings is a function of total government revenue (i.e., if government revenue increases/decrease, its savings tend to increase/decrease), in subscenario 2a (2b) government savings increases by more than 52.63 (154.30) percent (as a percentage of government's total revenue).

Furthermore, a boost in the consumer price index of approximately 0.42 (1.28) percent induced by subsidy cuts depletes total domestic demand by 0.39 (1.18) percent under simulation subscenario 2a (2b). Accordingly, total household consumption tends to decrease as much as 0.73 (2.21) percent through the implementation of simulation experiment 2a (2b). However, total investment is estimated to increase by 0.30 percent under subscenario 2a and by 0.88 percent under subscenario 2b because of the increase in economy-wide savings (that primarily stems from the sharp rise in total government savings). In terms of the impact of simulation experiments on economy as a whole, a moderate and negative change in GDP is observed, with the estimated contraction of 0.01 percent in simulation subscenario 2b. This contraction occurs because the fall in total household consumption as a component of GDP formation is large enough to reimburse any positive effects stemming from the remaining

components. Notice that the GDP is not affected under implementation of simulation subscenario 2a. On the whole, the obtained results reveal that the magnitude of macroeconomic impacts is systematically higher in simulation subscenario 2b, in contrast to 2a.

Finally, columns 4 and 5 of Table 6.1 highlight the impacts of full accession simulation experiments on macroeconomic aggregates under two alternative subscenarios 3a and 3b, respectively. Given that those scenarios combine the effects of the previously discussed simulation experiments (1+2a≡3a and 1+2b≡3b), we will not repeat a discussion regarding the factors behind the changes due to simulations. The similar explanations of the upward and downward movements also apply in those simulation experiments. Nevertheless, we will concentrate our discussion on the inter-scenarios' similarities/differences in terms of macroeconomic impacts, which determine the final net outcome of the combined simulation experiments 3a and 3b.

The first observation indicates that when both reform policies are in place, tariff liberalization appears to be dominant regarding the impacts on trade flows. Under both experiments, the simulation exercise predicts growth in aggregate exports and imports. This occurs because under previously discussed simulation experiments aggregate imports and exports experience an expansion. In particular, simulation subscenario 3a (3b) leads to a 0.43 (0.54) percent increase in aggregate exports and a 0.87 (1.04) percent increase in aggregate imports, in association with real exchange rate depreciation of approximately 1.53 (2.68) percent. Disaggregating the results across trading regions reveal that imports from CIS decrease by 9.17 (8.97) percent, whereas imports from ROW increase by 5.97 (6.11) percent under the implementation of simulation subscenario 3a (3b). On the other hand, exports to CIS increase by around 2.15 (2.20) percent and exports to ROW increase by around 0.24 (0.35) percent under simulation subscenario 3a (3b).

Because the aggregate domestic output is projected to increase slightly under all above considered simulation scenarios, our combined subscenario 3a (3b) leads to a further rise in gross output as much as 0.05 (0.08) percent. However, domestic output that is delivered to the home market is expected to experience a decline by around 0.27 percent under simulation subscenarios 3a and also under 3b because of the dominant effect arising from the tariff liberalization scenario.

As far as the outcome of simulation experiments on the government budget concerned, it is found that government revenue from the savings together with the slight increase in tariff

revenues stemming from the subsidy reduction partially offsets the loss of government revenue that stems from the lowering tariffs. Thus, overall government revenue is observed to be less negatively affected under combined simulation subscenario 3a (3b), with a corresponding contraction rate of 3.62 (0.30) percent. It is also estimated that government savings (as a percentage of government total revenue) decreases under subscenario 3a (106.16 percent), whereas it increases under subscenario 3b (4.63 percent). Despite the fact that subsidy cut scenario results in an increase in tariff revenues, this increase is estimated to be relatively modest to outweigh the loss in tariff revenues brought by a tariff liberalization scenario. Hence, overall tariff revenue is projected to decrease by around 44.80 (44.24) percent under the full accession simulation experiment 3a (3b).

Due to dominant effects arising from the tariff liberalization scenario in determining the outcome of factor market adjustments, all factor prices are observed to be positively affected. In particular, it is expected that on average return to capital (across sectors) and labor (across labor types) would increase 1.18 (1.89) and 0.65 (0.60) percent, respectively, in simulation subscenario 3a (3b). Furthermore, according to the model estimates, the economy-wide wage rate for skilled and unskilled labor tends to increase 0.76 (0.81) and 0.54 (0.38) percent, respectively, under simulation subscenario 3a (3b).

In terms of the impacts of simulation subscenario 3a on patterns of domestic demand, it appears that the (negative/positive) effects stemming from the tariff liberalization scenario more than offsets the (positive/negative) effects stemming from the subsidy cut scenario (under 2a). However, the reverse effects hold when we look at the results from the simulation subscenario 3b. Hence, overall domestic demand is projected to grow by 0.52 percent under subscenario 3a, whereas the same variable appears to exhibit a contraction with the estimated figure of 0.28 percent under simulation subscenario 3b. Regarding the effects on investment demand, it is found that aggregate investment decreases as much as 0.48 percent in subscenario 3a, but increases as much as 0.12 percent in subscenario 3b. Moreover, total household consumption is estimated to increase by 1.52 (0.01) percent under the implementation of the subscenario 3a (3b) because of the dominant effects arising from the tariff liberalization scenario. Further on, consumer price index is estimated to decrease by 0.39 percent under simulation subscenario 3a, but to increase by around 0.46 percent under simulation subscenario 3b.

Lastly, we consider the combined impacts of simulation scenarios on GDP. According to our estimates, there is minimal but positive growth in GDP, with an estimated growth rate of 0.04

(0.03) percent under simulation subscenario 3a (3b). This result appeals to our intuition because tariff liberalization scenario produces relatively strong positive impact on GDP, in contrast to agriculture subsidy cut scenarios that produce a very slightly negative GDP growth effects.

All in all, above discussed findings indicate that the WTO accession would actually enhance economic growth regardless of the country's membership status.

6.2.2 Sectoral impacts

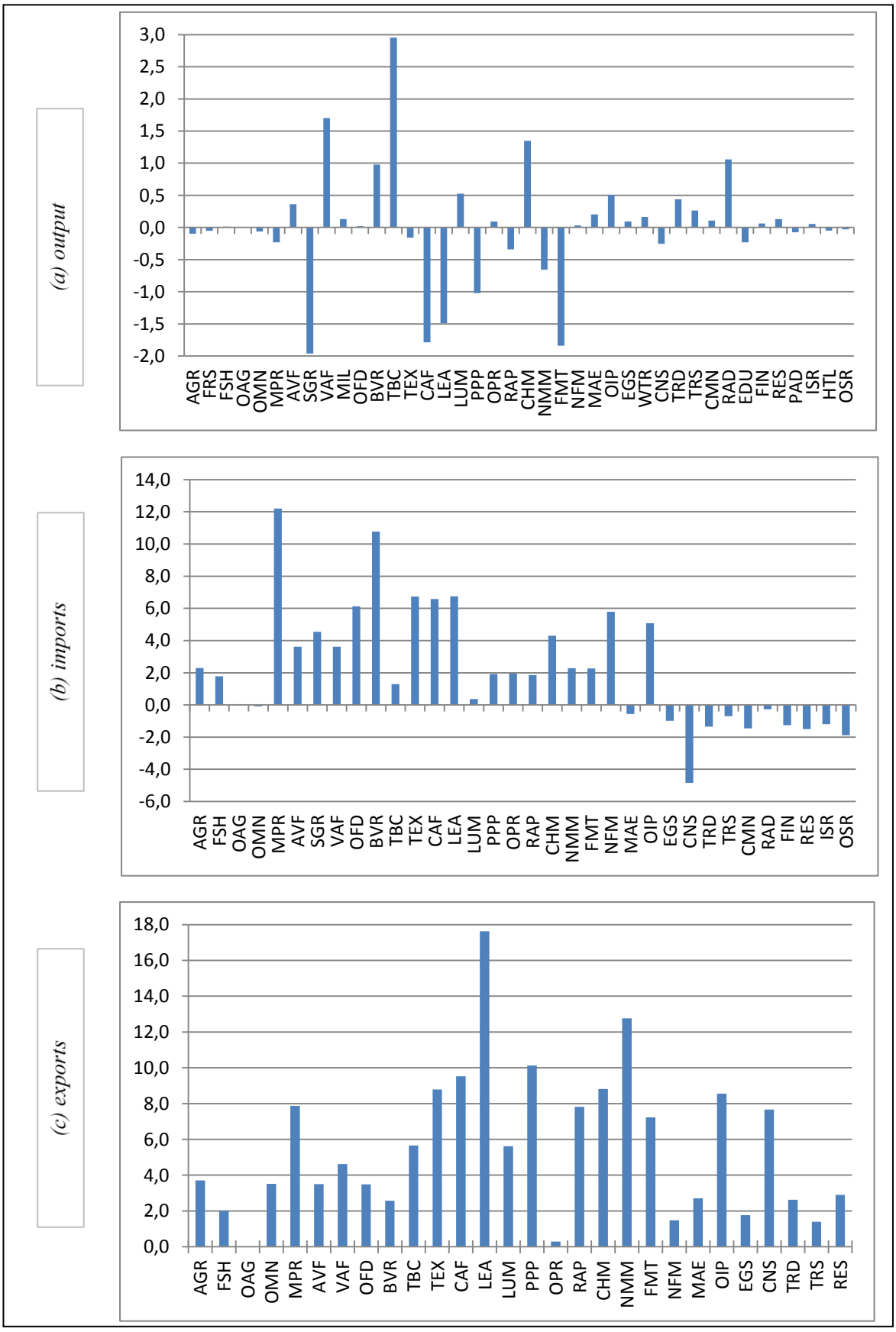
To deliver further insights regarding the impacts of study-specified simulation experiments, in this subsection, we break down the projected results into sectoral level effects. The considered policy simulations affect the performance of economic activities differently, depending on the characteristics of each particular activity. Given the central focus of the study, we limit the presentation and discussion of results explicitly in the main text to those highlighting how simulation scenarios affect the sectoral output, import, and export volumes.[77]

Figures 6.1 and 6.2 illustrate the variations in sectoral level variables (outputs, exports, and imports) following the tariff liberalization scenario, which is equivalent to percentage changes from their corresponding benchmark values. As expected, tariff liberalization leads to pronounced structural effects throughout the economy. Those sectors that are export-intensive and initially (relatively) unprotected through tariffs in comparison to other sectors are estimated to expand their production level following the liberalization in tariffs. This occurs because export-intensive sectors benefit more from the exchange rate depreciation and the relatively unprotected sectors face milder import competition in the domestic market following the lowering of tariffs. In addition, the sectors that use more intermediate inputs instead of value-added in the production process and the largest share of those intermediate inputs that constitute import-intensive goods (for which tariff cuts apply) are also estimated to expand their production level. This happens because these sectors experience a significant reduction in the cost of their intermediate inputs (due to cheaper imports) and this in turn stimulates their production.

The tobacco sector is expected to be the largest winner from the tariff liberalization scenario, with more than a 2.95 percent increase in output (Figure 6.1(a)). This result is not surprising because the tobacco sector is relatively least protected sector (in terms of tariff) and also the

[77] The sectoral level price effects (changes in output, import, and export prices by sectors) are given in Appendix VI.

FIGURE 6.1: Sectoral level results from tariff liberalization, in percentage changes



Source: Author's estimation based on AzCGE model

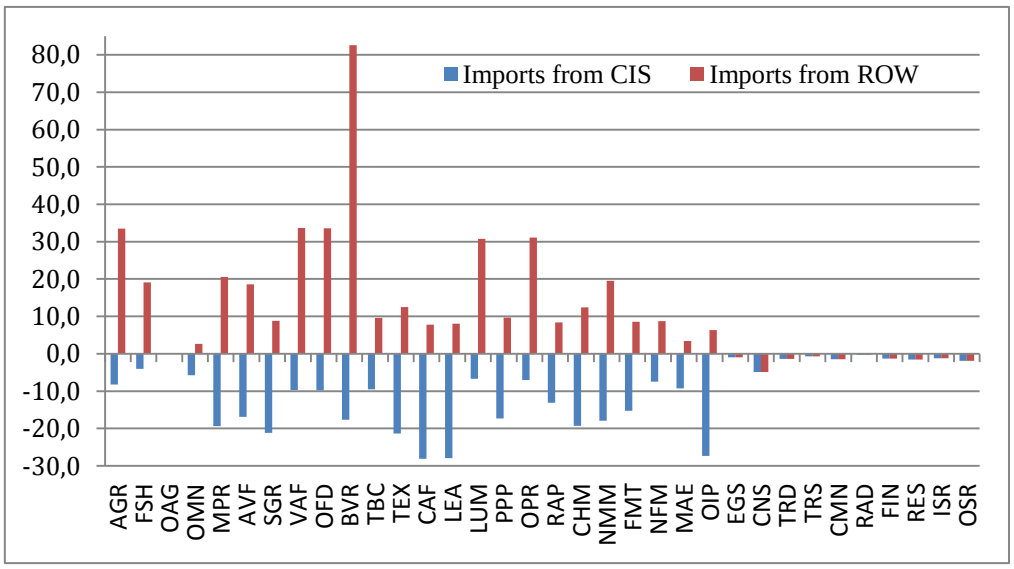
strongest export-intensive sector of the economy. Furthermore, sectors such as prepared and preserved fruits/vegetables, other chemical products, research and development, beverages, and lumber could also be counted as potential remarkable winners, with estimated output growth rates of 1.70, 1.35, 1.06, 0.98, and 0.53 percent, respectively. These results are attributed largely to the fact that the aforementioned sectors primarily use import-intensive goods as an intermediate input (which becomes cheaper due to liberalization in tariffs) in their production. Moreover, the fact that beverages, prepared and preserved fruits/vegetables, and other chemical products sectors are strongly export-intensive also contributes to the expansion in those sectors' production.

On the contrary, the sectors that initially enjoyed a relatively high protection level in terms of tariffs as well as supply either the entire or a significant share of their output to the domestic market (less export-intensive/import-competing sectors) is likely to experience a contraction in their production level (except that dairy products sector that experiences output growth[78]). This happens because a reduction in tariffs and the accompanied price decreases for imports markedly shrinks the competitive power of these sectors *vis-à-vis* foreign suppliers in the domestic market. Accordingly, substitution from domestically produced commodities toward imports in domestic demand occurs, which in turn translates into the contraction in those sectors' production level. This outlook explains the output fall in sugar, ferrous metals, clothes and furs, leather, and paper and paper products (including publishing sectors), with contraction rates of 1.96, 1.84, 1.79, 1.49, and 1.02 percent, respectively. These sectors are the most notable potential losers within the economy as a consequence of considered tariff reforms. Accompanying the changes in sectoral output arising from tariff liberalization, there are also changes in the import and export patterns of economic activities. Apart from the service sectors, all of the initially import-registered sectors from ROW (non-CIS countries) are estimated to experience a positive import growth (Figure 6.2). The sectors with relatively high protection rates in terms of tariffs undergo larger import price decreases and, accordingly, higher levels of import growth from ROW. On the other hand, imports from CIS are estimated to shrink in all initially import-registered sectors from not being able to compete

[78] At the benchmark year, zero import flow is registered for the dairy products sector, as we have seen in the preceding chapter. This implies that the dairy products sector does not face competition from foreign suppliers in the domestic market in pre- and post-simulation periods. Meanwhile, this sector reaps the benefits from cheaper imports due to liberalization in trade barriers and thus expands. Generally, in the CGE models, the sectors for which zero import flow are registered at the benchmark/reference year experience no trade effects in the post-simulation period, regardless of the degree of tariff cuts. This is the well-known "stuck on zero trade" problem that arises from employing the Armington method of modeling trade. For an extensive discussion on this issue, see Kauiper and Tongern (2006).

with cheaper imports from ROW.

FIGURE 6.2: The changes in import flows across trading partners from tariff liberalization, in percentage



Source: Author's estimation based on AzCGE model

The variations in import demand across ROW and CIS determine the net impact of the tariff liberalization scenario on aggregate imports. According to the outcomes of simulation exercise, aggregate import growth is observed in most initially import-registered sectors (Figure 6.1(b)). Sectors such as meat and meat products, beverages, leather, textiles, and clothes and furs register relatively high growth in aggregate imports, with estimated figures of 12.21, 10.77, 6.75, 6.72, and 6.59 percent, respectively. On the export side, it is found that the real exchange rate depreciation due to tariff liberalization encourages exports virtually in all initially export-recorded sectors. The most noteworthy increase in aggregate exports (CIS+ROW) is expected to occur in leather, non-metallic minerals, paper and paper products (including publishing), clothes and furs, and other chemical products sectors, with the corresponding figures of 17.63, 12.76, 10.13, 9.53, and 8.81 percent, respectively (Figure 6.1(c)). Similar patterns of export growth are also estimated to occur in exports to ROW and CIS.[79]

An interesting comment could be made regarding the patterns of the specialization driven by the trade liberalization scenario. Apparently, the sectors that benefit most from tariff liberalization are those in which capital is relatively more intensively employed. This result stands in contrast to the presumption of conventional trade theory (Heckscher-Ohlin

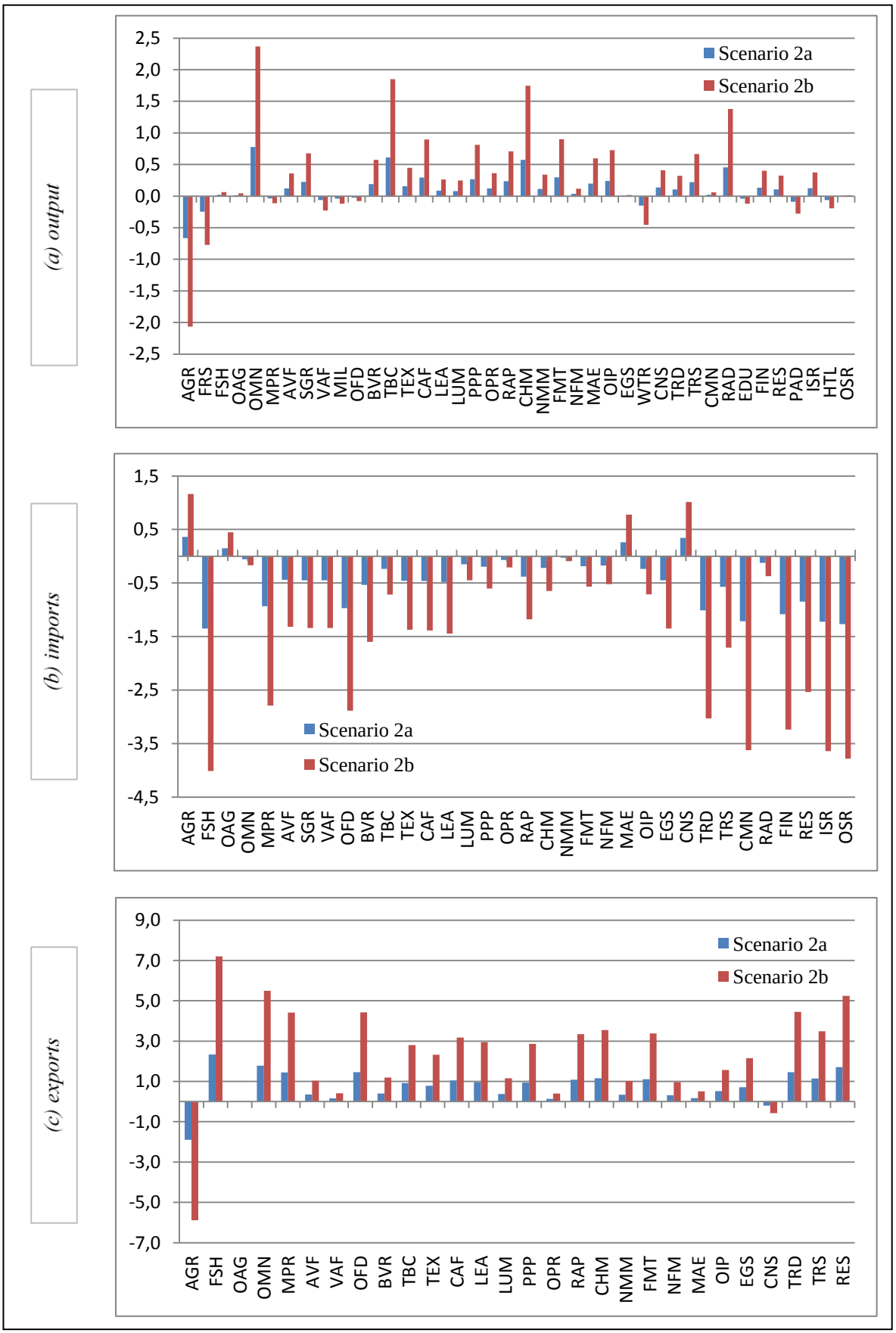
[79] For this reason, we do not present the changes in the sectoral level exports across trading destinations ROW and CIS. We also follow the same track whenever necessary in the following parts of this section.

paradigm), according to which liberalization in trade barriers should cause an expansion of sectors that employ intensively the relatively abundant factor in the economy (which is labor in Azerbaijan). On the other hand, what happens in those capital-intensive sectors is not consistent with what we observe in other capital-intensive sectors. For instance, clothes and furs and leather sectors are also capital-intensive sectors of the economy, but they experience a decline in their production level. This result, however, appears to be in accordance with the expectations of conventional trade theory. At the same time, in labor-intensive sectors, we also observe mixed results. For instance, the effects of tariff liberalization on production of textiles and sugar sectors move in opposite directions (namely, the textiles sector expands, but the sugar sector contracts). On the whole, our findings reveal that factor abundance does not grant a unique framework to interpret the outcomes of our trade liberalization exercise. This might, of course, be due to violation of the factor mobility assumption of the conventional trade theory in the AzCGE model. As indicated earlier, in the AzCGE model, capital is defined as sector-specific because of the limited time horizon of our analysis. Furthermore, this might also be due to maintaining the assumption of product differentiation by country of origin in domestic and export markets.

While trade liberalization leads to a contraction of some sectors of the economy (particularly, in non-tradable and domestic-oriented sectors), it creates a beneficiary situation for the export-intensive manufacturing sectors, mainly through real exchange rate depreciation. In fact, this is a good sign for the overall sustainable development of the economy and indeed works against the Dutch disease effect.

With respect to the simulation experiments 2a and 2b, Figure 6.3 illustrates the percentage changes in variables at the sectoral level (outputs, imports, and exports) from their corresponding base-year values. According to our estimates and as expected, a reduction in agricultural subsidies most adversely affects the agriculture sector. Due to the nature of used subsidies, i.e., production-related or cost-reducing subsidies, reduction scenarios (2a and 2b) immediately lead to an increase in the costs of production in the agriculture sector. The higher production costs inevitably result in a rise in the price of agriculture products, which in turn discourages demand for domestically produced agriculture goods both in the local and foreign markets. Accordingly, domestic agriculture suppliers adjust their production level downward by approximately 0.66 (2.06) percent under simulation subscenario 2a (2b) (Figure 6.3(a)). At the same time, the aggregate exports (CIS+ROW) of the agriculture sector are estimated to decrease by 1.90 (5.88) percent in simulation subscenario 2a (2b) (Figure 6.3(c)).

FIGURE 6.3: Sectoral level results from agriculture subsidy reforms, in percentage changes



Source: Author's estimation based on AzCGE model

A comparable acceleration of export contraction for the agriculture sector also occurs in exports to CIS and ROW. Further on, higher domestic output prices in agriculture render imports of those products less expensive, thereby leading to a demand shift on agriculture goods from domestically produced goods toward imports. Hence, the aggregate imports (CIS+ROW) of agriculture sector are estimated to increase by 0.36 (1.16) percent under simulation subscenario 2a (2b) (Figure 6.3(b)). A similar acceleration of import growth for the agriculture sector also occurs in imports from CIS and ROW.

Having discussed the projected effects of subsidy reform scenarios on performance of the agriculture sector, we now examine the corresponding spill-over effects of this policy shock on the remainder of the economic activities that are incorporated in the model. The stagnation in the agriculture sector generates forward-linkage effects, particularly for downstream food processing industries, which suffer from decreased supply and higher prices of agriculture input. This explains the generalized output contraction in prepared and preserved fruits/ vegetables, dairy products, meat and meat products, and other food products sectors, with contracting rates of 0.06 (0.23), 0.04 (0.12), 0.04 (0.11), and 0.02 (0.08) percent, respectively, under simulation experiment 2a (2b).[80] The stagnation in the agriculture sector also generates backward-linkage effects for some sectors of the economy, which suffer from decreased demand for their output. Given that the significant portion of forestry and water supply sectors' total output goes to the agriculture sector (as an intermediate input), these sectors experience a remarkable contraction in their output of approximately 0.25 (0.77) and 0.15 (0.45) percent, respectively, under simulation subscenario 2a (2b). On the other hand, virtually all sectors with no or relatively weak linkages to agriculture are estimated to expand their production level from subsidy cut scenarios. This happens because of several reasons. First, these sectors are (nearly) not affected (directly) from the negative trend in the agriculture sector. Second, they benefit from the higher supply and lower wage rate for unskilled labor as well as from the exchange rate depreciation. Among the largest estimated growers are other minerals, other chemical products, research and development, clothes and furs, and ferrous metals sectors, with an expected output growth of 0.78 (2.37), 0.57 (1.75), 0.45 (1.38), 0.30 (0.90), and 0.30 (0.90) percent, respectively, under simulation subscenario

[80] It is worthwhile to mentioning that some of the sectors to which agriculture has relatively strong forward-linkages are estimated to expand their production level (such as tobacco, sugar, and animal and vegetable oils/fats sectors). Such a positive outcome is noted because these sectors—except sugar—are relatively strong export-intensive sectors of the economy and thus significantly benefit from the exchange rate depreciation induced by subsidy cuts. Moreover, given that the sugar sector is strongly labor-intensive and the largest share of its labor demand constitutes unskilled labor, this sector significantly benefits from decreased wage rate for unskilled labor caused by the agriculture subsidy cuts.

2a (2b).[81]

Turning to the foreign trade effects, it is found that the scrolling down of subsidies results in a decrease in import volumes in most initially import-registered non-agriculture sectors, reflecting a reduction in domestic demand on imports. The highest aggregate import contraction, with figures of 1.35 (4.01), 1.27 (3.78), 1.22 (3.64), 1.21 (3.62), and 1.08 (3.24) percent, occur in fishery, other services, insurance and pension funds, other chemical products, and financial services sectors, respectively, under simulation subscenario 2a (2b). Nevertheless, exports in nearly all initially export-registered non-agriculture sectors are projected to expand because of the currency depreciation induced by a subsidy cut that makes domestically produced goods relatively less expensive compared to foreign suppliers' goods in external markets. The largest increase in aggregate exports is estimated to occur in fishery, other minerals, real estate and business services, trade, and other food products sectors, with the resultant growth rates of 2.33 (7.20), 1.79 (5.49), 1.71 (5.25), 1.46 (4.46), and 1.45 (4.42) percent, respectively, under simulation subscenario 2a (2b). The same patterns of changes in imports/exports also hold when we consider the effects of simulation experiments on imports/exports from/to CIS and ROW.

Although a reduction in subsidies hits the agriculture sector adversely, this scenario leads to an expansion in export-intensive manufacturing sectors, largely due to exchange rate depreciation. This points out that the considered reforms in agricultural policy regime could actually help to mitigate the negative effects of the Dutch disease in the export-oriented manufacturing sectors.

Overall, the direction of estimated impacts in simulation subscenario 2b is the same as that in subscenario 2a but with higher magnitudes. This indicates that the sectors experiencing an expansion (shrinkage) in their output, imports, and exports under simulation experiment 2a would grow (contract) with higher rates under the implication of simulation experiment 2b.

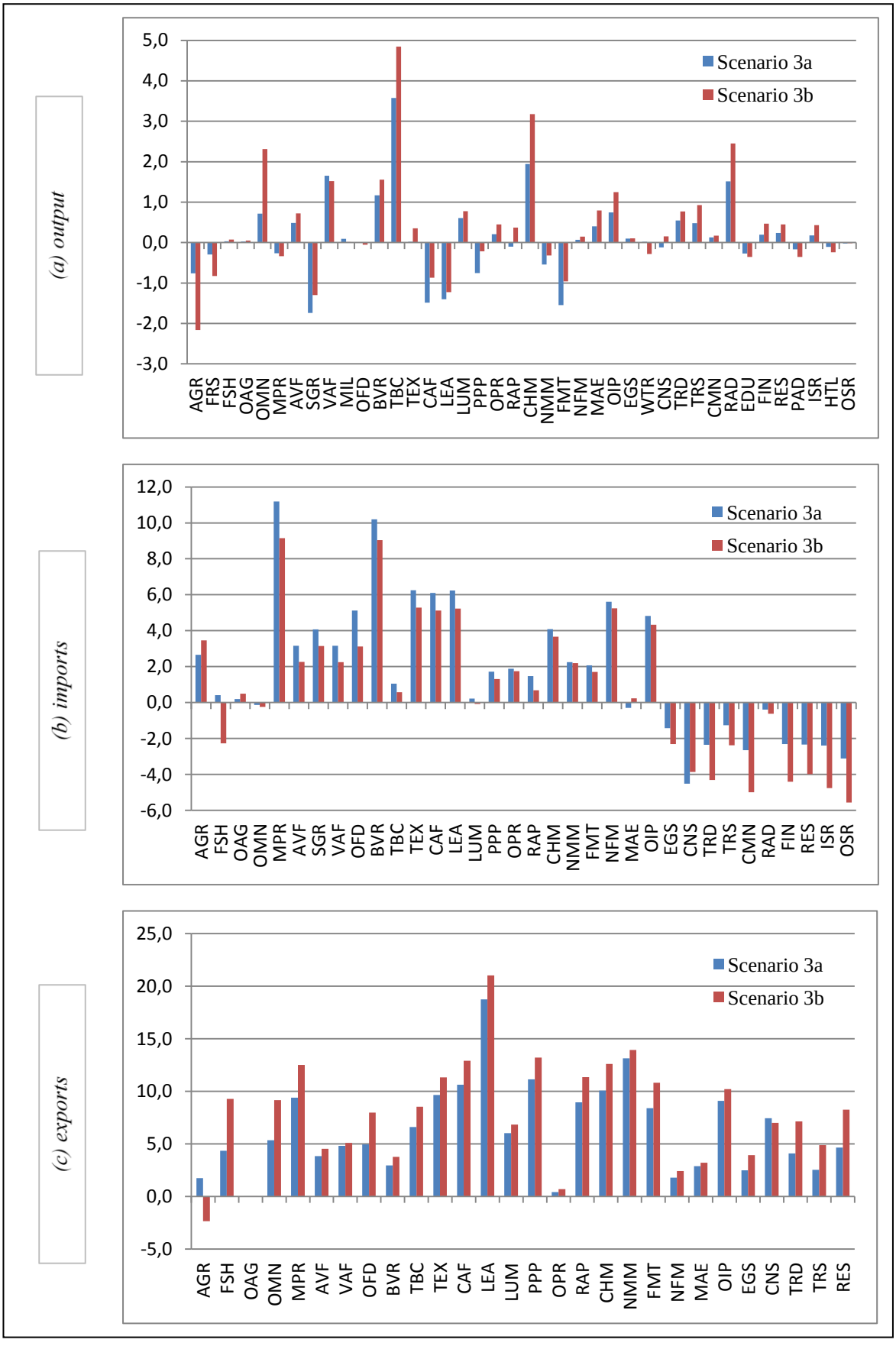
Lastly, Figures 6.4 and 6.5 provide a comprehensive picture concerning the changes in production level and trade flows by sectors as percentage variations from their corresponding benchmark values following the full accession scenarios 3a and 3b. The sectors for which an

[81] Interestingly, the incidence of output fall is projected to occur in few service sectors that have limited linkages to the agriculture sector (such as public administration, health and social assistance, and education sectors). These findings are noted mainly for two reasons. First, these are non-tradable sectors of the economy and, therefore, are unable to benefit from exchange rate depreciation. Second, an increase in wage rate for skilled labor significantly aggravates the (factor) cost structure in these sectors because they use skilled labor most intensively in their production process.

output expansion is recorded under previously discussed tariff and subsidy reduction scenarios are projected to be the remarkable growers under combined simulation experiments. Among those sectors, the most noteworthy output growth occurs in tobacco, other chemical products, prepared and preserved fruits/vegetables, research and development, and beverages sectors, with the estimated growth rates of 3.58 (4.85), 1.95 (3.17), 1.65 (1.52), 1.52 (2.45), and 1.17 (1.56) percent, respectively, under simulation subscenario 3a (3b) (Figure 6.4(a)). These findings indicate that aforementioned sectors are the largest potential winners from accession to the WTO within the Azerbaijani economy. Conversely, remarkable output contraction occurs in sugar, ferrous metals, clothes and furs sectors, and leather sectors, with estimated contraction rates of 1.74 (1.30), 1.55 (0.96), 1.48 (0.87), and 1.40 (1.23) percent, respectively, under simulation subscenario 3a (3b) because of the (negative) dominant effects stemming from the tariff liberalization scenario. Furthermore, the agriculture sector also exhibits a relatively strong contraction in its production level, estimated to be as large as 0.76 percent under simulation subscenario 3a and 2.17 percent under simulation subscenario 3b. This happens because agriculture sector experiences a contraction in its production level under all simulation experiments discussed above. Overall, those resulting sectoral level output contractions indicate that the aforementioned sectors are the largest potential losers from the WTO membership within the Azerbaijani economy.

While comparing the sectoral level output effects of two alternative full accession simulation scenarios, it can be verified that expected WTO membership under developed country status would generate a relatively stronger structural adjustments throughout the Azerbaijani economy in contrast to entering the WTO with developing country status. Because of the dominant effects stemming from the tariff liberalization scenario, aggregate import growth (CIS+ROW) in nearly all initially import-registered sectors are estimated, under full accession simulation scenarios 3a and 3b (Figure 6.4(b)). According to our estimates, the most notable import increase occurs in meat and meat products, beverages, textiles, leather, and clothes and furs sectors, with estimated growth rates of 11.18 (9.16), 10.19 (9.04), 6.25 (5.29), 6.24 (5.23), and 6.10 (5.12) percent, respectively, under simulation experiment 3a (3b). Disaggregating the results show that imports from CIS shrinks, while imports from ROW expands in most import-registered sectors again due to dominant effects created by the tariff liberalization scenario (Figure 6.5(a) and (b)). Apart from the agriculture sector, all initially export-registered sectors are estimated to experience an increase in their aggregate exports (CIS+ROW) under full accession simulation scenarios (Figure 6.4(c)).

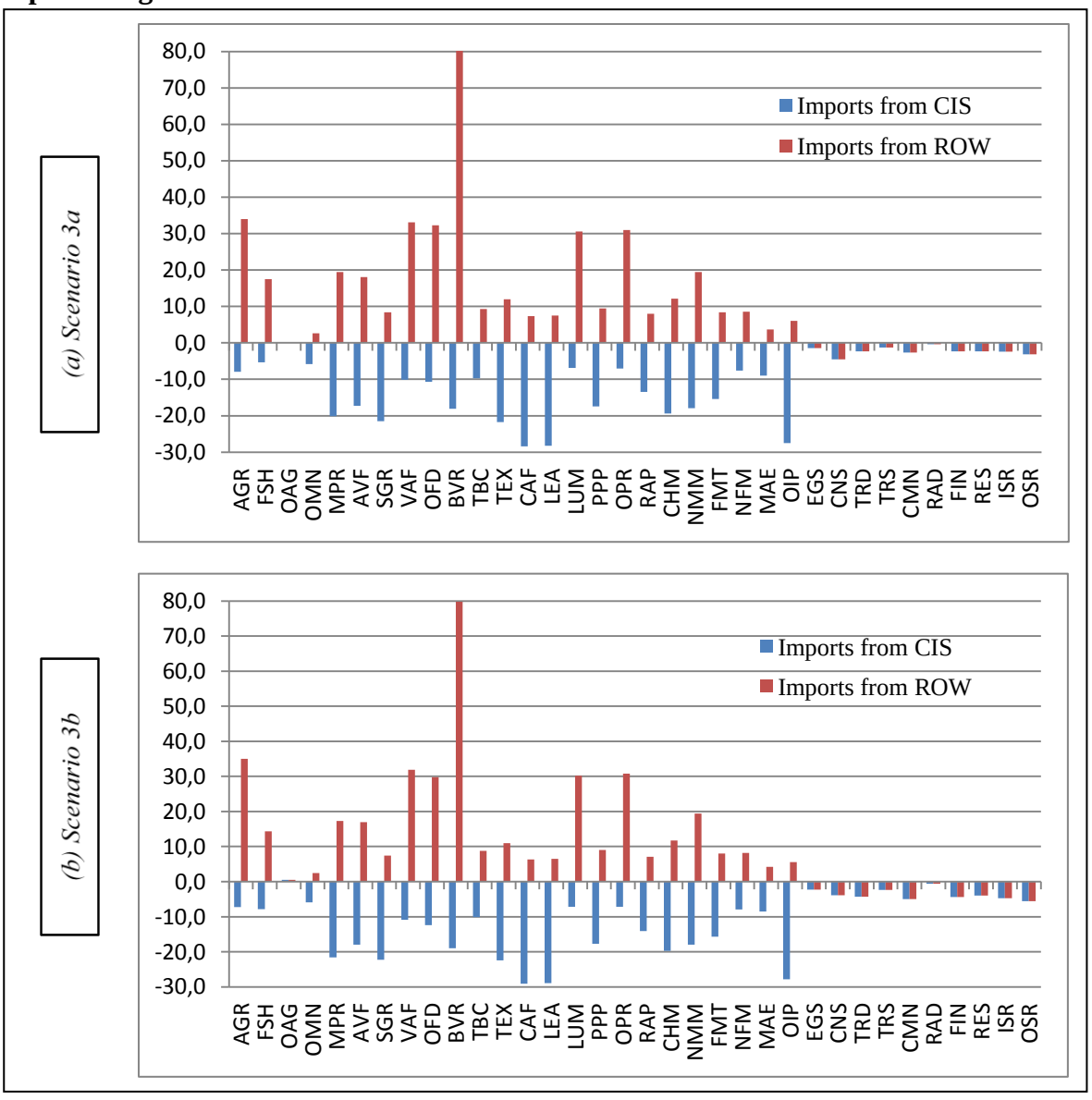
FIGURE 6.4: Sectoral level results from WTO accession, in percentage changes



Source: Author's estimation based on AzCGE model

The most notable aggregate export growth occurs in leather, non-metallic minerals, paper and paper products (including publishing), clothes and furs, and other chemical products sectors, with corresponding growth rates of 18.74 (21.01), 13.14 (13.91), 11.14 (13.21), 10.63 (12.89), and 10.06 (12.61) percent, respectively, under simulation subscenario 3a (3b) because these sectors experience a remarkable growth in their export volumes under previously discussed simulation scenarios 1 and 2a (2b).

FIGURE 6.5: The changes in import flows across trading partners from WTO accession, in percentage



Source: Author's estimation based on AzCGE model

According to our simulation results, the exports in agriculture sector increases by 1.75 percent under simulation subscenario 3a because of the dominant effect stemming from simulation scenario 1 over 2a, whereas it tends to contract by 2.34 percent under the implementation of

simulation subscenario 3b because of the dominant effect stemming from simulation scenario 2b over 1.

The similar patterns of the effects in export flows are also estimated to occur in exports to CIS and ROW. As can be seen from Figure 6.4(c), under simulation subscenario 3b, the sectors experience a higher growth in their export volumes than under simulation subscenario 3a. This is attributed to the fact that under simulation subscenario 3b, the domestic producers face with higher export price increases due to higher real exchange rate depreciation in contrast to subscenario 3a.

On the whole, the above results indicate that WTO membership and its accompanied policy reforms would largely promote trade by sectors (both imports and exports), particularly for the non-CIS countries.

6.2.3 Household level welfare impacts

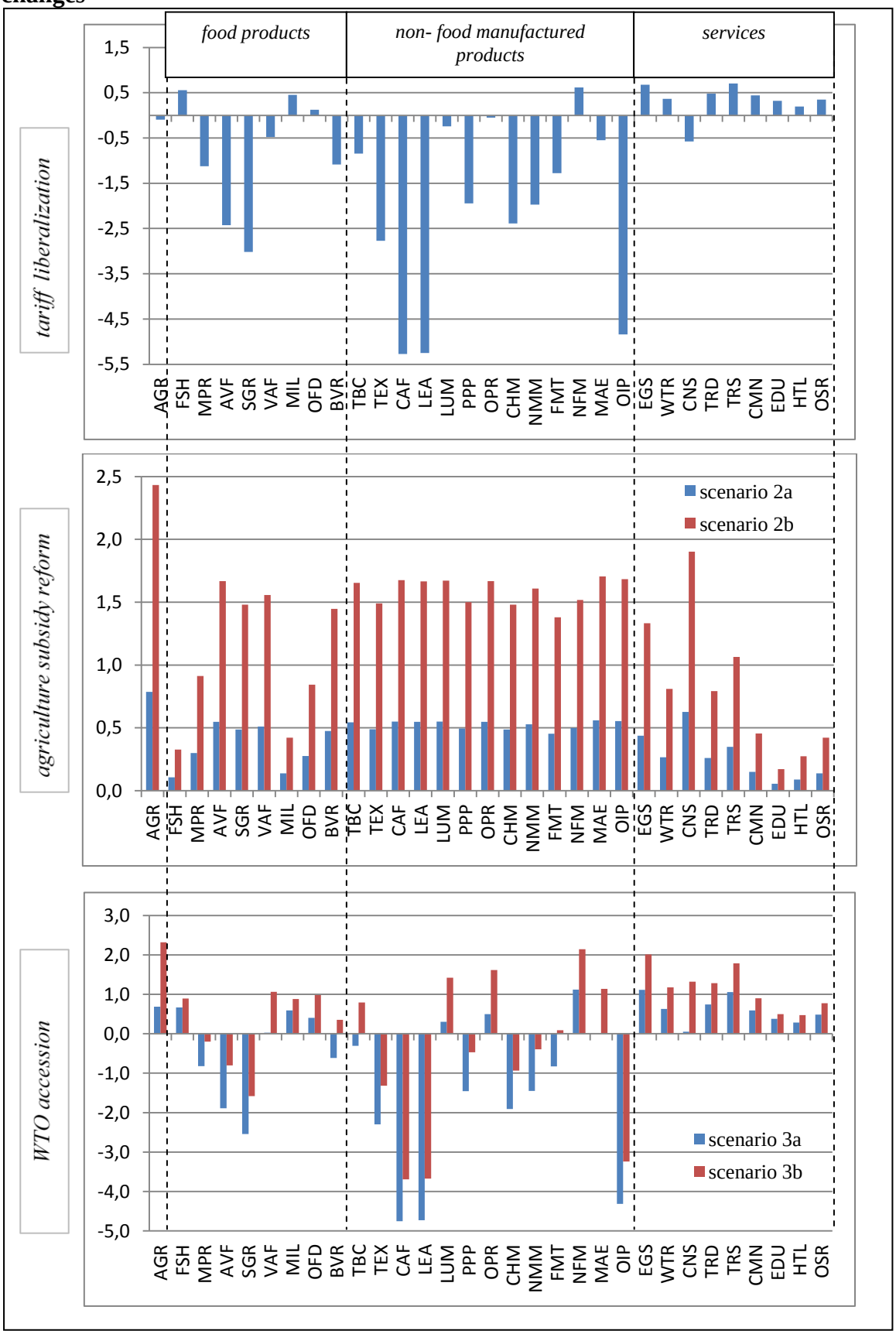
As regards the social aspects of the study-specified simulation experiments, in this subsection we discuss the results obtained concerning household level welfare while exploiting the micro-simulation features of our modeling framework. As previously mentioned, to account the household level welfare impacts, we use Hicksian equivalent variation concept as a percentage of base case household consumption; a positive value indicates a welfare gain, whereas a negative value indicates a welfare loss. To present the results in a more transparent and convenient manner under each simulation scenario, we first report the estimated distribution of welfare gains/losses for the entire sample of households and then aggregate the results in each income decile. Furthermore, to gain extended insight into the impacts on households at the regional level, we present the estimated distribution of welfare gains/losses for the entire sample of urban and rural households separately and then again aggregate the results in each income decile within urban and rural households.

The net impacts of simulation experiments on a household's welfare depend on the variations in payments to production factors in the economy (factor prices) that directly affects the income level of the households, together with variations in consumption prices of goods and services that directly affects the expenditure patterns of the households. However, the extent to which those variations in prices affect the welfare level of households depends solely on characteristics of each household, including its factor income sources and consumption preferences.

However, before examining the welfare effects, it is appropriate to present the impacts of the

considered simulation experiments on consumption prices across goods and services. Notice that we have already discussed the impacts of simulation experiments on factor rewards in subsection 6.2.1. Figure 6.6 presents the consumption price effects of simulation experiments as percentage deviations from their corresponding base case prices. As revealed in the upper panel of the Figure 6.6, tariff liberalization scenario leads to a price drops in the majority of consumption goods and services in the domestic market. The highest incidence of price decline observed in manufactured non-food products, including clothes and furs (5.27 percent), leather (5.25 percent), other industrial products (4.84 percent), and textiles (2.77 percent). Furthermore, sugar sector (3.02 percent) also experiences a relatively remarkable consumption price decrease. Contrary to tariff liberalization scenario, the scenarios that involves lowering subsidies for the agriculture lead to an increase in prices for consumption goods and services in the domestic market (under both subscenarios 2a and 2b)—as it is shown in the middle panel of the Figure 6.6—with a notable increase in agriculture (0.79 (2.43) percent in subscenario 2a (2b)), construction (0.63 (1.90) percent in subscenario 2a (2b)), machinery and equipments (0.56 (1.70) percent in subscenario 2a (2b)), other industrial products, including recycling (0.55 (1.68) percent in subscenario 2a (2b)), and clothes and furs (0.55 (1.67) percent in subscenario 2a (2b)). Finally, as revealed in the bottom panel of the Figure 6.6, the full accession simulation experiments generate mixed results. In particular, some goods and services experience a price increase, whilst others experience a price decrease. The highest incidence of price increases are projected to occur in agriculture (0.69 (2.32) percent in subscenario 3a (3b)), non-ferrous metals (1.12 (2.24) percent in subscenario 3a (3b)), electricity, gas and steam (1.11 (2.01) percent in subscenario 3a (3b)), transportation (1.06 (1.78) percent in subscenario 3a (3b)), and oil processing sectors (0.50 (1.61) percent in subscenario 3a (3b)). On the contrary, the steepest price decreases are projected to occur in clothes and furs (4.75 (3.69) percent in subscenario 3a (3b)), leather (4.73 (3.67) percent in subscenario 3a (3b)), other industrial products, including recycling (4.31 (3.24) percent in subscenario 3a (3b)), sugar (2.55 (1.58) percent in subscenario 3a (3b)), and textiles sectors (4.31 (3.24) percent in subscenario 3a (3b)). Although the direction of price effect for the majority of goods are the same under both full accession simulation experiments, there are a small number of goods (beverages, tobacco products, and ferrous metals) for which we have estimated price decreases under simulation subscenario 3a, but price increases under simulation subscenario 3b. In the following, we discuss how the changes in the prices of consumption goods and services (discussed above) and in the prices of production factors (discussed in the subsection 6.2.1) end up influencing the welfare level of the households.

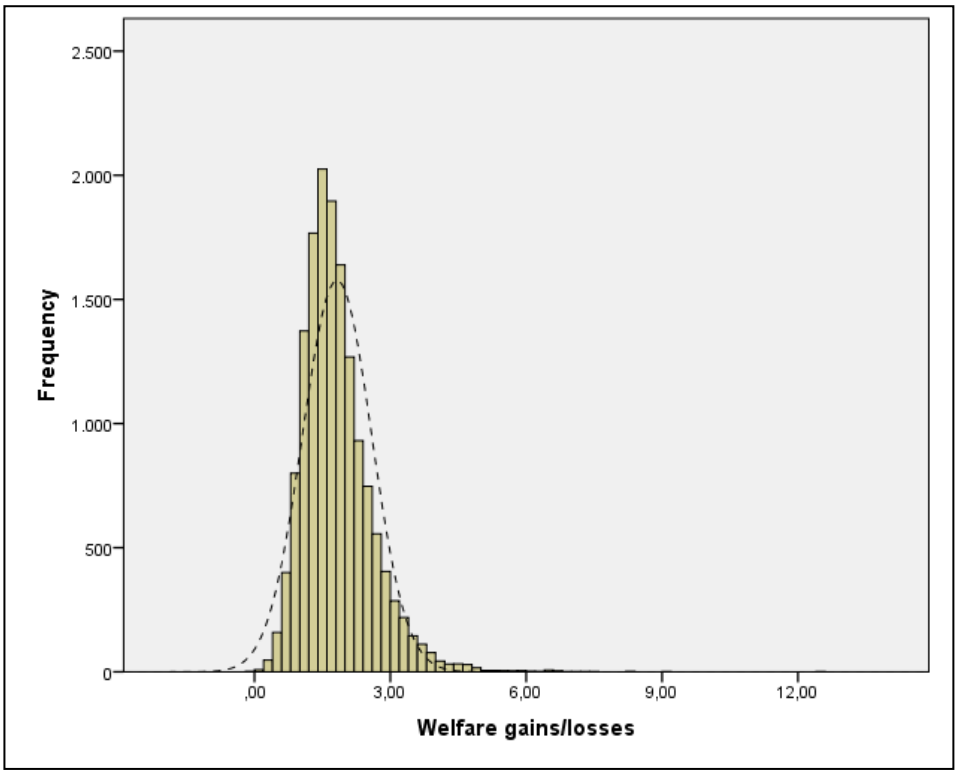
FIGURE 6.6: Consumption price variations across simulation scenarios, in percentage changes



Note: The price changes are presented only for those goods and services that are consumed by households.
Source: Author's estimation based on AzCGE model

The estimated distribution of welfare gains/losses under the tariff liberalization scenario for an entire household sample is illustrated in Figure 6.7. It appears that virtually all households (around 99.99 percent) experience an improvement in their welfare in the range of 0.01 – 12.59 percent of consumption. The distribution of projected welfare gains/losses is centered around the mean of 1.82 percent of consumption.

FIGURE 6.7: The national level distribution of estimated welfare gains/losses from tariff liberalization



Note: The welfare gains/losses are estimated for the entire sample that consists of 15,062 households. According to our estimates, 99.99 percent of households (equivalently 15,059 households) obtain a welfare gain, whereas the remainder 0.01 percent (equivalently 3 households) experience a welfare loss. The distribution of estimated welfare gains is centered around the mean of 1.82 percent of consumption, with a corresponding standard deviation of 0.76 percent.
Source: Author's estimation based on micro-simulation model

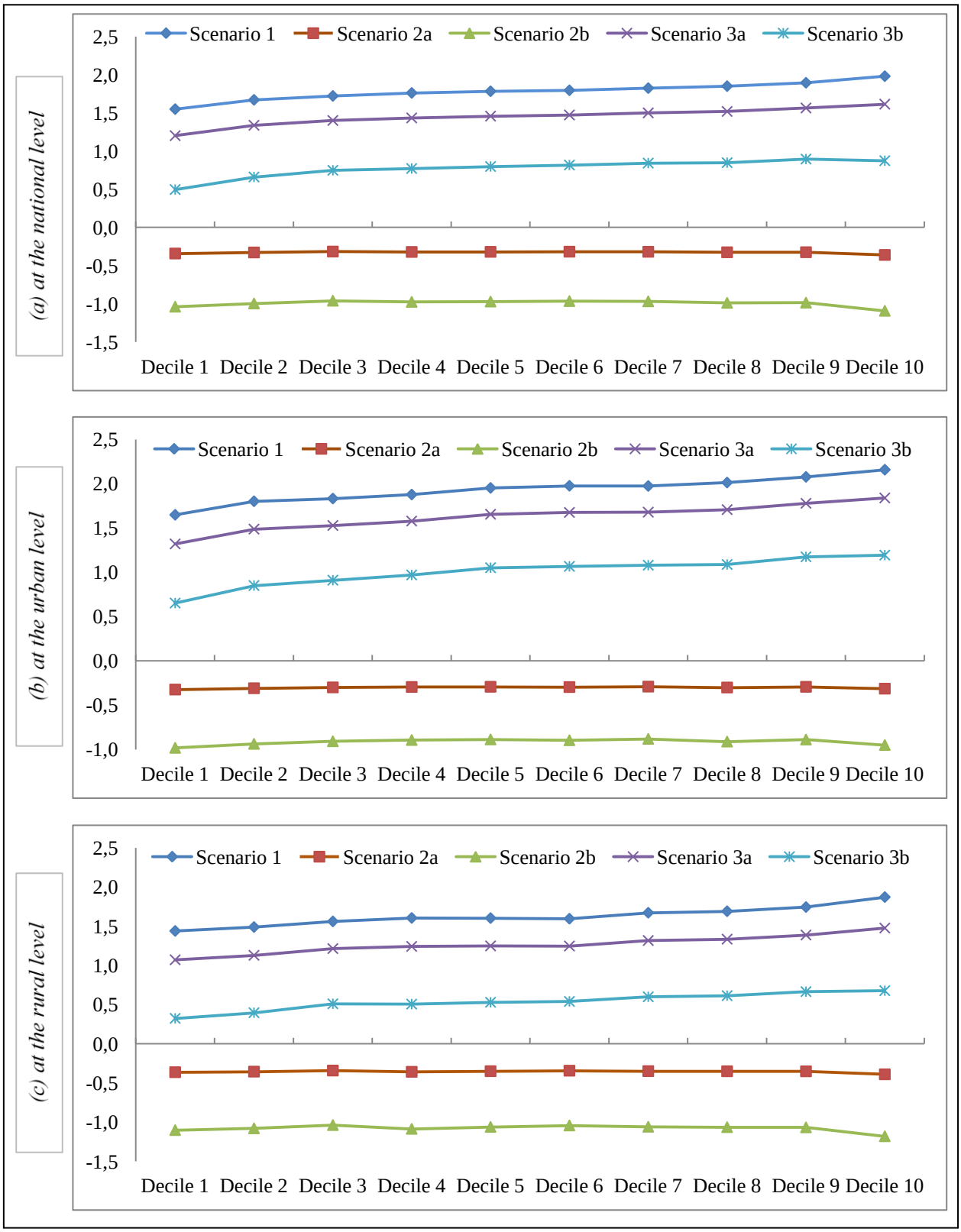
Given that tariff liberalization causes lower consumption prices for the majority of the goods and services, which in turn improves the purchasing power of households (i.e., households can purchase a relatively higher amount of goods and services), and higher factor returns, which in turn raises the income of the households, this outcome was expected. The welfare gains are observed to be unequally distributed across income deciles (at the national level) (Figure 6.8(a)). In particular, it is found that the wealthier households are, the greater their welfare gains are. For instance, the average gain of the wealthiest households is projected to be as large as 1.98 percent of consumption, whereas the same figure is projected to be as large as 1.55 percent of consumption for the poorest households. To understand the factors behind

of those varied effects, we must recall the factor income sources and consumption preferences of households across income deciles. As we have seen in the preceding chapter, unlike rest of the population, wealthy households rely more on earnings from capital, for which the rate of return is estimated to increase the most following the tariff lowering. Clearly, this leads to a faster increase in the income of the wealthy households than other households. Additionally, in contrast to other households, wealthy households possess a larger share of manufactured non-food items in their consumption budget, for which the highest price falls are estimated because of the tariff liberalization. In turn, this leads to a faster improvement in the purchasing power of the wealthy households than others.

As regards the regional aspects of welfare impact analysis, the estimation results show that more than 99.9 percent of rural and urban households obtain a welfare gains following tariff cuts (Figure 6.9(a) and (b)). However, the projected welfare gains of urban households are lower than rural households' welfare gains. In particular, the distribution of the estimated welfare gains/losses for urban households is centered around the mean of 1.69 percent of consumption, whereas for rural households is centered around the mean of 1.96 percent of consumption. While recalling the factor income sources and consumption preferences of households across regions, one can explain the discrepancies in welfare effects at the regional level. From the earlier chapters, we have seen that the rural households rely more on earnings from capital—for which the rate of return is estimated to increase the most due to tariff cuts—than their urban counterparts. Accordingly, tariff-cut-induced increase in return to capital affects markedly income of the rural households and ultimately their welfare level. In addition, the fact that the rural households consume more manufactured non-food commodities—for which the highest consumption price falls are registered due to tariff cuts—than the urban households also contributes to the higher welfare gain obtained by rural households.

While examining the decile level welfare impacts of lowering tariffs within each region, it is found that on average welfare gains over deciles are disproportionally higher in rural households in comparison with their urban counterparts (Figure 6.8(b) and (c)). Similar to the national level findings, at the regional level the wealthiest households are those who experience the largest improvement in their welfare (on average 2.16 (1.87) percent of consumption for rural (urban) households), whereas the poorest households receive the lowest improvement in their welfare (on average 1.65 (1.44) percent of consumption for rural (urban) households).

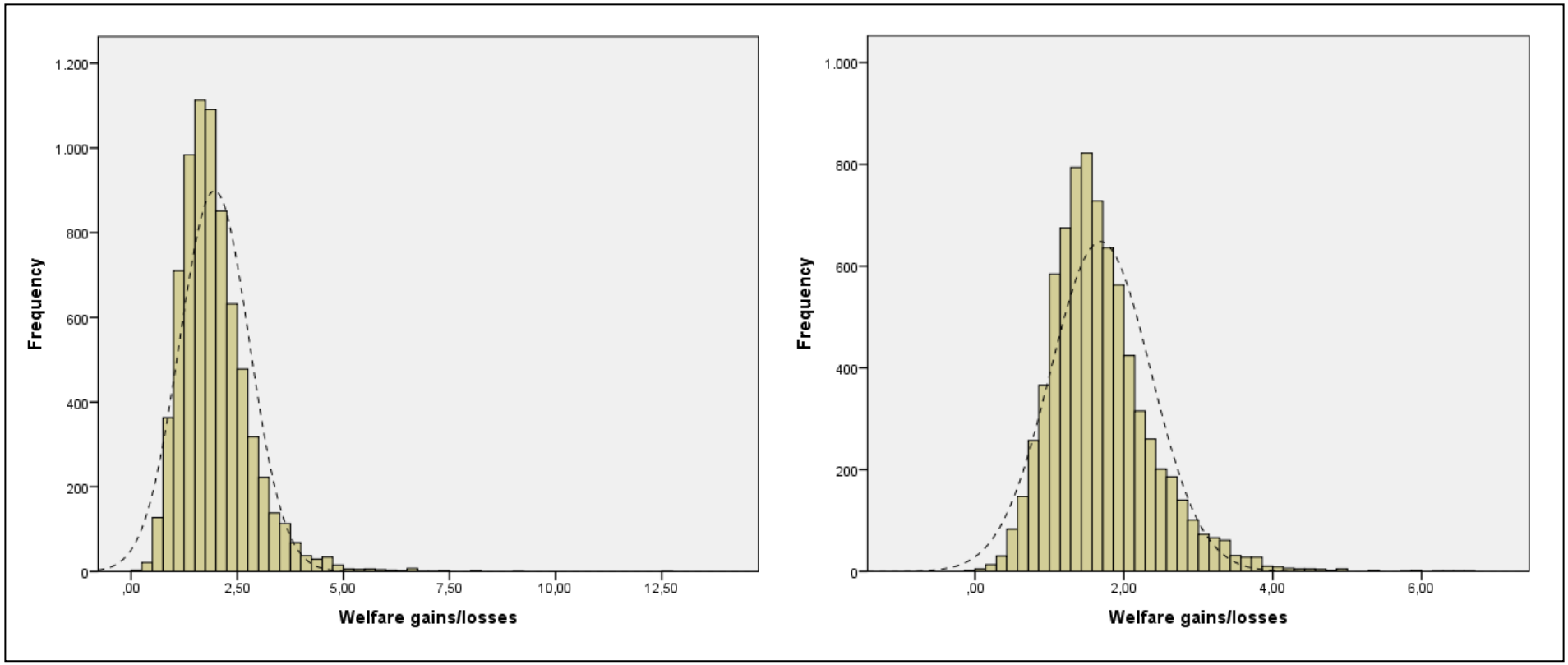
FIGURE 6.8: On average welfare gains/losses across deciles and simulation scenarios



Source: Author's estimation based on micro-simulation model

FIGURE 6.9: The regional level distribution of estimated welfare gains/losses from tariff liberalization

(a) rural households *(b) urban households*



Note: The distribution of estimated welfare gains/losses for rural population consists of 7,388 households and for urban population consists of 7,674 households. We have estimated that all rural households obtain a welfare gain (see *(a)*). Furthermore, we have estimated that 99.97 percent of urban households (equivalently 7,672 households) obtain a welfare gain, whereas the remainder 0.03 percent (equivalently 3 households) experience a welfare loss (see *(b)*). The mean value of welfare effects is centered around 1.96 percent of consumption, with a corresponding standard deviation of 0.78 percent for rural households and 1.69 percent of consumption, with a corresponding standard deviation of 0.68 percent for urban households.

Source: Author's estimation based on micro-simulation model

As for the second simulation experiments 2a and 2b, Figure 6.10 ((a) and (b)) illustrates the distribution of estimated welfare gains/losses for the entire sample of households. The estimation results show that nearly all households (around 99.7 percent in both subscenarios) experience a loss in their welfare from the scrolling down of agricultural subsidies. The distribution of projected welfare gains/losses is centered around the mean of -0.33 (-1.01) percent of consumption and ranges between -0.01 (-0.01) and -1.99 (-5.99) percent of consumption under the implementation of simulation subscenario 2a (2b). This finding is largely attributed to the fact that the subsidy-cut-induced increase in consumption prices for goods and services deteriorates purchasing power of all households and ultimately their welfare level. In addition, reduction in payment to unskilled labor due to subsidy cuts negatively affects the income level of households who are endowed with unskilled labor.[82]

The welfare losses are observed to be almost evenly distributed across income deciles (at the national level) (Figure 6.8(a)). Nevertheless, a slightly steeper welfare loss occurs in the richest households, estimated to be on average as large as -0.36 (-1.09) percent of consumption, whereas households belonging to the middle-income classes (deciles 5-7) are observed to obtain a relatively smaller welfare loss that is estimated at about -0.32 (-0.97) percent of consumption in simulation subscenario 2a (2b).

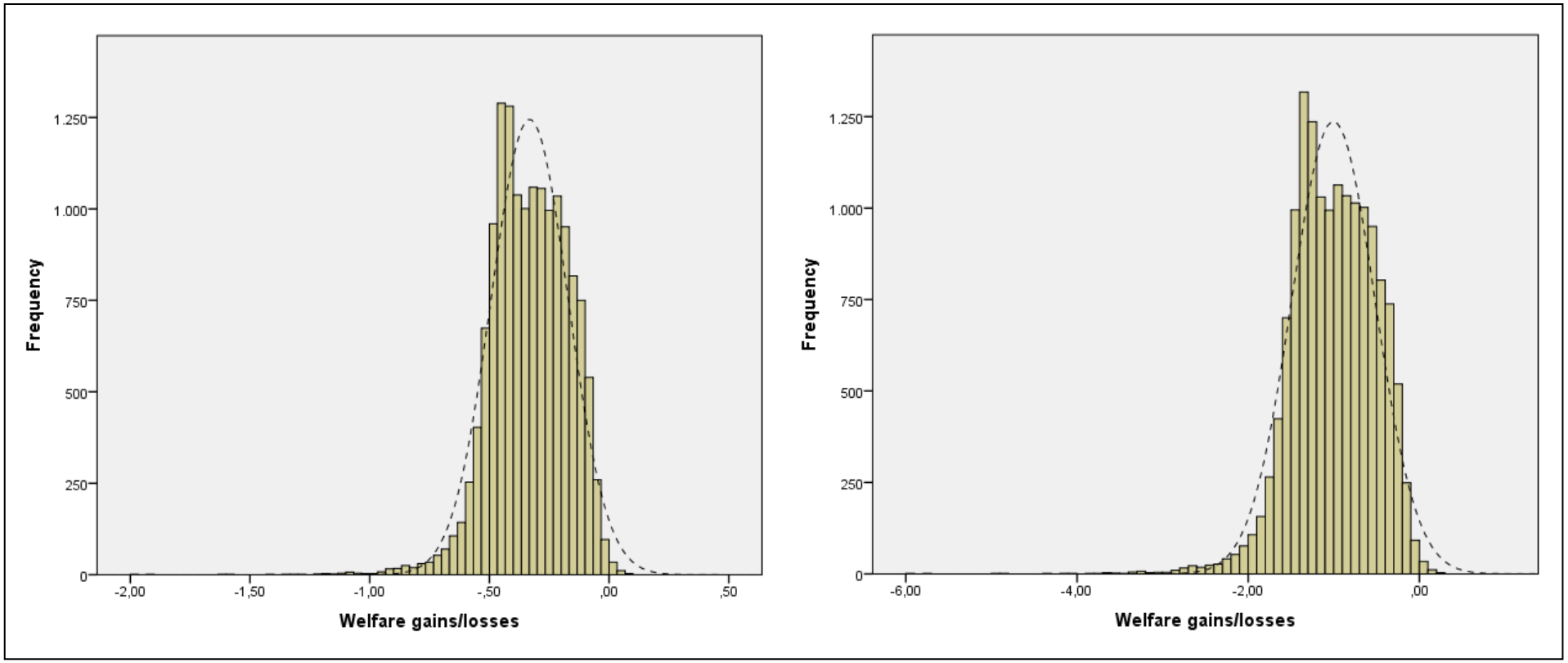
Regarding the regional level welfare impacts, more than 99.0 percent of urban and rural households are estimated to experience a loss in their welfare from the implementation of subsidy reform scenarios 2a and 2b (Figures 6.11 and 6.12). The projected distribution of the welfare losses for rural households is centered around the mean of -0.30 (-0.91) percent of consumption, whereas for urban households is centered around the mean of -0.36 (-1.09) percent of consumption under simulation subscenario 2a (2b). Apparently, the induced welfare losses of subsidy reforms are estimated to occur faster for urban households than for rural households. This happens due to the fact that rural households rely more on earnings from capital (in contrast to urban households), for which the rate of return is estimated to increase significantly (relative to other factors) following the subsidy reform scenarios. Consequently, rural households obtain relatively more income and thus are able to reimburse larger part of negative (consumption) price effects brought by subsidy cuts.

Further on, urban households over deciles are estimated to experience on average welfare losses at slightly steeper rates than their rural counterparts. It is also found that on average

[82] Notice that the estimated increase in returns to capital and skilled labor due to subsidy cuts are (relatively) modest to offset the real income loss of the vast majority of households.

FIGURE 6.10: The national level distribution of estimated welfare gains/losses from agriculture subsidy reforms

(a) simulation scenario 2a *(b) simulation scenario 2b*

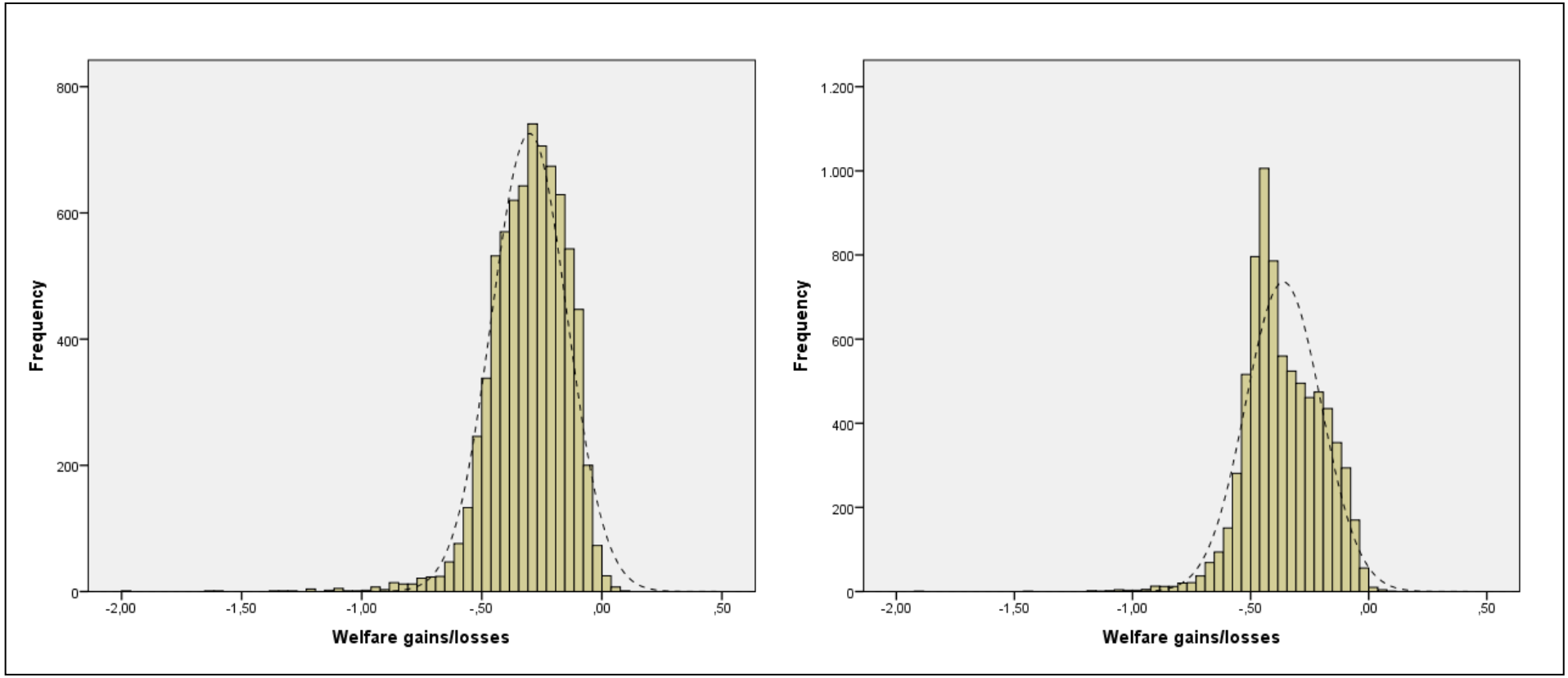


Note: The welfare gains/losses are estimated for entire sample consisting of 15,062 households. The distribution of welfare gains/losses under two alternative subscenarios (2a and 2b) indicates that 99.7 percent of households (equivalently 15,014 households) experience a welfare loss, whereas the remainder 0.3 percent (equivalently 48 households) obtain a welfare gain. The estimated distribution of welfare effects is centered around the mean value of -0.33 percent of consumption, with a corresponding standard deviation of 0.16 percent under simulation subscenario 2a (see *(a)*) and -1.01 percent of consumption, with a corresponding standard deviation of 0.49 percent under simulation subscenario 2b (see *(b)*).

Source: Author's estimation based on micro-simulation model

FIGURE 6.11: The regional level distribution of estimated welfare gains/losses from agriculture subsidy reforms *(simulation scenario 2a)*

(a) rural households *(b) urban households*

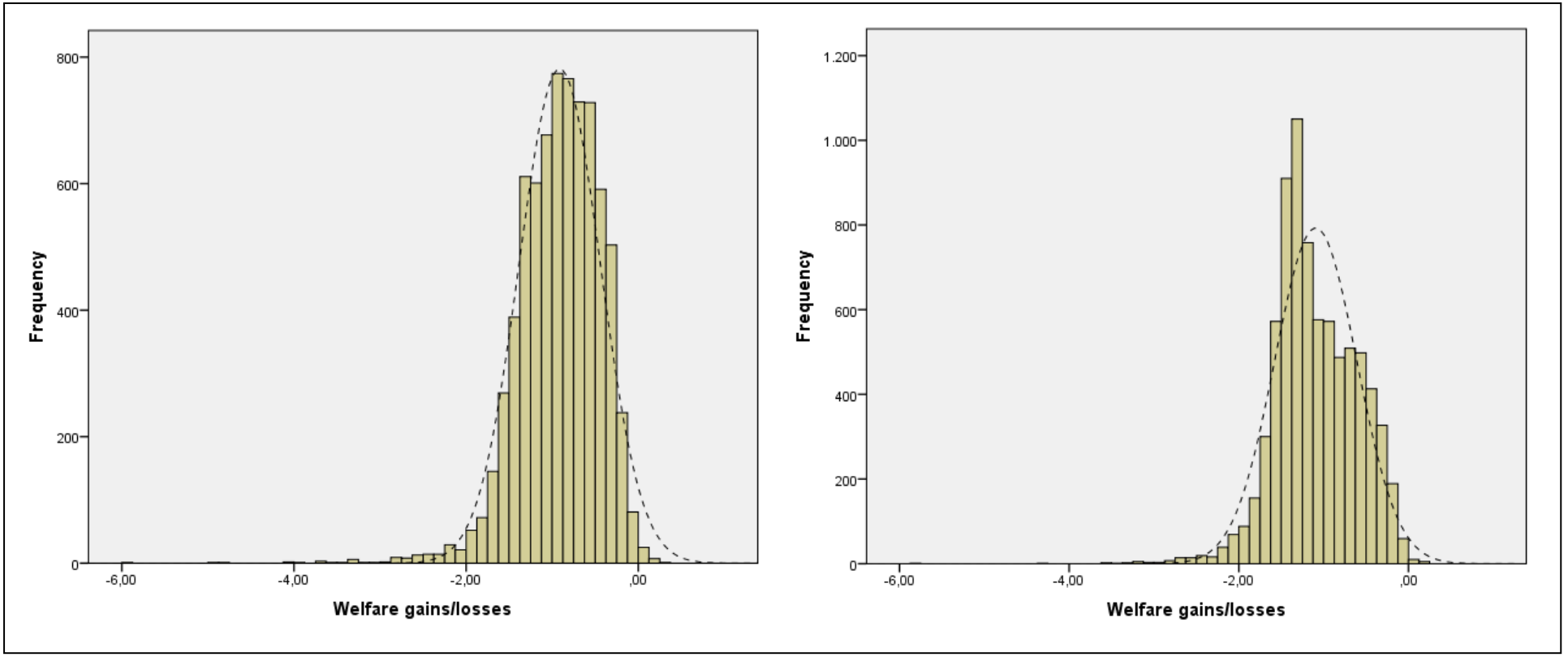


Note: The distribution of estimated welfare gains/losses for rural population consists of 7,388 households; meanwhile for urban population consists of 7,674 households. According to our estimates, 99.6 percent of rural households (equivalently 7,355 households) obtain a welfare loss, whereas the remainder 0.4 percent (equivalently 33 households) experience a welfare gain (see *(a)*). Furthermore, it is estimated that 99.2 percent of urban households (equivalently 7,659 households) obtain a welfare loss, whereas the remainder 0.2 percent (equivalently 15 households) experience a welfare gain (see *(b)*). The estimated mean value of welfare effects is centered around -0.30 percent of consumption for rural households, with a corresponding standard deviation of 0.16 percent and -0.36 percent of consumption for urban households, with a corresponding standard deviation of 0.17 percent.

Source: Author's estimation based on micro-simulation model

FIGURE 6.12: The regional level distribution of estimated welfare gains/losses from agriculture subsidy reforms *(simulation scenario 2b)*

(a) rural households *(b) urban households*



Note: The distribution of estimated welfare gains/losses for rural population consists of 7,388 households and for urban population consists of 7,674 households. According to our estimates, 99.6 percent of rural households (equivalently 7,355 households) obtain a welfare loss, whereas the remainder 0.4 percent (equivalently 33 households) experience a welfare gain (see *(a)*). Regarding to urban households, it is estimated that 99.8 percent of urban households (equivalently 7,659 households) obtain a welfare loss, whereas the remainder 0.2 percent (equivalently 15 households) experience a welfare gain (see *(b)*). The estimated distribution of welfare effects is centered around the mean value of -0.91 percent of consumption for rural households, with a corresponding standard deviation of 0.47 percent and -1.09 percent of consumption for urban households, with a corresponding standard deviation of 0.48 percent.

Source: Author's estimation based on micro-simulation model

welfare losses are nearly evenly distributed across deciles within rural (ranging between -0.29 (-0.88) and -0.32 (-0.98) percent of consumption in simulation subscenario 2a (2b)) and urban households (ranging between -0.34 (-1.04) and -0.39 (-1.18) percent of consumption in simulation subscenario 2a (2b)) (Figure 6.8(b) and (c)).

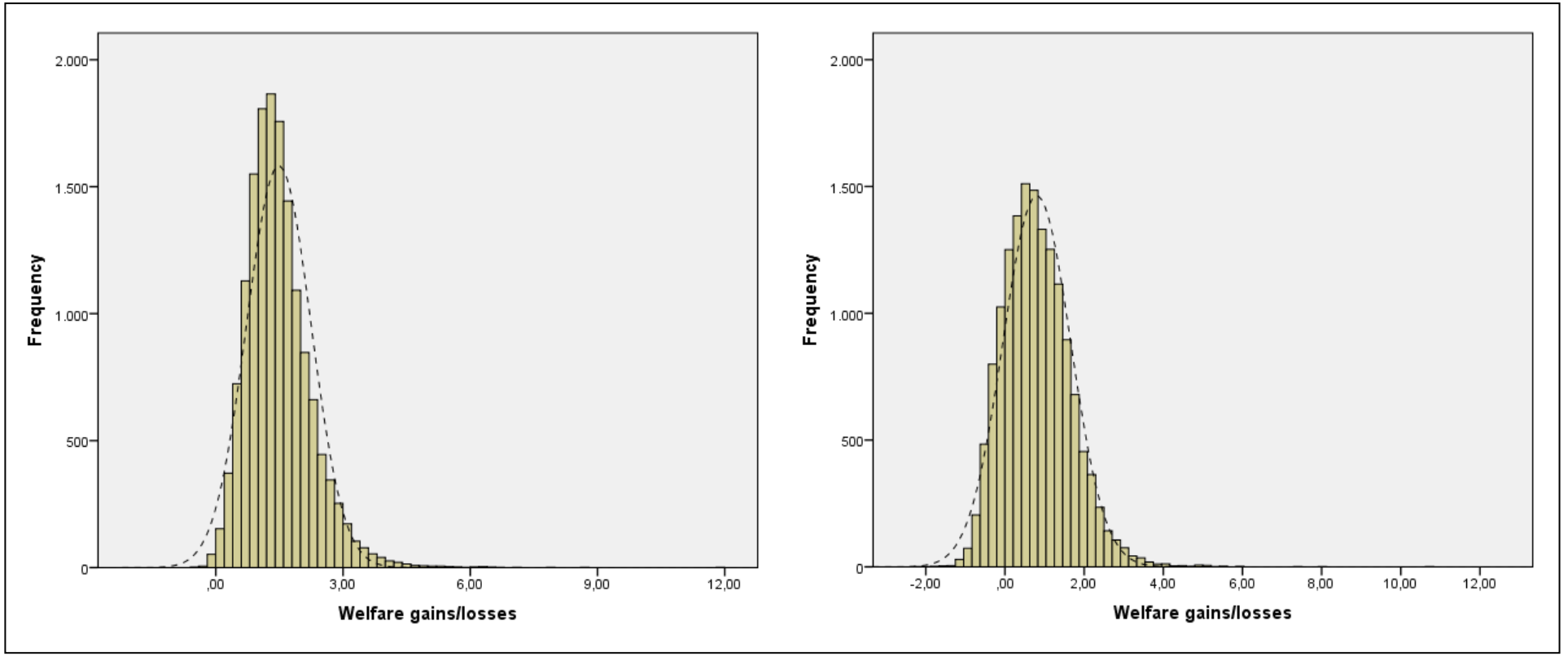
Although under both simulation scenarios (2a and 2b) the absolute number of losing households in terms of their welfare has been estimated as approximately the same, the magnitude of the households' welfare losses is higher under simulation subscenario 2b compared to 2a. In other words, the loss of living standards of households is particularly severe under implication of simulation subscenario 2b. This finding is largely explained by the fact that simulation subscenario 2b generates sharper negative consumption price effects than 2a, which in turn more sharply deteriorates households' costs of living and ultimately causes a steeper welfare losses.

Finally, we explore the welfare impacts of full accession simulation scenarios, in which the previously discussed simulation experiments implemented simultaneously under two alternative subscenarios 3a and 3b. As we have seen above, tariff liberalization scenario produces welfare gains for almost all households, whereas agriculture subsidy reduction scenarios (both 2a and 2b) exert an opposite results. According to this view, the final net effects of combined simulation scenarios (3a and 3b) on the sign and level of a households' welfare depend on which effect dominates.

As shown in Figure 6.13(a), under simulation subscenario 3a by around 99.6 percent of households experience a welfare gain that ranges between 0.01 and 11.95 percent of consumption, whereas the remainder of the households (0.4 percent) are the net losers whose welfare loss ranges between -0.01 and -0.52 percent of consumption. Overall, distribution of the estimated welfare impact is centered around the mean of 1.49 percent of consumption. The simulation subscenario 3b produces considerably less progressive results in terms of the welfare implications. As revealed in Figure 6.13(b), under simulation subscenario 3b around 82.6 percent of households obtain a welfare gain, whereas the remainder of the households (17.4 percent) tend to lose. Correspondingly, estimated welfare gains (losses) range between 0.01 (-0.01) and 10.64 (-1.39) percent of consumption. The distribution of the estimated welfare impact is centered around the mean of 0.80 percent of consumption under implementation of simulation subscenario 3b.

FIGURE 6.13: The national level distribution of estimated welfare gains/losses from WTO accession

(a) simulation scenario 3a *(b) simulation scenario 3b*

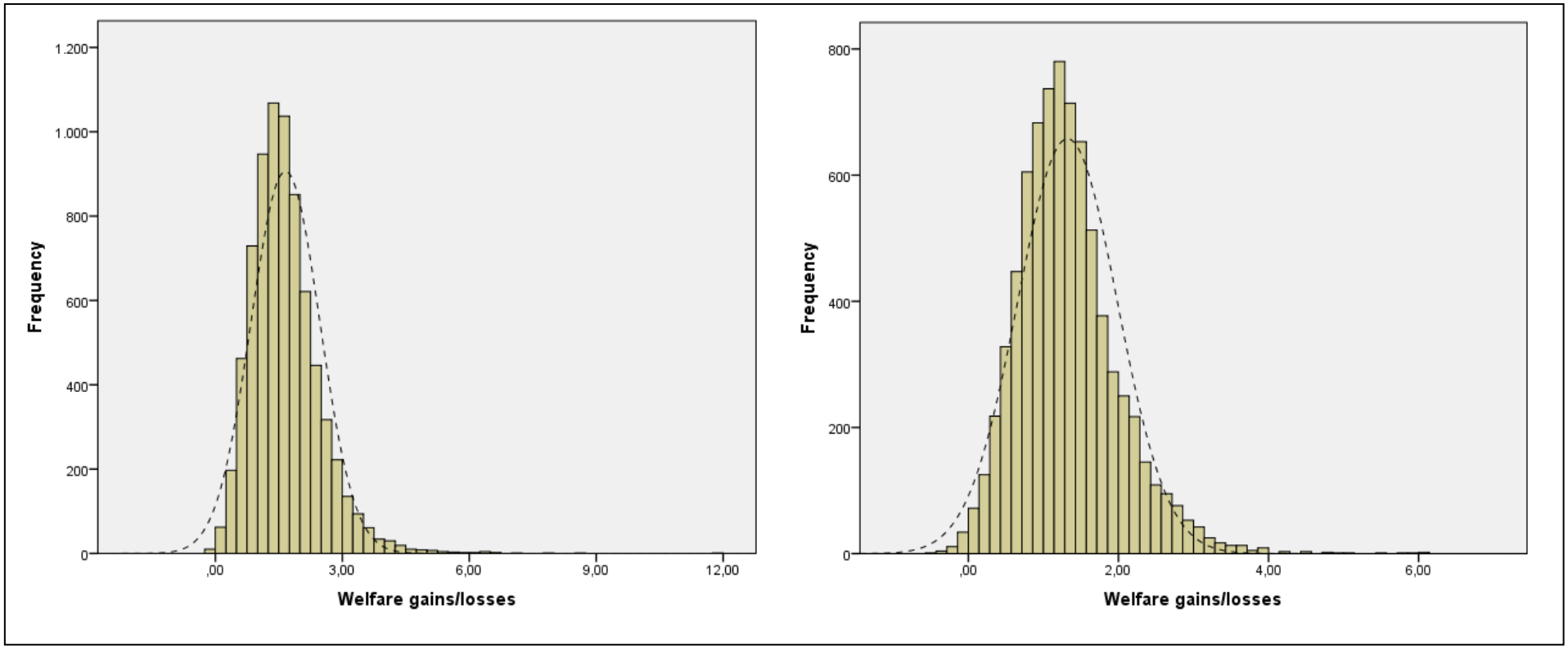


Note: The welfare gains/losses are estimated for entire sample consisting of 15,062 households. The distribution of welfare gains/losses under full accession subscenario 3a indicates that by around 99.6 percent of households (equivalently 15,002 households) experience a welfare gain, whereas the remainder 0.4 percent (equivalently 60 households) obtain a welfare loss (see *(a)*). Moreover, according to our estimations, under simulation subscenario 3b by around 82.6 percent households (equivalently 12,434 households) experience a welfare gain, whereas the remainder 17.4 percent (equivalently 2,628 households) experience a welfare loss (see *(b)*). The estimated mean value of welfare distribution is centered around 1.49 percent of consumption, with a corresponding standard deviation of 0.76 percent under simulation subscenario 3a and 0.80 percent of consumption, with a corresponding standard deviation of 0.86 percent under simulation subscenario 3b.

Source: Author's estimation based on micro-simulation model

FIGURE 6.14: The regional level distribution of estimated welfare gains/losses from WTO accession *(simulation scenario 3a)*

(a) rural households *(b) urban households*

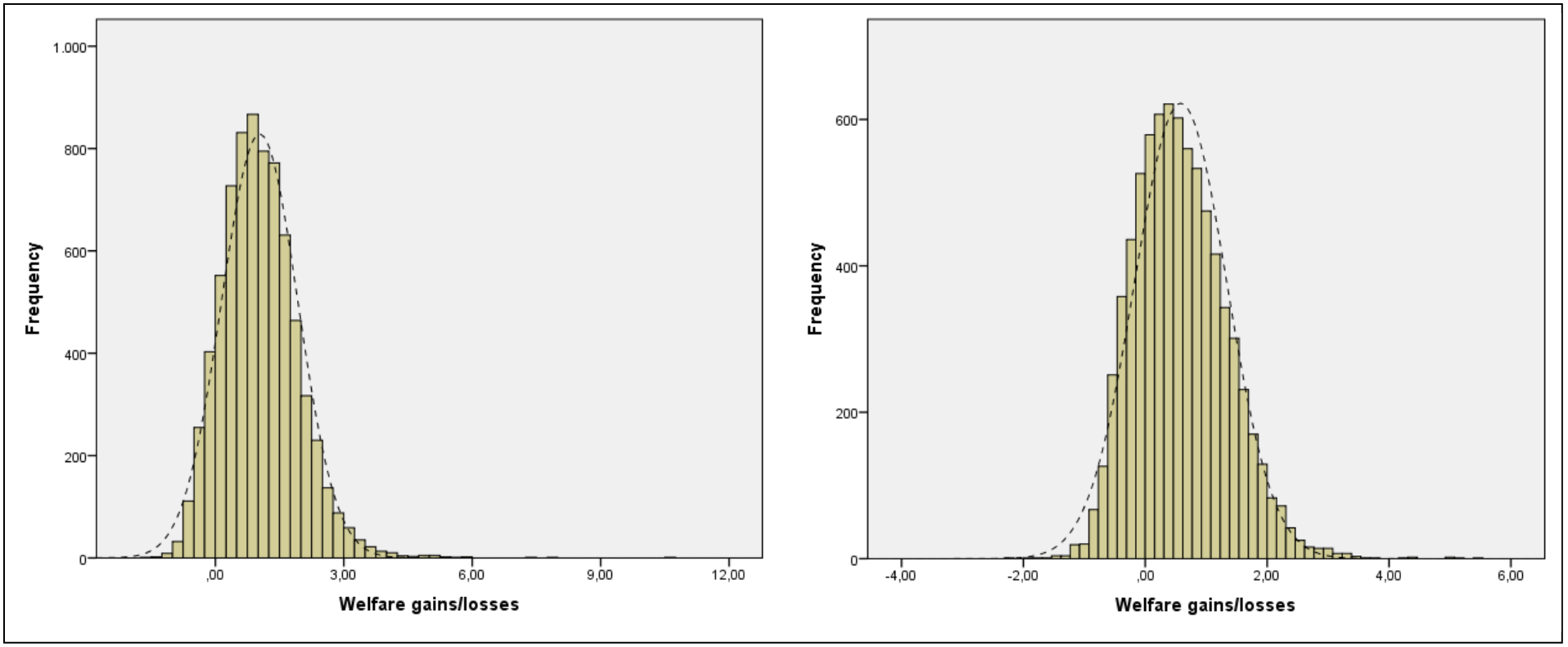


Note: The distribution of estimated welfare gains/losses for rural population consists of 7,388 households and for urban population consists of 7,674 households. According to our estimates, 99.9 percent of rural households (equivalently 7,378 households) obtain a welfare gain, whereas the remainder 0.1 percent (equivalently 10 households) experience a welfare loss (see *(a)*). Regarding to urban households, it is estimated that 99.3 percent of urban households (equivalently 7,624 households) obtain a welfare gain, whereas the remainder 0.7 percent (equivalently 50 households) experience a welfare lose (see *(b)*). The estimated mean value of welfare effects is centered around 1.66 percent of consumption for rural households, with a corresponding standard deviation of 0.81 percent and 1.32 percent of consumption for urban households, with a corresponding standard deviation of 0.67 percent.

Source: Author's estimation based on micro-simulation model

FIGURE 6.15: The regional level distribution of estimated welfare gains/losses from WTO accession *(simulation scenario 3b)*

(a) rural households *(b) urban households*



Note: The distribution of estimated welfare gains/losses for rural population consists of 7,388 households and for urban population consists of 7,674 households. According to our estimates, 89.0 percent of rural households (equivalently 6,574 households) obtain a welfare gain, whereas the remainder 11.0 percent (equivalently 814 households) experience a welfare loss (see *(a)*). Regarding to urban households, it is estimated that 76.3 percent of households (equivalently 5,858 households) obtain a welfare loss, whereas the remainder 23.7 percent (equivalently 1,816 households) experience a welfare gain (see *(b)*). The estimated distribution of welfare effects is centered around the mean value of 1.04 percent of consumption for rural households, with a corresponding standard deviation of 0.90 percent and 0.58 percent of consumption for urban households, with a corresponding standard deviation of 0.76 percent.

Source: Author's estimation based on micro-simulation model

Obviously, tariff liberalization plays a central role by determining the final outcome of welfare effects under combined simulation experiments (both in 3a and 3b). On the whole, the obtained results suggest that acceding WTO is beneficial for the majority of population irrespective of a country's accession status. However, our results designate that the welfare gainers among the households would be considerable higher and households would experience a larger improvement in their welfare level, if a country joins the WTO with developing country status.

Moreover, under simulation subscenario 3a (3b) the largest welfare gainers are the wealthiest households, with an estimated on average gain of 1.61 (0.87) percent of consumption, whereas the poorest households contain relatively fewer gainers, whose on average welfare gain is estimated at 1.20 (0.49) percent of consumption (at the national level) (Figure 6.8(a)).

As far as the impact of the simulation experiments on the welfare level of households at the regional level concerned, it appears that under simulation subscenario 3a around 99.9 percent of rural households and 99.3 percent of urban households experience an improvement in their welfare (Figure 6.14(a) and (b)). The distribution of projected welfare impact for rural households is centered around the mean of 1.66 percent of consumption and for urban households is centered around the mean of 1.32 percent of consumption. However, under simulation subscenario 3b around 89.0 percent of rural households and 76.3 percent of urban households experience a welfare gain (Figure 6.15(a) and (b)). Accordingly, the distribution of welfare impact is centered around the mean of 1.04 percent of consumption for rural households and 0.58 percent of consumption for urban households. From the results presented above, it is obvious that if a country joins the WTO under developing country status, virtually all urban as well as rural households would entail an improvement in their welfare. However, entering the WTO under developed country status would lead considerably to less progressive results in terms of the welfare impacts. It is also found that the WTO accession would favor rural households regardless of the country's accession status.

Furthermore, it is estimated that on average welfare gains of rural households over income deciles are higher in comparison to their urban counterparts in both simulation subscenarios 3a and 3b (Figure 6.8(b) and (c)). The highest gain occurs to the wealthiest households (in both regions), while the poorest households are those who obtain the lowest gain. In particular, under simulation subscenario 3a, the wealthiest households located in rural (urban) areas obtain on average welfare gain by around 1.84 (1.48) percent of consumption, whereas the same figure is estimated to be as large as 1.32 (1.07) percent of consumption for the

poorest households located in rural areas. Under simulation subscenario 3b, the wealthiest rural (urban) households obtain on average welfare gain by around 1.19 (0.68) percent of consumption, whereas the poorest rural (urban) households obtain on average welfare gain of 0.65 (0.32) percent of consumption.

While summarizing the welfare impacts across income deciles, one can state that the WTO membership is likely to be pro-rich regardless of the country's accession status because the wealthy households acquire (on average) the largest welfare gains both at the national and the regional levels.

6.2.4 Poverty impacts

In line with the final intention of the study, this subsection performs a poverty impact analysis at the national and regional levels (urban/rural) with the aid of the FGT class of poverty measures. In particular, the post-simulation estimates for the FGT indices, including poverty rate, poverty gap, and poverty severity are compared with the corresponding pre-simulation reference year estimates. Those comparisons are reported as percentage point changes in Table 6.2, in which the positive value indicates an increase in poverty indices, whereas the negative value denotes a reduction in poverty indices. The changes in the price level of goods and services, which cause an adjustment in the endogenous poverty line, and of production factors, which cause a change in income of the poor, determine the variations in poverty indices. However, the extent to which those price changes influence poverty depends on the income sources of the poor and the sensitivity of the poverty line due to price variations in goods and services. With this preliminary remark, we proceed to an examination of the impacts of study-specified simulation scenarios on poverty.

With regard to first simulation scenario, a substantial drop in all three poverty measures are estimated both at the national and regional levels (column 1 of Table 6.2). This occurs because the tariff-cut-induced decrease in consumption prices for the majority of goods and services results in a downward adjustment in the poverty line (by 0.49 percent from the benchmark level) and increase in payments to production factors results in a raise in income level of the poor. This finding indicates that tariff liberalization would help the number of people living under the poverty line to come out of poverty (poverty rate) and the poor that are still below the poverty line to move closer toward the line (poverty gap). Furthermore, a tariff cut would also improve the inequality situation among the poor (poverty severity). The magnitude of the fall in the poverty rate, poverty gap, and poverty severity indices at the

national level are estimated to be as large as 5.52, 7.37, and 8.30 percentage points, respectively. However, fall in poverty indices is observed to be higher in urban areas than in rural areas. More specifically, the poverty rate, poverty gap, and poverty severity indices are estimated to shrink by 6.16, 9.09, and 11.23 percentage points in urban areas, whereas by 5.29, 6.93, and 9.95 percentage points in rural areas, respectively.

TABLE 6.2: Poverty impacts, in percentage point variations

	Tariff liberalization (sim 1)	Agriculture subsidy reform		WTO accession	
		Developing (sim 2a)	Developed (sim 2b)	Developing (sim 3a)	Developed (sim 3b)
Poverty rate					
- national	-5.52	1.33	3.32	-4.61	-2.81
- rural	-5.29	1.13	2.44	-4.49	-2.98
- urban	-6.16	1.88	5.82	-4.93	-2.35
Poverty gap					
- national	-7.37	1.27	3.90	-6.18	-3.71
- rural	-6.93	1.06	3.25	-5.92	-3.86
- urban	-9.09	2.04	6.27	-7.16	-3.20
Poverty severity					
- national	-8.30	1.40	4.30	-7.01	-4.32
- rural	-9.95	2.05	6.19	-5.66	-1.77
- urban	-11.23	3.56	10.91	-7.90	-3.58

Source: Author's estimation based on micro-simulation model

Because the adjusted poverty line applies for both rural and urban areas, disparities in poverty impacts between regions primarily reflect the changes in the income of the poor living in rural and urban areas.[83] As we have seen in the preceding chapter, all poverty indices in the benchmark year are significantly lower in urban areas than in rural areas, therefore, a one-percent increase in income prompts a relatively stronger reduction in poverty measures in urban areas. Moreover, as previously mentioned, the urban poor are located closer to the poverty line compared to the rural poor (see poverty gap index). Thus, urban poor are relatively more responsive to downward shift in the poverty line, i.e., the same level of downward adjustment in the poverty line would lift more poor above the line in urban areas compared to rural areas.

Regarding the second simulation scenarios, it appears that scaling down agriculture subsidies lead to an unfavorable poverty situation in the country, as all poverty indices designate a positive change (in both scenarios 2a and 2b) at the national and regional levels (columns 2

[83] Notice that we do not have separate poverty lines for urban and rural areas in our model because the AzSTAT calculates only a nation-wide poverty line.

and 3 of Table 6.2). This outcome reveals that agricultural subsidy reforms would push the most vulnerable people who previously were living above the poverty line into poverty (poverty rate), widen the gap between the poor and the poverty line (poverty gap), and deteriorate the inequality situation among the poor (poverty severity). The subsidy-cut-induced increase in prices for consumption goods and services, which results in an upward adjustment in the poverty line (by 0.23 (0.71) percent in simulation subscenario 2a (2b) from the benchmark level), together with decrease in payments to unskilled labor, which causes in a decline in the income level of the poor, plays a crucial role in exacerbating the poverty situation. At the national level, the estimation results suggest that the poverty rate, poverty gap, and poverty severity indices would increase by 1.33 (3.32), 1.27 (3.90), and 1.40 (4.30) percentage points, respectively, under simulation experiment 2a (2b). Interestingly, analyzing the regional dimensions of poverty impacts indicate that rural poverty is relatively less adversely affected as opposed to urban poverty following the agriculture subsidy reforms. In particular, the poverty rate, poverty gap, and poverty severity indices are estimated to increase by 1.13 (2.44), 1.06 (3.25), and 2.05 (6.19) percentage points in rural areas, whereas the same indices are estimated to rise by 1.88 (5.82), 2.04 (6.27), and 3.56 (10.91) percentage points in urban areas, respectively, under simulation subscenario 2a (2b). By the same token as above, discrepancies in poverty impacts across regions are largely attributed to the fact that all poverty indices for urban areas are considerably lower compared to rural areas in the base year; thus, a one-percent decline in income prompts a relatively larger increase in urban poverty. On the whole, the increase in poverty indices appears to be considerably larger under simulation subscenario 2b than under 2a. This finding occurs because under the implementation of simulation subscenario 2b, the economy experiences a relatively sharper rise in consumption prices and a relatively sharper decline in return to unskilled labor. These in turn harm the poor to a higher degree in contrast to the implementation of simulation subscenario 2a. Based on these results, one could conclude that the greater the subsidy reforms in agriculture are (in terms of percentage cuts in subsidies), the larger their unfavorable effects on poverty within the country would be.

Lastly, in the simulation scenarios 3a and 3b the direction and magnitude of changes in poverty measures is determined by combining the impacts of the tariff liberalization and agriculture subsidy reduction scenarios (columns 4 and 5 in Table 6.2). Apparently, the positive poverty effect produced by tariff liberalization scenario more than offsets the negative poverty effect produced by agriculture subsidy reform scenarios. Hence, the net positive poverty impact prevails under both simulation subscenarios 3a and 3b. This indicates

that accession to the WTO would help to alleviate poverty in the country (regardless of the accession status). According to the estimates, the poverty rate, poverty gap, and poverty severity indices at the national level are expected to deteriorate as much as 4.61 (2.81), 6.18 (3.71), and 7.01 (4.32) percentage points, respectively, under simulation subscenario 3a (3b). An additional interesting insight can be obtained while comparing the poverty impacts of two alternative full accession simulation scenarios at the national level. As can be seen from the Table 6.2, under simulation subscenario, 3a the model produces more pronounced effects on the reduction of poverty indices than under simulation subscenario 3b. With this background, one may state that a country's accession to the WTO with developing country status would lead to significantly better results in terms of nation-wide poverty alleviation compared to accession under developed country status.

Further on, the estimations at the regional level indicate that under simulation subscenarios 3a and 3b the poverty measures are negatively affected in both rural and urban areas. In particular, the poverty rate, poverty gap, and poverty severity indices are expected to decrease by 4.49 (4.93), 5.93 (7.16), and 5.66 (7.90) percentage points, respectively, in rural (urban) areas following the simulation subscenario 3a. On the other hand, under simulation subscenario 3b, poverty rate, poverty gap, and poverty severity indices are expected to decrease by 2.98 (2.35), 3.86 (3.20), and 1.77 (3.58) percentage points. Such an outcome of the simulation experiments reveals that the WTO membership in general would help to decrease the poverty in both rural and urban areas. However, acceding the organization under developing country status would generate more progressive results in terms of the poverty alleviation in urban and rural areas, in contrast to acceding the organization under developed country status.

6.3 Concluding remarks

In this chapter, the results of the simulated implementation of the WTO-accompanied policies are carefully presented and extensively discussed. In particular, in line with the study's central intention, we simulated the impacts of policies on selected important macroeconomic variables, sectoral level variables, household level welfare, and poverty.[84]

[84] In order to avoid repetition, we will discuss the conclusions of this chapter, which is also the conclusions of this thesis, in the general conclusion part of the thesis (Chapter 7).

7 SENSITIVITY ANALYSIS AND GENERAL CONCLUSION

In the preceding chapter, we discussed results of the policy simulation experiments obtained from the model that relies on a number of behavioral parameters, such as various elasticities, which have been entirely excerpted from external sources. As with any simulation experiment, the findings of our simulation exercise also depend on the choice of these input parameters. Undoubtedly, simultaneous estimation of elasticity parameters in the course of the study would be preferable in implementing the model. However, due to reasons mentioned earlier, we stay with the common procedure, as observed in many other CGE studies, and adopt these parameters from relevant studies. Thus, it is not valid to claim that the elasticity parameters used in the model reflect reality; in fact, this is a widespread criticism of using the CGE models for the *ex-ante* policy evaluations (Boehringer, 2004; Kitwiwaltanachai et al., 2010; Dixon and Jorgenson, 2012). The uncertainties surrounding elasticity parameters in turn create a greater need to test these parameters in terms of their impacts on the model. Therefore, in the first part of the present chapter, systematic sensitivity analysis is carried out with an aim to gauge the validity and robustness of the model's central findings with respect to exogenously adopted elasticity space. The emphasis in the second part of this chapter is placed on drawing conclusions of the overall study, including the main findings, relevant policy implications, limitations, and possibilities for further improvements.

7.1 Systematic sensitivity analysis

To perform the sensitivity analysis in the context of the CGE models, one may consider one or two different sets of elasticity parameters (i.e., arbitrary doubling and/or halving the pre-established level of elasticities), solve the model for each set and then examine the sensitivity of changes in study-relevant endogenous variables. In the literature, this way of conducting sensitivity analysis is known as *ad-hoc* sensitivity analysis.[85] While lending some insight into the robustness of model results with respect to variation in exogenously adapted behavioral parameters, this approach is far from systematic in exploring the effects of different combinations of elasticity parameters (Arndt, 1996). To the contrary, recent advances in the literature suggest a convenient way of undertaking the sensitivity analysis: systematic

[85] As an example of application of the *ad-hoc* sensitivity analysis within the CGE framework, readers can refer to Pauw and Thurlow (2011), Timilsina et al. (2011), and Alvarez-Martinez and Polo (2012), among other recent studies.

sensitivity analysis. The most common approach to systematic sensitivity analysis is to conduct a Monte Carlo procedure,[86] which is a tool also widely used within the GTAP community. Through the Monte Carlo procedure, the model is repeatedly solved using a randomly generated vector of elasticity parameters.[87] This approach was proposed by Harrison and Vindor (1992) and Harrison et al. (1993) and implemented among other recent studies in Tanaka and Hosoe (2011), Bouet et al. (2012), and Lanz et al. (2013). This approach delivers more reliable and systematic insight into the impacts of variations in elasticity parameters on the model results, in contrast to simple *ad-hoc* sensitivity analysis (Hermeling and Mennel, 2008; Arndt, 1996). Thus, to conduct a formal sensitivity analysis, we opted for the Monte Carlo approach. In particular, for each Monte Carlo run, all "barrowed" elasticity parameters of the AzCGE model (Armington elasticity of substitution between imports and domestic sales (σ_i^A) and between import origins (σ_i^{AR}), elasticity of transformation between domestic sales and exports (σ_i^T) and between export destinations (σ_i^{TR}), and elasticity of substitution between labor and capital (σ_i^F) and between skilled and unskilled labor (σ_i^{LD})) are independently (i.e., the covariance between elasticity parameters is zero) and simultaneously perturbed from their default values with all other assumptions being untouched.[88] This process is repeated until we have obtained a desired sample size—in our case, 200. Accordingly, a series of new equilibrium solutions with the new estimated endogenous variables are generated by the model.

However, before performing the analysis, it was necessary to invoke some assumptions about the underlying parameter distributions. Given that we did not have prior information regarding the distribution of elasticity parameters, similarly to Rutherford and Tarr (2008), we assumed a uniform distribution for all elasticity parameters over specified range. The range of parameters was set to +/-25 percent around the default values; expressing formally, we have chosen: $\sigma_i^A \sim \mathcal{U}$ (3.75, 6.25), $\sigma_i^{AR} \sim \mathcal{U}$ (8.5, 12.5), $\sigma_i^T \sim \mathcal{U}$ (2.25, 3.75), $\sigma_i^{TR} \sim \mathcal{U}$ (4.5, 7.5),

[86] The Gaussian Quadrature is an alternative to the Monte Carlo approach for systematic sensitivity analysis (see Arndt, 1996; DeVuyst and Preckel, 1997). However, due to the easiness of modeling and application of the Monte Carlo approach within the GAMS framework, we discerned this approach for our systematic sensitivity analysis.

[87] For a formal description and application of the Monte Carlo approach within CGE models, readers can refer to Belgodere and Vellitini (2011).

[88] As we noted in a previous chapter, elasticity parameters σ_i^{AR} and σ_i^{TR} in our model are tied to elasticity parameters σ_i^A and σ_i^T, respectively, via the "rule of two" assumption (recall $\sigma_i^{AR} = 2 \cdot \sigma_i^A$ and $\sigma_i^{TR} = 2 \cdot \sigma_i^T$). The same assumption also holds in our sensitivity analysis.

$\sigma_i^F \sim \mathcal{U}(1.125, 1.175)$, and $\sigma_i^{LD} \sim \mathcal{U}(0.75, 1.25)$.

To save space and time, we limited ourselves to conducting a sensitivity test solely for simulation of scenario 3a. Since direct interest of the current study is to quantify the economic and social consequences of Azerbaijan's WTO membership, choosing the full accession simulation experiment is more appropriate for our sensitivity analysis.

Using the results obtained from the stochastic simulations, we have computed a mean of percentage changes (percentage point changes in the case of poverty measures) for selected endogenous variables. Additionally, Chebychev's inequality[89] is used to place confidence interval on the results. These statistics provide useful insights into the robustness of the simulation results. Although results for all endogenous variables in the model change with variations in the elasticity parameters, we report the outcome of the sensitivity test for a number of the most important variables, mainly to save the space. Figures 7.1-7.3 provide an illustrative statistical summary of the results.

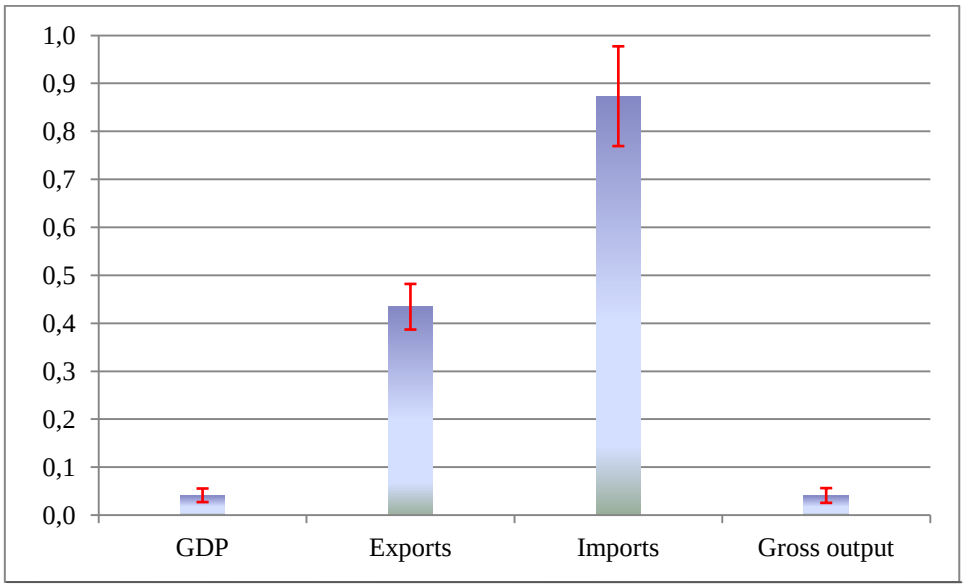
The upshot of sensitivity analysis in terms of the effects on selected macroeconomic variables reveals that the mean values are very close to our central model findings (Figure 7.1). Furthermore, looking at the confidence interval, we can be 90 percent confident that the impact of the considered simulation experiment (full accession scenario 3a) would remain positive for all reported macroeconomic aggregates, irrespective of the used elasticity parameter values. These results reinforce our main conclusions regarding the macroeconomic effects of Azerbaijan's expected WTO accession.

Regarding the effects on production level (output) by sectors, the mean of the systematic sensitivity results show a roughly similar pattern to our point estimates (Figure 7.2). However, according to the established confidence interval, direction of percentage changes in production level could differ from our main findings in five sectors: textiles, other minerals, other food products, clothing and furs, and other services. For instance, in the textiles sector, the considered simulation experiment (3a) could lead to a decline in output as large as 0.71 percent, or the sector could possible grow by 2.48 percent under the 90 percent confidence interval.

[89] Assuming that we have a random variable X with the mean μ and standard deviation σ, Chebychev's inequality states that for each positive real number *k*, the probability that the value of X does not lie within *k* standard deviations of the mean μ is no more than $1/k^2$. Formally, Chebychev inequality can be presented as:

$$P\{|X-\mu| > k\sigma\} < \frac{1}{k^2}.$$

FIGURE 7.1: Systematic sensitivity analysis: macroeconomic effects as percentage changes

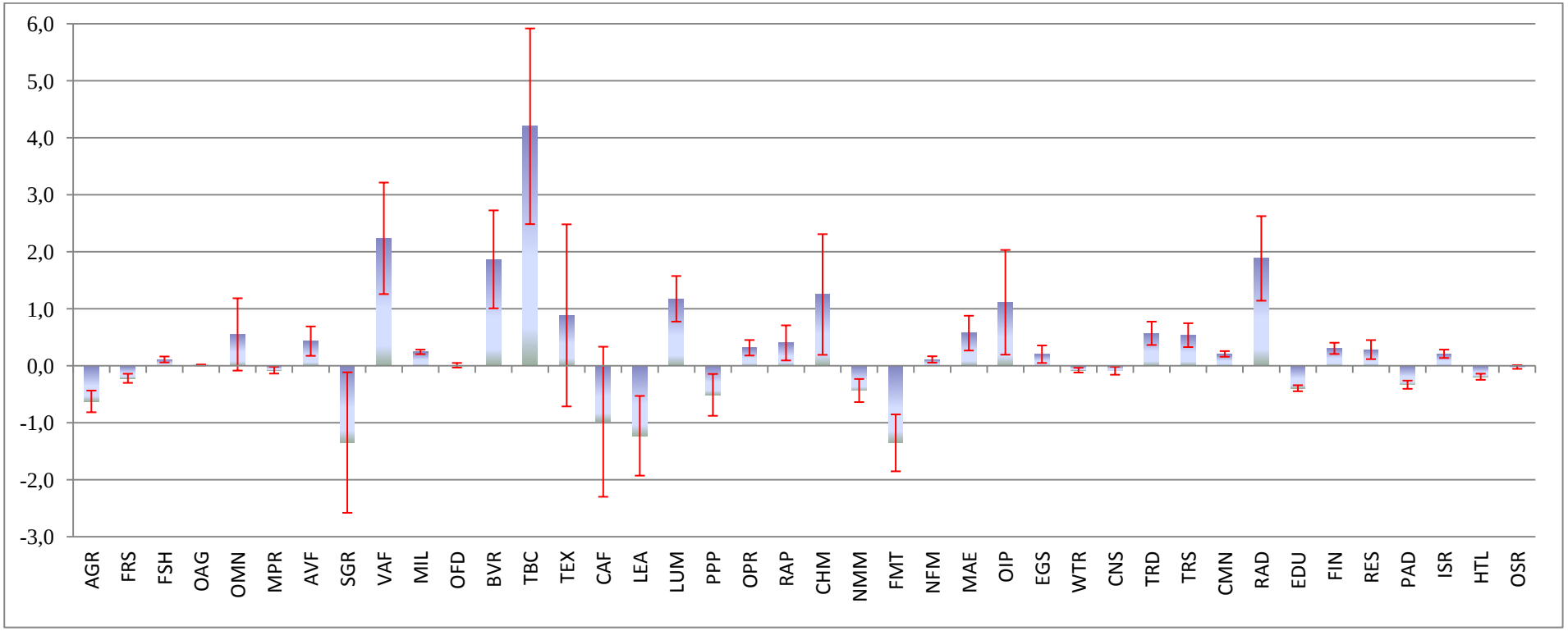


Note: The bars in the figure denote a means and the vertical lines show 90 percent confidence interval. The lower and upper bound of confidence intervals are computed as $\mu \pm k \cdot \sigma$, where k =3.16 for 90 percent confidence interval.
Source: Author's estimation from Monte Carlo simulations

Besides this caveat, we can be at least 90 percent confident that the majority of the "winning" ("losing") sectors in terms of output growth (contraction) from our central model findings would remain "winners" ("losers") under considered simulation scenario, regardless of the used elasticity parameters. Accordingly, our primary conclusion as to sectoral level output effects of Azerbaijan's WTO accession appear to be robust.

The mean values of the welfare effects as a percentage of consumption (on average across households) drawn from the systematic sensitivity analysis do not significantly differ from our core model findings (Figure 7.3). However, the confidence interval is observed to be relatively wider. Likewise, in contrast to our main findings, our 90 percent confidence interval indicates that a full accession scenario (3a) could be welfare reducing (on average), both at the national (with the estimated lower (upper) bound -1.24 (4.22) percent) and regional levels (with the estimated lower (upper) bound for rural welfare -1.16 (4.57) percent and for urban welfare -1.13 (3.69) percent). However, as shown in Figure 7.3, the largest parts of the confidence intervals lie in the positive zone. Therefore, it is less likely that welfare effects (on average) of WTO accession on households (as a percentage of consumption) would be negative (both at the national and regional levels). Accordingly, the results of the study in terms of the welfare impacts of WTO accession can be considered rather robust to plausible range of uncertainty about the elasticity parameters.

FIGURE 7.2: Systematic sensitivity analysis: sectoral level output effects as percentage changes

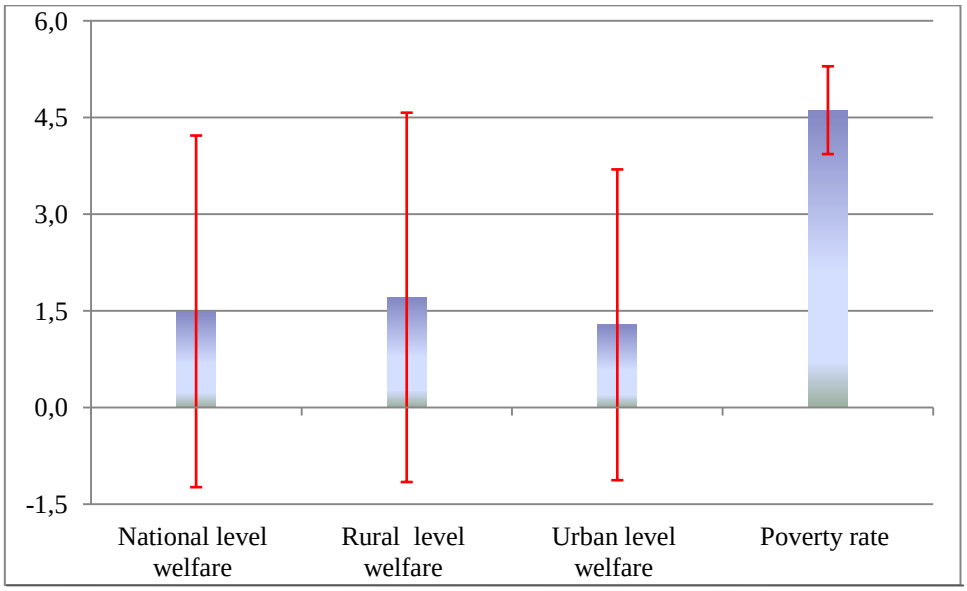


Note: The bars in the figure denote a means and the vertical lines show 90 percent confidence interval. The lower and upper bound of confidence intervals are computed as $\mu \pm k \cdot \sigma$, where k =3.16 for 90 percent confidence interval.

Source: Author's estimation from Monte Carlo simulations

Lastly, concerning the effects on poverty, the mean value in poverty rate deviation (national level) resulting from the sensitivity test is almost identical to the poverty rate deviation of our core model simulation (Figure 7.3). In addition, we can be at least 90 percent confident that the considered full accession simulation scenario would bring a fall in poverty rate at the national level, estimated to be within the range of 3.93-5.29 percentage points. This outcome indicates that the study's basic conclusion regarding poverty effects of Azerbaijan's WTO membership is strongly robust.

FIGURE 7.3: Systematic sensitivity analysis: welfare effects (on average) as percentage changes and poverty effects as percentage point changes



Note: The bars in the figure denote a means and the vertical lines show 90 percent confidence interval. The lower and upper bound of confidence intervals are computed as $\mu \pm k \cdot \sigma$, where k =3.16 for 90 percent confidence interval.
Source: Author's estimation from Monte Carlo simulations

7.2 General conclusion

7.2.1 Summary of the study and main findings

In this study, we have endeavored to quantitatively scrutinize the economic and social impacts of Azerbaijan's WTO accession, thereby contributing to ongoing controversial debates on this issue among policy-makers, representatives of the business community, and economists. To achieve this objective, we have pursued the following steps.

To start, it was indispensable to answer the question: What would WTO accession mean for Azerbaijan? More precisely, it was essential to identify important economic policy reforms that would likely come along with Azerbaijan's expected WTO membership. With this in mind, we initiated a comprehensive discussion regarding the compatibility of the relevant

domestic economic policies (those intensively discussed in the course of negotiations) with WTO-defined principles and rules. Liberalization of trade barriers in the form of lowering tariffs and reforms in domestic agriculture policy regime through scrolling down subsidies were found to be the most likely policy changes that would accompany Azerbaijan's WTO accession. Therefore, we confined ourselves to changes in these policies in the context of Azerbaijan's WTO membership. Additionally, it was also found that depending on the expected accession status (developing or developed country), Azerbaijan would undertake a different reform path in its domestic agriculture policy regime. More explicitly, entering the WTO under developed country status would bring, in itself, more profound reforms in agricultural policy, as opposed to entering this organization under developing country status.

After determining the shape of potential policy changes that would likely accompany Azerbaijan's WTO accession, as a following step, we reviewed theoretical and empirical evidence on the economic and social impacts of those policies. Although economic literature concludes that trade liberalization enhances an economic growth and improves social welfare, it fails to suggest any conclusive evidence concerning the effects on poverty. In terms of the economic impacts of reducing trade-distorting agriculture subsidies, the economic literature suggests that such a movement in policies hits the agriculture sector adversely. However, the effects of agriculture subsidy cuts on the rest of the economy are ambiguous and depend on the structure of the national economy. Concerning the effects of scrolling down the agricultural subsidies on poverty, the literature suggests that this policy is more than likely to create anti-poor effects. Furthermore, we also initiated a brief discussion on the existence of Dutch disease phenomenon in Azerbaijani economy (as a country-specific distinctiveness) and drew a brief theoretical discussion regarding the likely effects of WTO-imposed policy reforms on Dutch disease. It is found that Azerbaijan appears to exhibit the classical symptoms of Dutch disease phenomenon, and the discussions based on theoretical evidence supports the contention that liberalizations in trade barriers might mitigate the negative effects of the Dutch disease.

Subsequently, for an empirical part of the study, we developed a country-specific, multi-sectoral, static computable general equilibrium model (named AzCGE) that is complemented by a multi-household, non-behavioral micro-simulation model with endogenous poverty line—as the best possible rigorous quantitative instrument for the purposes of the current research. The top-down mode was chosen as the most appropriate technique for linking the models (the AzCGE model with the micro-simulation model). Furthermore, the Hicksian

equivalent variation (as a percentage of consumption) and FGT class of measures were utilized to account for the welfare and poverty effects, respectively. The developed approach enabled us to address all aspects of the study-relevant research questions in detail and thus provide a complete picture of the effects from the expected policy changes. In particular, employing the AzCGE model made it possible to derive sophisticated conclusions regarding the macroeconomic effects (research question (i)) and sectoral level effects (research question (ii)), while employing the micro-simulation model made it possible to derive household level welfare and poverty implications of considered policy reforms (research question (iii)).

As a next step, it was necessary to assemble a consistent database for empirical implementation of the developed model. The year 2006 was chosen for the reference/ benchmark year because all necessary databases were completely available for this year. A unique social accounting matrix for the Azerbaijani economy was constructed using diverse data sources to implement the AzCGE model. The widely applied least squares technique was used to eliminate various inconsistencies in the prior constructed SAM. The final (balanced) SAM for the Azerbaijani economy (by this means also the AzCGE model) comprises 40 activities, 40 commodities, 3 production factors, 1 representative household, 1 government, 1 corporate enterprise, 1 saving-investment, and 2 rest of the world accounts. Further on, to implement the micro-simulation model, we used data from a nationwide survey on households' budgets, obtained directly from the AzSTAT. For the purposes of the study, several inconsistencies in the survey were eliminated and its contained information was reorganized in order to use it directly in our micro-simulation model. All the households that are found in the survey consisting of 15,062 households have been incorporated into the micro-simulation model. As a final stage of data compilation process for our analytical framework, various behavioral parameters were also determined. While some were calibrated using the information contained by the SAM and the HBS, others were adopted from relevant studies. Lastly, based on the assembled datasets, descriptive statistics were provided for the reference year. This enabled us to understand the structure of the economy as well as the characteristics of the population belonging to different social strata, in general, and to the poor, in particular.

In the following, the developed model and its underlying database were used to examine short- to medium-term economic and social impacts (*ex-ante*) of the policy reforms that would likely accompany Azerbaijan's WTO membership. In particular, to investigate the research questions of the study, a set of counterfactual policy scenarios were postulated and

simulated. As the different components of WTO accession reform package, we first simulated the impacts of tariff liberalization and agriculture subsidy reforms separately, which helped us to understand the direction and magnitude of the effects regarding each of these policies. In the sequel, the simulations were carried out for the complete package of WTO accession policy reforms: the combination of tariff liberalization and agriculture subsidy reform scenarios. Given the remaining uncertainties associated with Azerbaijan's expected membership status in the WTO at the current stage of negotiations, we have simulated two alternative policy options, where one of them considers accession of Azerbaijan as a developing country and the other as a developed country. The outcomes of the experiments were presented for a set of important economic and social variables that are in line with the study's core intention.

The key findings of the study can be summarized as follows:

- At the broadest level, the findings of the study permit us to conclude that Azerbaijan stands to benefit from accession to the WTO because subsequent policy reforms are projected to have overall positive impacts on the economic performance and social environment in the country.
- Accession to the WTO generates pronounced structural adjustments throughout the economy (especially in the case of acceding under developed country status). In general, sector-specific results indicate that the membership favors mainly the export-intensive manufacturing sectors. The sectors such as tobacco, other chemical products, beverages, prepared and preserved fruits/vegetables, other minerals, textiles, and other industrial products (including recycling) are projected to be the most expanding production sectors of the economy ("winners"). Further on, among the service sectors, accession favors research and development, transportation, and trade sectors. Conversely, WTO accession creates a bias against the production in domestic-oriented sectors. The sectors such as leather, agriculture, sugar, ferrous metals, and clothes and furs are expected to be the largest contracting sectors of the economy ("losers").
- Regarding the trade flows, accession to the WTO is expected to increase the overall scale of Azerbaijan's foreign trade and also diversify imports and exports in terms of both composition of commodity and geographical distribution.
- Although obtained results indicate that WTO accession would have an adverse effect on agriculture sector development, export-intensive non-oil/non-gas manufacturing sectors are expected to expand. This outlook pinpoints that Azerbaijan's deeper

integration into the global economic community in the form of accession to the WTO would be, in general, a good policy response to Dutch disease. In turn, this could contribute to long-term and sustainable socio-economic development of the economy.

- In terms of the social impacts of WTO accession, the membership is expected to improve the overall well-being of the population of Azerbaijan. This is illustrated by an improvement in the welfare level (as a percentage of consumption) of the vast majority of households. However, the welfare gains are unevenly distributed among households belonging to different income groups/deciles and dwelling in different regions. For Azerbaijan, the membership is expected to be more (less) beneficial for the wealthiest (poorest) stratum of the population (both at the national and regional levels). Although inequality impact assessment of WTO accession goes beyond the scope of the current study, it is interesting to note that such an outcome is a bad sign for likely development of inequality within the country after the membership. Furthermore, regarding the welfare impacts of the accession at the regional level (urban versus rural), WTO membership is expected to be more welfare enhancing for rural households compared to urban households. Such an outcome could potentially lead to narrowing the existing disparities in well-being between urban and rural populations within the country. Overall, being WTO members as a developing country generates more progressive results in terms of welfare implication. On the other hand, entering the WTO under developed country status results welfare losses (on average) for urban households, but welfare gains (on average) for rural households.

- Rather importantly, WTO accession reduces the level of poverty in Azerbaijan (both at the national and regional levels), thereby accelerating the already-existing positive trend in the poverty-alleviation process. Additionally, the accession contributes gradually to a reduction in the depth and severity of poverty in the country. Although WTO accession is found to be potentially pro-poor, irrespective of Azerbaijan's membership status, it appears that accession under developing country status leads to notably more pronounced outcomes in terms of lessening the level, depth, and severity of poverty than becoming the member of this organization with developed country status.

- A last important piece of information emerging from our analysis is that liberalization in trade barriers in the form of lowering tariffs is the main driving force for the obtained results.

As a final step, we have devoted considerable attention to the sensitivity analysis with respect to uncertainties in exogenously adopted elasticity parameters, aiming to increase the credibility of the study's main findings. For this purpose, we employed a systematic sensitivity analysis based on the Monte Carlo approach, which has proven to be the most appropriate and unbiased methodology for sensitivity tests. On the whole, the results of the sensitivity test engender confidence in the model results and the general conclusion of the study.

Several important policy implications can be derived from the findings of the study. First, based on our empirical assessment, which shows that Azerbaijan would obtain economic and social benefits after becoming a member of the WTO, one can argue that the concerns of some policy-makers, economists, and representatives of the business community are unfounded regarding the potential negative impacts of accession.[90] In turn, this indicates that as an applicant country, Azerbaijan should speed up the pace and intensity of its membership negotiations with the WTO. Second, obtained results designate that Azerbaijan's desire to become a member of the WTO as a developing country is somewhat justified because accession under developing country status tends to bring relatively remarkable benefits in terms of welfare improvement and poverty reduction.[91] Therefore, as an appropriate strategy, Azerbaijan should continue its efforts in membership negotiations to join this organization under developing country status.[92] Third, given that WTO accession would most severely affect the agriculture sector (largely due to subsidy cuts), the government should undertake complementary policies to easy out the costs of economic adjustment in this particular sector. The government of Azerbaijan could further support the agriculture sector while comprehensively redesigning its contemporary domestic agricultural policy regime. In particular, it is reasonable to use those support measures that are classified under the green box instead of currently applied amber box measures. As we mentioned in Chapter 2, the green box measures do not face any restrictions due to WTO rules. The green box measures

[90] Alongside our estimated benefits, there could also be other dimensions of the benefits of being a member of the WTO. For instance, Drabek and Baccetta (2004) pointed out that the WTO accession may improve the quality of domestic institutions and help eradicate corruption in the society, which is considerably high in Azerbaijan, according to the Corruption Perception Index provided by Transparency International in recent years. Furthermore, membership also gives the possibility to use the dispute settlement mechanism of the organization.

[91] It is important to note that joining the WTO under developing country status also brings some other privileges, such as the country receives technical and professional assistance from the organization.

[92] Notice that we draw this particular conclusion based on the short- to medium-term effects of the accession. However, considering long-term effects may lead to different conclusions.

could include, e.g., research, pest and disease control, marketing and promotion services; decoupled income payments; income insurance and safety-net programs; environmental programs; and investment aids.

7.2.2 Limitations of the study and future research areas

Despite considerable efforts made to investigate the economic and social impacts of Azerbaijan's accession to the WTO as precisely as possible, this study is still constrained by various factors that could be considered limitations of the study. In this subsection, we acknowledge the existence of several sets of limitations of the study and, accordingly, provide the most relevant suggestions for future research and advancements.

As with many empirical studies, the first set of limitations concerns availability of comprehensive and accurate databases. As already noted, the original IO table, which is the core of our SAM building is less informative regarding the agriculture sector in the economy, such that it includes a single agriculture sector at the aggregated level. Therefore, we were not able to identify the potential "winners" and "losers" from the considered policy reforms among agriculture subsectors. Nevertheless, given the economic and political importance of this sector in the country,[93] an attempt in future research should be directed to assembling detailed information on agriculture subsectors to disaggregate this sector into several lines of production in the compiled SAM. This could be then used to enrich the agriculture sector modeling within the AzCGE framework. In turn, this would allow in-depth assessment of agricultural sector, thereby adding valuable inputs into the WTO accession issues.

As mentioned further up, in common with the most other studies that adopt CGE models, we have also "borrowed" elasticity parameter values from relevant literature. This can be seen as another limitation of the study. Although a sensitivity test with respect to employed elasticity parameters was conducted to increase confidence in the robustness of the results, econometric research is needed to estimate the "right" elasticity parameters in the case of Azerbaijani economy. In turn, this would narrow down the range of uncertainties in elasticity space and thus improve the overall predictions of the model findings.

The following set of limitations is associated with the nature of employed model. The current model is static and thus misses the dynamic impacts of the policies. However, in future

[93] As we have already seen in the preceding chapters, agriculture is the third largest sector of the economy and the government considers this sector as a part of its economic diversification policy into the non-oil/non-gas sector.

research, the model developed and used in this study can be expanded by introducing dynamic features to the model. This will make it possible to track long-term responses of the economy to considered policy changes. Note that the dynamic model would also require additional datasets. The study is also limited considering the market perfection in all commodity and factor markets and the constant return to scale technology assumption in all production sectors. In reality, however, some parts of the economy might operate under market imperfection and the technology in some sectors might exhibit increasing or decreasing return to scale. Therefore, in further research, a closer examination of structure of all relevant markets and production sectors is needed. This would allow identification and incorporation of market imperfections and/or economies of scale whenever necessary into the utilized model, which in turn could potentially improve overall predictions of the study.

The remaining set of limitations is associated with considered experimental designs (or counterfactual policy simulations). It is well known that the WTO membership could also improve access to foreign markets (Michalopoulos, 2002; Drabek and Bacchetta, 2004). Ferhad (2010) confirmed that Azerbaijan's accession to the WTO would reduce the trade barriers faced by Azerbaijani exporters in their export destinations (particularly in non-CIS countries). This would in turn impact export prices faced by Azerbaijani producers, which in itself would have some economic and social consequences. Due to time and data limitations in the course of this study, we have neglected this aspect of the WTO accession and concentrated solely on the policy changes that would likely to happen within the country.[94] Nonetheless, taking this effect of the accession into account could probably lead to more progressive results and further lines of research should focus on this issue.

Notwithstanding the above stated limitations, findings of the study provide a very useful insight into the economic and social impacts of policies that is likely to accompany Azerbaijan's WTO accession.

To conclude, it is worthwhile to note that the developed AzCGE model and its linked micro-simulation model is sufficiently flexible and thus could deserve as an analytical framework for various research directions outside the scope of this study (together with the underlying datasets)—such as analyzing the various tax policies, structural reform policies, and energy polices, among others.

[94] To measure (quantitatively) the potential size of the changes in trade barriers imposed against Azerbaijan's exports in non-CIS countries following the WTO membership would require compilation and evaluation of wide-ranging qualitative and quantitative information regarding the various trade regulations in those countries. Due to time and resource constraints, it was not possible to carry out this assessment within the current study.

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APPENDIX I: Mapping between SAM and HBS commodity classification

		Rice
		Cereals
		Oranges, satsumas, mandarins, clementines
		Bananas
		Apples
		Pears
		Other drupe fruits
		Other fruits
		Melons
		Grapes
		Other types of berrys
		Nuts
		Cabbage, cauliflower, and broccoli
		Other green plants, including lettuce, and peppers
		Cucumber
		Tomatoes
		Other garden plants and vegetables
1	**Agriculture**	Beets
		Carrots
		Onions and garlic
		Other fruits
		Mushrooms
		Potatoes
		Ponys
		Live traction vehicles
		Horses
		Gardening
		Other pets
		Veterinary services
		Animal care and training services
		Beans
		Cotton
		Wool
		Eggs
		Honey
2	**Forestry**	Not consumed
		Live and chilled fish
		Omul
		Chub
		Sturgeon
		Beluga
3	**Fishery**	Billfish
		Llish
		Thunnus
		Mat
		Other types of edible fish
		Alive and chilled seafood
4	**Oil and gas extraction**	Not consumed

5	**Other minerals**	Not consumed
6	**Meat and meat products**	Preparations made by the addition of fish sensory
		Beef with bones
		Beef without bones
		Pork chops without bones
		Pork chops with bones
		Sheep and goat meat
		Sheep and goat meat without bones
		Sheep and goat meat with bones
		Chicken meat
		Chicken thigh
		Other chicken meat products
		Other poultry meat
		Other home animals chops
		Meat of wild animals and birds
		Beef legs, tails, and internal organs
		Sheep legs and internal organs
		Pork liver
		Other meat products
		Water boiled sausage
		Water-boiled, smoked, semi-smoked sausage
		After drying smoked sausage
		Other sausages
		Sausage, small sausage
		Smoked meat and meat, snacks
		Meat and meat plants for children
		Canned meat products with splitting
		Tinned meat
		Meat preparations and manufactured articles
		Crushed and frozen fish
		Pickled, smoky, and dried fish
		Salty herring
		Canned fish fat, other than children food
		Fish canning tomato sauce
		Other canned fish
		Semi-prepared fish products
7	**Animal and vegetable oils/fats**	Animal fats
		Margarine
		Other edible vegetable oils and fats
		Olive oil
		Sunflower oil
		Other vegetable oils
		Edible fats of animal origin
8	**Sugar**	Sugar
9	**Prepared and preserved fruits/vegetables**	Dried fruit
		Dried grapes
		Frozen and canned fruit products
		Potato starch
		Other starchy tuberous
		Frozen vegetables
		Dried vegetables

		Dried mushrooms
		Other canned vegetables
		Vegetable snacks
		Canned tomatoes
		Vegetable foods for kids
		Semi-prepared vegetable products
		Potatoes, semi-finished, and finished goods
		Soybean products
		Jam
		Canned fruits
		Fresh fruit and canned foods for kids
		Ketchup
		Mayonnaise
10	**Dairy products**	Pasteurized and sterilized milk containing 2,5-3,5% of fat
		Pasteurized and sterilized milk containing more than 3,5% of fat
		Pasteurized and sterilized milk containing less than 2,5% of fat
		Modified milk ingredients
		Dried milk
		Mixture of dry milk for baby food
		Dry cream
		Sweetened thickened milk
		Other milk cans
		Yogurt
		Cream
		Sour cream
		Milk products for baby's
		Oxygenated milk products
		Other milk products
		The composition of the hard and soft cheese, peppery yeast
		Type of soft cheese
		All other cheese
		Cottage cheese with fat
		Cottage cheese without fat
		Cottage cheese and other products
		Ice cream
		Not pasteurized milk and milk products
11	**Other food products**	Flour mixed
		Wheat flour
		Rye flour
		Semolina
		Buckwheat
		Oatmeal and barley cereals
		Other cereals
		Wheat bread
		High quality wheat bread
		First sort of wheat bread
		Rye bread and other bakery products
		Bakery products with fats
		Rusk products
		Bagel products
		Cookies
		Pryanik

		Other bakery and flour confectionery
		Filled pillow in the confectionery
		Spagetti
		Pasta
		Inside filled and unfilled dough products
		Inside of dough filled with meat products
		Pastry filled with domestic fish products
		Inside of dough filled with cheese products
		Inside of dough filled with fruit products
		Inside of dough filled with vegetables products
		Inside filled dough products
		Oatmeal "Hercules"
		Cereals, flour, starch or nutrient products for children
		Other cereal products
		Chocolate
		Caramels
		Pastille, lozenge
		Other confectionery products
		Other sauces and spices
		Salt
		Culinary products and spices
		Maya, soup and concentrates
		Other food products for children
		Other food products
		Coffee
		Tea
		Cocoa and cocoa powder
		Sturgeon and caviar gold and bank cashier’s check
		Egg powder
		Mélange of a mixture of frozen eggs
12	**Beverages**	Mineral water
		Soft drinks
		Other beverages
		Fruit juices
		Vegetable juices
		Vodka
		Cognac
		Cream liqueur
		Wine
		Fine quality wines and champagne
		Beer
13	**Tobacco**	Filtered cigarettes
		Cigars
		Tobacco - flake
		Drugs
14	**Textiles**	Silk, synthetic stapl
		Carpet and carpet tiles
		Cotton fabric for home furnishings
		Bedroom accessories
		Bedrooms network
		Dining room and bathroom networks
		Other textile articles

		Industrial-use textile products
15	**Clothing and furs**	Warm lining and fur coats
		Hot primer coat, plas
		Suit, jacket, vest
		Trousers
		T-shirts
		Underwear, including night shirts
		Products from socks
		Warm lining and fur coats from skin
		Hot primer coat from skin
		Frock
		Skirt, pants
		Sweater, jacket, pullover
		Socks
		Warm lining, furs and coats
		Hot primer coats and jackets
		Clothing for children up to age
		Tissues, scarfs
		Gloves, couplings, one-finger gloves
		Working clothes
		Haberdashery
		Clothing repair
		Clothing construction
		Cleaning, washing, and painting of clothes
		Renting clothes
16	**Leather products**	Men head-dresses from leather
		Women head-dresses from leather
		Children with leather headgear
		Other head coverings from leather
		Winter boots jackboot for men
		Half boots and shoes
		Specialized sports shoes for men
		Other types of men's shoes
		Women and winter boots jackboot
		Slippers
		Summer shoes
		Women's specialized sports shoes
		Other types of women shoes
		Long-throat warm, warm winter boots
		Boots are a warm, semi-throat boots, slippers
		Summer footwear made by leather
		Specialized sports shoes for kids
		Other types of children's shoes
		Shoe repair and rental
		Leather coats and jackets
		Items for travel and other leather products
17	**Lumber**	Wooden flooring
		Wood cutting
18	**Paper and paper products, including publishing**	Books
		Newspapers and periodicals
		Other printing materials
		White paper bijouterie

		Wallpapers
19	**Oil processing**	Gasoline
		Other oil processing products
		Lubricants
20	**Rubber and plastic**	Not consumed
21	**Other chemical products**	Paints and varnishes
		Synthetic detergents
		Soaps
		Other chemical products used in household
		Wash and dry cleaning
		Medical drugs
		Vitamins and mineral materials
		Medical products
		Toilet soap
		Perfumes and toilet waters
		Other perfumery-cosmetic products
		Other liquid fuels
22	**Non-metallic minerals**	Window glasses
		Sanitary ware
		Bricks
		Cement
		Slate and roofing materials
		Chandeliers for lighting and other equipment
		Glass and crystal products
		Ceramic, porcelain, and ceramic cooking utensils
		Kitchen utensils and other accessories
		All non-metallic equipments
		Glasses and contact lenses
23	**Ferrous metals**	Sets of dishes
		Plates, ovens, and stoves
		Fixed garage
24	**Non-ferrous metals**	Jewelry
		Bijouteria
		Watches
		Other watches
		Watches and jewelry repair services
25	**Machinery and equipments**	Refrigerators
		Freezers
		Spare parts
		Washing machines
		Drying device
		Dishwashers
		Heaters
		Conditioners
		Cleaner devices
		Sewing machines
		Other major household appliances
		Small electric appliances
		Cottage equipment
		Small electric goods
		All other equipment and hand tools bag

		Garden equipments
		Household equipments
		Tools needed for home services
		Other therapeutic appliances and equipment
		Other medical equipment and devices repair
		Cars
		Motorcycles
		Cycles
		Trailers transport goods for animals
		Spare parts and equipment repair and maintenance services
		Color TV
		Black and white TV appearance
		Video players
		Other TV equipment
		Receivers
		Recorders
		Audio players
		Stereo systems
		Radio equipments
		Cameras
		Video cameras
		Other camera equipments
		Optical and surveillance equipment
		Personal computers
		Complete with peripheral equipment
		Other equipment for data processing
		Audio cassettes – written
		Video cassettes – written
		Other equipment for sound and describe writing - written
		Audio cassettes – clean
		Video cassettes – clean
		Other audio equipment for recording and description - clean
		Goods for sport and leisure time
		Tourist microbuses, vans, and trailers
		Musical instruments
		Long-term, large-scale, other recreational equipment
		Work, entertainment equipments
		Other equipments
		Personal hygiene and electrical appliances
		Non-electric appliances for personal hygiene
		Telephone and telefax equipments
		Phone and fax devices and its repair services
		Repair of household appliances
		Tools and equipment repair
		Repair of personal-use machinery and equipment items
26	**Other industrial products, including recycling**	Kitchen furniture
		Bedroom furniture
		Living and dining rooms kit
		Tables and chairs
		Upholstered furniture
		Other furniture
		Things art design

		Other home appliances
		Other household goods
		Items for babies
		Items for personal use
		Other industrial products
		Games and toys
		Articles for collection
		Items for sports
		Office supplies
27	**Electricity, gas, and steam**	Electricity
		Natural gas supply
		Compressed gas supply
		Peat
		Hot water supply
		Central heating
		Coal and coks
28	**Water supply**	Supply of water
29	**Construction**	Building and decoration services
		Materials needed to repair in construction
		Linoleum and other floor coverings services
		Administration, management, and organization of households fund
		Technical services for construction works
		Administration and management in the field construction
		Other services for building and building construction
30	**Trade**	Restaurants
		Cafe, cupboards, and bars
		Catering services
		Other meals outside of the home
		Canteens
		Hotels, lodging houses, and similar Institutions
		Hostel accommodation
		Other hotel services
31	**Transportations**	Other services related to transportation
		Electric train around town
		Tram
		Metro
		Rail fares
		Bus fares
		Minibus taxi services
		Other taxi related services
		Bus fares
		Taxi
		Air fares
		Boat fares
		Other passenger transportations
		Other transport services
		Trolleybus
		Other air, cable, and ground transportation
		Other transport services
32	**Post and communication**	Postal services
		Phone numbers on the registration services

		Telephone and facsimile synchronization services
		Telegraph services
		Internet access services
33	**Research and development**	Not consumed
34	**Education**	Pre-school and primary education
		Secondary education
		Continuing education
		Higher education
		Other forms of education
35	**Financial services**	Financial intermediary services
		Other financial services
36	**Real estate services and business services**	Rents for appartments
		Rents paid by residents living in the house owned by a family
		Other types of lease payments
		Other types of rental activities
		Equipments rental
37	**Public adminstration**	Not consumed
38	**Insurance and pension funds**	Life insurance
		Dwelling insurance
		Health insurance
		Transport insurance
		Other types of insurances
39	**Health and social assistance**	General medical services
		Special medical service
		Dental services
		Prosthetic teeth
		Medical laboratory services and x-ray cabinets
		Nurses and midwives services
		Other related services
		Hospitals, health centers, and maternity hospital services
		Rehabilitation services
40	**Other services**	Pre-school administrations services
		Legal consulting services
		Religious services
		Other ceremony services
		Mediation and other services
		Waste transportation
		Sewer service
		Sports and physical training services
		Entertainment services
		Training organizations and hobby classes
		Photography service
		Movies, theaters, and concerts
		Museums, gardens, and zoo
		Other services on the organization of cultural events
		Services related to gambling games
		Services of recreation centers in Azerbaijan
		Trips in domestic rivers and the sea
		Trips in transport vehicle stacking
		Other domestic related travel services

		Excursion service in Azerbaijan
		Foreign travel services
		Services of barbers
		Bath, shower, and sauna services
		Services of other beauty saloons
		Repair of household goods and utensils
		Open-air tourist recreation services
		Other services

APPENDIX II: A detailed documentation of SAM development

Intermediate Demand: The figures are obtained directly from the IO table.

Capital rents: The values are taken explicitly from the IO table. In the original IO table capital remunerations across the economic activities are defined in two rows: "gross operating surplus" and "consumption of fixed assets". These rows are summed up in order to define capital rents across the economic activities.

Labor remunerations (skilled and unskilled): The values are extracted from the IO table, HBS and GTAP database. The values for labor remunerations across the economic activities are defined in two rows taken from the original IO table: "wages and salaries", and "social contributions". These rows are summed up in order to define the remunerations to labor across economic activities presented in the SAM. Next, the information contained by the HBS and GTAP database is used to split labor remunerations into skilled and unskilled labor remunerations for the economic activities. As already discussed in section 5.1, we have categorized the labor compensation of each household's working individuals as obtained either from skilled or unskilled labor. Using the additional information from the HBS on each working individual's employed economic activity, we have defined the shares of skilled and unskilled labor compensation in the total labor compensation for some of the economic activities. In particular, the HBS classifies working individuals' employed economic activities into 18 activities (agriculture, mining, manufacturing, production/share and supply of electricity/gas/steam, water supply, construction, trade, transportation and storage, accommodation of tourists and public catering, information and communication, financial and insurance activities, real estate activities, professional and scientific activities, public administration and support service activities, education, human health and social work activities, art/entertainment and recreation, and other services activities). The proportions of skilled and unskilled labor compensation in the total labor compensation for agriculture, water supply, trade, transportation, post and communication, research and development, education, real estate and business services, public administration, health and social assistance, electricity, gas and stream, and other services sectors represented in the SAM are directly derived from the HBS data. Notice that the HBS classifies financial and insurance activities as a single sector. However, in our SAM, we have classified financial activities and insurance activities including the pension fund as separate sectors. Because of that, we have taken the shares of skilled and unskilled labor for financial and insurance activities from the HBS and apply it to derive the skilled and unskilled labor proportions for both financial activities and insurance activities including the pension fund sectors.

Due to the limitations in the HBS data, it was impossible to split labor compensation for all economic activities represented in the SAM. Thence, the GTAP database has been employed to obtain the shares of skilled and unskilled labor compensation in the total labor compensation for the remaining economic activities. Dimaranan and Narayanan (2008) decomposed total payments to labor into payments to skilled and unskilled labor almost for all countries represented in the GTAP 7 database (including Azerbaijan). They have aggregated standard GTAP 57 sectors into 30 sectors. The payment shares of skilled and unskilled labor

for sectors such as other minerals, meat and meat products, dairy products, other food products, textiles, clothes and furs, leather products, lumber, paper and paper products, including publishing, oil processing, non-metallic minerals, non-ferrous metals, other industrial products, including recycling, construction are directly used in order to decompose total labor payments in our SAM. However, the payment shares for metal vehicles and parts, other transport equipment, electronic equipment, and other machinery and equipments sectors from the GTAP 7 database are aggregated through unweighted means to derive the skilled and unskilled payment shares in total labor payment for machinery and equipments sector represented in our SAM. In a similar way, the payment shares for oil extraction, and gas extraction sectors are aggregated to derive the shares for oil and gas extraction sector; the payment shares for iron and steel, and fabricated metal products are aggregated to derive the shares for ferrous metals sector. In contrast to the GTAP 7 database, our SAM classifies tobacco products and beverages as separate sectors. Therefore, we have taken the proportion of skilled and unskilled labor for tobacco products and beverages sector from the GTAP 7 database and use it to derive the skilled and unskilled labor proportions for both tobacco products and beverages sectors. The GTAP 7 classifies chemical products including rubber and plastic as a single sector. However, our SAM classifies rubber and plastic, and other chemical products as separate sectors. Because of that, we have taken the shares of skilled and unskilled labor for chemical products including rubber and plastic from the GTAP 7 and apply it to derive the skilled and unskilled labor proportions for both rubber and plastic, and other chemical products sectors. The GTAP 7 database does not classifies prepared and preserved fruits/vegetables as a single sector and includes it into the other food products sector. Accordingly, we have used the shares for other food products sector from the GTAP 7 to derive the shares for prepared and preserved fruits/vegetables represented in our SAM. Dimaranan and Narayanan (2008) do not distinguish forestry, fishery, and sugar sectors as separate sectors. Thus, we have used the payment shares for skilled and unskilled labor from the GTAP 5 database to split those sectors' labor compensation by skill levels in our SAM. Furthermore, cattle meat (that includes animal fats), and vegetable oils sectors from the GTAP 5 database are aggregated to derive the skilled and unskilled labor proportions for animal and vegetable oils/fats sector for our SAM. Notice that the GTAP 5 does not classify Azerbaijan as a separate region and includes Azerbaijan in FSU (Former Soviet Union) region. Hence, we have used the shares defined for FSU.

Indirect taxes: The values on indirect taxes are taken directly from the IO table.[95]

Domestic sales: The values for domestic sales are not given explicitly in the IO table. However, based on the known total values of gross domestic output and exports for each of the production activity; the values on domestic sales are calculated by subtracting export values from the gross domestic output.

Tariffs: In order to determine the values for collected tariffs across imported goods, we have pursued the following steps. In the first step, using the MacMap database, we have defined

[95] The IO table for Azerbaijan does not make any distinction between taxes applied to economic activities (such as value-added taxes, excise taxes, and etc.) and reports them in a combined form. Because we are not interested in an extensive treatment of the effects of various tax policies, we are satisfied with this combination for our analysis.

the applied tariff rates for each imported good. In the second step, by multiplying the applied tariff rates by import values from the non-CIS countries, we have calculated collected tariffs across imported goods.[96] Tariff rates in the MacMap are estimated at the HS (Harmonized System), SITC (Standard International Trade Classification) and GTAP level of commodity classification. The rates of applied tariffs for the commodity groups that are classified similarly to those defined in GTAP, HS and SITC in our SAM are directly used in our matrix building. More precisely, tariff data for agriculture, and rubber and plastic sectors are taken from the HS classification; tariff date for meat and meat products, animal and vegetable oils/fats, beverages, tobacco products, and other chemical products sectors are taken from the SITC classification; and tariff data for remaining sectors—except ferrous metals, and machinery and equipments—are taken from the GTAP classification. Further on, to obtain the rates of applied tariffs for those commodity groups that are classified differently in our SAM, we have taken tariff rates at the GTAP level and aggregate the corresponding commodity groups through simple unweighted means. In particular, tariff data for iron and steel, and fabricated metal products sectors are aggregated in order to derive tariff rate for ferrous metals sector presented in our SAM. Tariff data for motor vehicles and parts, other machinery and equipment, other transport equipment, and electronic equipment sectors are aggregated in order to derive tariff rate for machinery and equipments sector presented in our SAM.

Imports: The data on imports are obtained from the IO table and BoP statistics. First, we have used the IO table to obtain the total import flows for each sector. Then, the BoP statistics is employed to extract the import shares from CIS and non-CIS countries for each sector.

Capital income of households: The values on capital income of households are explicitly taken from the HBS. In order to be able to extrapolate the values at the national level (as they typically appear in the SAM and also in the national accounts) capital income of each household is multiplied by its respective sample weight and then summed up across all households.

Skilled labor income of households: The values on skilled labor income of households are obtained from the HBS. In order to be able to extrapolate the values at the national level skilled labor income of each household is multiplied by its respective sample weight and then summed up across all households.

Unskilled labor income of households: The values on unskilled labor income of households are taken from the HBS. In order to be able to extrapolate the values at the national level unskilled labor income of each household is multiplied by its respective sample weight and summed up across all households.

Capital income of enterprises: Using information from the IO table and HBS, we have derived capital income of corporate enterprises. The enterprises own only their corporate capital as a production factor and the economy-wide remunerations from capital are distributed between the households account and the enterprises account. Accordingly, we use

[96] As already stated, the reference year for the current study was chosen as 2006. However, estimated applied tariff rates for Azerbaijan start from 2009 in the MacMap database. Since the structure of tariffs did not substantially evolved in Azerbaijan between 2006 and 2009, we rely on these rates that are estimated for year 2009.

the known values for economy-wide returns to capital from the IO table and for total capital income received by households from the HBS in order to compute the enterprises' income received from the corporate capital: the balance of capital remuneration not paid to households are treated as capital income received by enterprises.

Income taxes: The values on income taxes are directly extracted from the HBS. In order to be able to extrapolate the values at the national level income tax paid by each household is multiplied by its respective sample weight and summed up across all households.

Inter-household transfers: The data on inter-household transfers are directly obtained from the HBS. In order to be able to extrapolate the values at the national level unskilled labor income of each household is multiplied by its respective sample weight and summed up across all households.

Households savings: The difference between incomes and expenditures of households are defined to be a households' savings. In order to be able to extrapolate the values at the national level unskilled labor income of each household is multiplied by its respective sample weight and summed up across all households.

Corporate taxes: The value on corporate taxes is explicitly taken from the government budget statistics (profit taxes paid by enterprises).

Enterprises savings: The data on net savings of the enterprises are defined as the difference between incomes and expenditures.

Government consumption: The values on government's consumption expenditure along the commodities are taken directly from the IO table.

Social transfers: The figures on social transfers directed to households are taken from the HBS. In order to be able to extrapolate the values at the national level transfers received by each household is multiplied by its respective sample weight and then summed up across all households.

Government savings: The data on government savings are calculated as the difference between the government's total incomes and total expenditures.

Investments: The data on investment demand is explicitly drawn from the IO table.

Exports: The data on exports are obtained from the IO table and BoP statistics. First, we have used the IO table to extract the total export flows for each sector. Then, the BoP statistics is employed to extract the export shares to CIS and non-CIS countries for each sector.

Remittances: Using the HBS, we have compiled overall foreign remittances received by households. In addition, using the information contained by survey conducted by the European Bank for Reconstruction and Development (2007), we assume that the largest share of remittances (85 percent) is received from CIS countries and the rest (15 percent) from non-CIS countries.

Foreign savings: The data on foreign savings (current account) are computed as the difference between total foreign exchange inflows and outflows.

APPENDIX III: Classification of activities/commodities in the SAM, IO table, and GTAP database

Sectoral classification in SAM 2006			Sectoral classification in IO Table 2006		Sectoral classification in GTAP 8 database	
Number	**Code**	**Describtion**	**Number**	**Describtion**	**Number**	**Describtion**
1	AGR	Agriculture	1	Agriculture	1	Paddy Rice: rice, husked and unhusked
					2	Wheat: wheat and meslin
					3	Other Grains: maize (corn), barley, rye, oats, other cereals
					4	Veg & Fruit: vegetables, fruitvegetables, fruit and nuts, potatoes, cassava, truffles,
					5	Oil Seeds: oil seeds and oleaginous fruit; soy beans, copra
					6	Cane & Beet: sugar cane and sugar beet
					7	Plant Fibres: cotton, flax, hemp, sisal and other raw vegetable materials used in textiles
					8	Other Crops: live plants; cut flowers and flower buds; flower seeds and fruit seeds; vegetable seeds, beverage and spice crops, unmanufactured tobacco, cereal straw and husks, unprepared, whether or not chopped, ground, pressed or in the form of pellets; swedes, mangolds, fodder roots, hay, lucerne (alfalfa), clover, sainfoin, forage kale, lupines, vetches and similar forage products, whether or not in the form of pellets, plants and parts of plants used primarily in perfumery, in pharmacy, or for insecticidal, fungicidal or similar purposes, sugar beet seed and seeds of forage plants, other raw vegetable materials
					9	Cattle: cattle, sheep, goats, horses, asses, mules, and hinnies; and semen thereof
					10	Other Animal Products: swine, poultry and other live animals; eggs, in shell (fresh or cooked), natural honey, snails (fresh or preserved) except sea snails; frogs' legs, edible products of animal origin n.e.c., hides, skins and furskins, raw , insect waxes and spermaceti, whether or not refined or coloured
					11	Raw milk

					12	Wool: wool, silk, and other raw animal materials used in textile
2	FRS	Forestry	2	Forestry	13	Forestry: forestry, logging and related service activities
3	FSH	Fishery	3	Fishery	14	Fishing: hunting, trapping and game propagation including related service activities, fishing, fish farms; service activities incidental to fishing
4	OAG	Oil and gas extraction	4	Extraction of crude oil and natural gas, service activities incidental to oil and gas extraction excluding surveying	15	Oil: extraction of crude petroleum and natural gas (part), service activities incidental to oil and gas extraction excluding surveying (part)
					16	Gas: extraction of crude petroleum and natural gas (part), service activities incidental to oil and gas extraction excluding surveying (part)
5	OMN	Other minerals	5	Mining of metal ores	17	Other Mining: mining of metal ores, uranium, gems. other mining and quarrying
			6	Coal mining, lignite and peat	18	Coal: mining and agglomeration of hard coal, lignite and peat
			7	Clay, salt, gems, and other mining and quarrying		
6	MPR	Meat and meat products	8	Meat and meat products	19	Cattle Meat: fresh or chilled meat and edible offal of cattle, sheep, goats, horses, asses, mules, and hinnies. raw fats or grease from any animal or bird.
					20	Other Meat: pig meat and offal. preserves and preparations of meat, meat offal or blood, flours, meals and pellets of meat or inedible meat offal; greaves
7	AVF	Animal and vegetable oils/fats	9	Animal and vegetable oils/fats	21	Cattle Meat: fresh or chilled meat and edible offal of cattle, sheep, goats, horses, asses, mules, and hinnies. raw fats or grease from any animal or bird.

					22	Vegetable Oils: crude and refined oils of soya-bean, maize (corn),olive, sesame, ground-nut, olive, sunflower-seed, safflower, cotton-seed, rape, colza and canola, mustard, coconut palm, palm kernel, castor, tung jojoba, babassu and linseed, perhaps partly or wholly hydrogenated,inter-esterified, re-esterified or elaidinised. Also margarine and similar preparations, animal or vegetable waxes, fats and oils and their fractions, cotton linters, oil-cake and other solid residues resulting from the extraction of vegetable fats or oils; flours and meals of oil seeds or oleaginous fruits, except those of mustard; degras and other residues resulting from the treatment of fatty substances or animal or vegetable waxes.
8	SGR	Sugar	10	Sugar	23	Sugar
9	VAF	Prepared and preserved fruits/ vegetables	11	Prepared and preserved fruits/ vegetables	24	Other Food: prepared and preserved vegetables, fruit juices and vegetable juices, prepared and preserved fruit and nuts, all cereal flours, groats, meal and pellets of wheat, cereal groats, meal and pellets n.e.c., other cereal grain products (including corn flakes), other vegetable flours and meals, mixes and doughs for the preparation of bakers' wares, starches and starch products; sugars and sugar syrups n.e.c., preparations used in animal feeding, bakery products, cocoa, chocolate and sugar confectionery, macaroni, noodles, couscous and similar farinaceous products, food products n.e.c.
10	MIL	Dairy products	12	Dairy products	25	Milk: dairy products
11	OFD	Other food products	13	All cereal flours, groats, meal and pellets of wheat, cereal groats, meal and pellets	26	Other Food: prepared and preserved vegetables, fruit juices and vegetable juices, prepared and preserved fruit and nuts, all cereal flours, groats, meal and pellets of wheat, cereal groats, meal and pellets n.e.c., other cereal grain products (including corn flakes), other vegetable flours and meals, mixes and doughs for the preparation of bakers' wares, starches and starch products; sugars and sugar syrups n.e.c., preparations used in animal feeding, bakery products, cocoa, chocolate and sugar confectionery, macaroni, noodles, couscous and similar farinaceous products, food products n.e.c.
			14	Doughs for the preparation of bakers' wares, starches and starch products; sugars and sugar syrups		
			15	Cocoa, chocolate, and sugar confectionery		
			16	Macaroni, noodles, couscous and similar farinaceous products		

			17	Coffee, tea, spices and other food products		
12	BVR	Beverages	18	Beverages	27	Beverages and Tobacco products
13	TBC	Tobacco	19	Tobacco	28	Beverages and Tobacco products
14	TEX	Textiles	20	Textile yarn and thread	29	Textiles: textiles and man-made fibres
			21	Other textile articles		
			22	Knitted or crocheted fabrics		
15	CAF	Clothing and furs	23	Clothing and furs	30	Wearing Apparel: Clothing, dressing and dyeing of fur
16	LEA	Leather products	24	Leather and leather products	31	Leather: tanning and dressing of leather; luggage, handbags, saddlery, harness and footwear
17	LUM	Lumber	25	Wood and products of wood and cork	32	Lumber: wood and products of wood and cork, except furniture; articles of straw and plaiting materials
18	PPP	Paper and paper products including publishing	26	Pulp, paper and paper products	33	Paper & Paper Products: includes publishing, printing and reproduction of recorded media
			27	Printing and reproduction of recorded media		
19	OPR	Oil processing	28	Refined petroleum products	34	Petroleum & Coke: coke oven products, refined petroleum products, processing of nuclear fuel
20	RAP	Rubber and plastic	29	Rubber products	35	Chemical Rubber Products: basic chemicals, other chemical products, rubber and plastics products
			30	Plastic products		
21	CHM	Other chemical products	31	Basic chemicals	36	Chemical Rubber Products: basic chemicals, other chemical products, rubber and plastics products
			32	Agrochemical products		
			33	Dye, varnishes and similar coatings		
			34	Pharmaceutical preparations, medical and pharmaceutical chemicals plant products		
			35	Glycerin, soap and detergents, cleaning and polishing preparations, perfumes and cosmetics tools		
			36	Other chemical products		
22	NMM	Non-metallic minerals	37	Glass and glass products and ceramic products used in construction	37	Non-Metallic Minerals: cement, plaster, lime, gravel, concrete
			38	Ceramic tiles and plates		

			39	Burnt clay bricks, pans, and construction products		
			40	Cement, lime and plaster		
			41	Concrete and cement products		
			42	Used in construction or for making sculptures of stone and articles thereof		
			43	Other non-metallic mineral products		
23	FMT	Ferrous metals	44	Basic ferrous metals	38	Iron & Steel: basic production and casting
			45	Pipes		
			46	Other ferrous metals		
			47	Metal constructions and related services		
			48	Metal tanks, tanks and vessels, radiators, central heating boilers and steam generators		
			49	Metal beating, pressing, laying on the pavement, powder metallurgy and engineering services	39	Fabricated Metal Products: Sheet metal products, but not machinery and equipment
			50	Knives, metal tools and products to be used in everyday life		
			51	Other fabricated metal products		
24	NFM	Non-ferrous metals	52	Non-ferrous metals	40	Non-Ferrous Metals: production and casting of copper, aluminium, zinc, lead, gold, and silver
25	MAE	Machinery and equipments	53	Machinery and equipments that are not included in other groups	41	Motor vehicles and parts: cars, lorries, trailers and semi-trailers
			54	Electrical equipment and apparatus	42	Other Machinery & Equipment: electrical machinery and apparatus n.e.c., medical, precision and optical instruments, watches and clocks
			55	Radio, television and communication equipment and apparatus	43	Other Transport Equipment: Manufacture of other transport equipment
			56	Medical devices and tools, precision and optical instruments etc.		

			57	Motor vehicles, trailers and semi-trailers	44	Electronic Equipment: office, accounting and computing machinery, radio, television and communication equipment and apparatus
			58	Other transport equipments		
26	OIP	Other industrial products, including recycling	59	Furniture, other groups not included in other industrial products	45	Other Manufacturing: includes recycling
			60	Recycling		
27	EGS	Electricity, gas and steam	61	Production and distribution of electricity services	46	Electricity: production, collection and distribution
			62	Distribution of natural gas and heating services	47	Gas Distribution: distribution of gaseous fuels through mains; steam and hot water supply
			63	Steam and hot water as well as chilled water and ice to cool the supply of services		
28	WTR	Water supply	64	Water collection, purification and distribution	48	Water: collection, purification and distribution
29	CNS	Construction	65	Construction	49	Construction: building houses factories offices and roads
30	TRD	Trade	66	Trade	50	Trade: all retail sales; wholesale trade and commission trade; hotels and restaurants; repairs of motor vehicles and personal and household goods; retail sale of automotive fuel
			67	Hotels and Restorants		
31	TRS	Transportations	68	Transportations	51	Water transport
					52	Air transport
					53	Other Transport: road, rail ; pipelines, auxiliary transport activities; travel agencies
32	CMN	Post and communication	69	Post and communication	54	Communications: post and telecommunications
33	RAD	Research and development	70	Research and development	55	Other Services (Government): public administration and defense; compulsory social security, education, health and social work, sewage and refuse disposal, sanitation and similar activities, activities of membership organizations n.e.c., extra-territorial organizations and bodies

34	EDU	Education	71	Education	56	Other Services (Government): public administration and defense; compulsory social security, education, health and social work, sewage and refuse disposal, sanitation and similar activities, activities of membership organizations n.e.c., extra-territorial organizations and bodies
35	FIN	Financial services	72	Financial services	57	Other Financial Intermediation: includes auxiliary activities but not insurance and pension funding (see next)
36	RES	Real estate and business services	73	Real estate services	58	Other Business Services: real estate, renting and business activities
			74	Renting activities		
			75	Other business services		
37	PAD	Public adminstration	76	Public adminstration services	59	Other Services (Government): **public administration and defense**; compulsory social security, education, health and social work, sewage and refuse disposal, sanitation and similar activities, activities of membership organizations n.e.c., extra-territorial organizations and bodies
38	ISR	Insurance and pension funds	77	Compulsory social security services	60	Other Services (Government): public administration and defense; **compulsory social security**, education, health and social work, sewage and refuse disposal, sanitation and similar activities, activities of membership organizations n.e.c., extra-territorial organizations and bodies
39	HTL	Health and social assistance	78	Health and social assistance	61	Other Services (Government): public administration and defense; compulsory social security, education, **health and social work**, sewage and refuse disposal, sanitation and similar activities, activities of membership organizations n.e.c., extra-territorial organizations and bodies
40	OSR	Other services	79	Computer services	62	Other Services (Government): public administration and defense; compulsory social security, education, **health and social work**, sewage and refuse disposal, sanitation and similar activities, activities of membership organizations n.e.c., extra-territorial organizations and bodies
			80	Legal consulting services		
			81	Architectural, engineering and related technical fields of research in the field of consultancy services		
			82	Technical testing and analysis services		

			83	Investigation and security services		
			84	Cleaning services for buildings		
			85	Recreation, culture and sports events services		
			86	Other services		

APPENDIX IV: Calibration of model's share and scale parameters

In this Appendix, we show how share and scale (efficiency) parameters of the behavioral equations have been calibrated.

Share parameters for Cobb-Douglass functions

In order to obtain share parameters for households consumption ($\alpha_{i,h}^{H}$), for government consumption (α_{i}^{G}), and for investment demand (α_{i}^{I}), we have rearranged demand functions for households (4.30), for government (4.32), and for investment (4.36) in the following way:[97]

$$\alpha_{i,h}^{H} = \frac{P_i^0 \cdot C_{i,h}^0}{CBUD_h^0} \qquad \text{(A4.1)}$$

$$\alpha_{i}^{G} = \frac{P_i^0 \cdot G_i^0}{GBUD^0} \qquad \text{(A4.2)}$$

$$\alpha_{i}^{I} = \frac{P_i^0 \cdot IN_i^0}{S^0} \qquad \text{(A4.3)}$$

The zeros at the top right of the endogenous variables denote values at the initial equilibrium (in other worlds, the values that are observed in the balanced SAM).

Share and scale (efficiency) parameters for CES and CET functions

CES aggregator between capital and labor

In order to obtain share parameters of capital (γ_i^F) and labor ($1-\gamma_i^F$), we have derived a tangency condition using the capital demand (4.4) and labor demand (4.5) functions (dividing equation (4.4) by (4.5)):

$$\frac{\gamma_i^F}{1-\gamma_i^F} \cdot \left(\frac{K_i^0}{L_i^0} \right)^{\frac{1}{\sigma_i^F}} = \frac{w^0}{r_i^0} \qquad \text{(A4.4)}$$

Rearranging (A4.4), we have obtained the share parameter of capital:

[97] Note that the prices in the model are normalized to one at the initial equilibrium. Because the AzCGE model focuses on the real side of the economy the absolute price levels does not matter in our modeling exercise.

$$\gamma_i^F = \frac{1}{1+\left(\frac{w^0}{r_i^0}\right)\cdot\left(\frac{K_i^0}{L_i^0}\right)^{\frac{-1}{\sigma_i^F}}} \qquad \text{(A4.5)}$$

Likewise, we have obtained share parameter for labor, that is $1-\gamma_i^F$.

Subsequently, by rearranging the CES production function (4.4), we have obtained the scale parameter φ_i^F in the following manner:

$$\varphi_i^F = \frac{VA_i^0}{\left[\gamma_i^F\cdot(K_i^0)^{\frac{\sigma_i^F-1}{\sigma_i^F}}+(1-\gamma_i^F)\cdot(L_i^0)^{\frac{\sigma_i^F-1}{\sigma_i^F}}\right]^{\frac{\sigma_i^F}{\sigma_i^F-1}}} \qquad \text{(A4.6)}$$

The similar procedure has been applied to calibrate the share and scale (efficiency) parameters for the remaining CES and CET functions that are utilized in the AzCGE model.

CES aggregator between skilled and unskilled labor

The share (γ_i^{FD}) and scale (φ_i^{FD}) parameters for the CES technology that is used to model skilled and unskilled labor aggregation have been calibrated in the following way:

$$\gamma_i^{FD} = \frac{1}{1+\left(\frac{w_{'uslab'}^{LD}}{w_{'sklab'}^{LD}}\right)\cdot\left(\frac{LD_{i,'sklab'}^0}{LD_{i,'uslab'}^0}\right)^{\frac{-1}{\sigma_i^{FD}}}} \qquad \text{(A4.7)}$$

$$\varphi_i^{FD} = \frac{L_i^0}{\left[\sum_f \gamma_{i,f}^{FD}\cdot(LD_{i,f}^0)^{\frac{\sigma_i^{FD}-1}{\sigma_i^{FD}}}\right]^{\frac{\sigma_i^{FD}}{\sigma_i^{FD}-1}}} \qquad \text{(A4.8)}$$

Armington aggregator between domestic output sold domestically and imports

The share (γ_i^A) and scale (φ_i^A) parameters for the Armington technology that is used to model toal domestic demand from domestically produced and domestically supplied goods and imports have been calibrated as follows:

$$\gamma_i^A = \frac{1}{1+\left(\frac{PDD_i^0}{PM_i^0}\right)\cdot\left(\frac{M_i^0}{XDD_i^0}\right)^{\frac{-1}{\sigma_i^A}}} \qquad \text{(A4.9)}$$

$$\varphi_i^A = \frac{X_i^0}{\left[\gamma_i^A\cdot(M_i^0)^{\frac{\sigma_i^A-1}{\sigma_i^A}}+(1-\gamma_i^A)\cdot(XDD_i^0)^{\frac{\sigma_i^A-1}{\sigma_i^A}}\right]^{\frac{\sigma_i^A}{\sigma_i^A-1}}} \qquad \text{(A4.10)}$$

Armington aggregator between import origins

The share (γ_i^{AR}) and scale (φ_i^{AR}) parameters for the Armington technology that is used to model imports from various destinations have been calibrated as follows:

$$\gamma_i^{AR} = \frac{1}{1+\left(\frac{PMT_{i,'row'}^0}{PMT_{i,'cis'}^0}\right)\cdot\left(\frac{MT_{i,'cis'}^0}{MT_{i,'row'}^0}\right)^{\frac{-1}{\sigma_i^{AR}}}} \qquad \text{(A4.11)}$$

$$\varphi_i^{AR} = \frac{M_i^0}{\left[\gamma_i^{AR}\cdot(MT_{i,'cis'}^0)^{\frac{\sigma_i^{AR}-1}{\sigma_i^{AR}}}+(1-\gamma_i^{AR})\cdot(MT_{i,'row'}^0)^{\frac{\sigma_i^{AR}-1}{\sigma_i^{AR}}}\right]^{\frac{\sigma_i^{AR}}{\sigma_i^{AR}-1}}} \qquad \text{(A4.12)}$$

CET aggregator between domestic supply and exports

The share (γ_i^T) and scale (φ_i^T) parameters for the CET technology that is used to model output allocation between domestic and export markets have been calibrated in the following manner:

$$\gamma_i^T = \frac{1}{1+\left(\frac{PDD_i^0}{PE_i^0}\right)\cdot\left(\frac{E_i^0}{XDD_i^0}\right)^{\frac{-1}{\sigma_i^T}}} \qquad \text{(A4.13)}$$

$$\varphi_i^T = \frac{XD_i^0}{\left[\gamma_i^T \cdot (E_i^0)^{\frac{1+\sigma_i^T}{\sigma_i^T}} + (1-\gamma_i^T)\cdot (XDD_i^0)^{\frac{1+\sigma_i^T}{\sigma_i^T}}\right]^{\frac{\sigma_i^T}{1+\sigma_i^T}}} \qquad \text{(A4.14)}$$

CET aggregator between export destinations

Finally, the share (γ_i^{TR}) and scale (φ_i^{TR}) parameters for the CES technology that is used to model allocation of total exports between various export destinations have been calibrated as follows:

$$\gamma_i^{TR} = \frac{1}{1+\left(\frac{PET_{i,'row'}^0}{PET_{i,'cis'}^0}\right)\cdot\left(\frac{ET_{i,'cis'}^0}{ET_{i,'row'}^0}\right)^{\frac{-1}{\sigma_i^{TR}}}} \qquad \text{(A4.15)}$$

$$\varphi_i^{TR} = \frac{E_i^0}{\left[\gamma_i^{TR} \cdot (ET_{i,'cis'}^0)^{\frac{1+\sigma_i^{TR}}{\sigma_i^{TR}}} + (1-\gamma_i^{TR})\cdot (ET_{i,'row'}^0)^{\frac{1+\sigma_i^{TR}}{\sigma_i^{TR}}}\right]^{\frac{\sigma_i^{TR}}{1+\sigma_i^{TR}}}} \qquad \text{(A4.16)}$$

APPENDIX V: Changes in return to capital by sectors, in percentage

Sectors	Trade liberalization (sim 1)	Agriculture subsidy reform		WTO accession	
		Developing (sim 2a)	Developed (sim 2b)	Developing (sim 3a)	Developed (sim 3b)
AGR	0.70	-2.33	-6.93	-1.64	-6.28
FRS	0.79	-0.81	-2.46	-0.02	-1.67
FSH	1.01	0.18	0.54	1.20	1.59
OAG	1.67	0.84	2.53	2.53	4.26
OMN	0.23	1.40	4.23	1.67	4.57
MPR	-0.28	-0.25	-0.78	-0.51	-0.99
AVF	3.60	1.21	3.62	4.86	7.38
SGR	-1.59	0.54	1.63	-1.05	0.04
VAF	8.25	0.42	1.19	8.78	9.74
MIL	1.65	-0.25	-0.72	1.42	0.96
OFD	1.15	-0.16	-0.49	1.01	0.73
BVR	6.63	1.21	3.65	7.92	10.52
TBC	8.91	1.89	5.74	10.98	15.19
TEX	1.68	0.61	1.81	2.37	3.74
CAF	-2.38	0.97	2.94	-1.38	0.64
LEA	-5.96	0.63	1.90	-5.35	-4.13
LUM	4.49	0.25	0.77	4.76	5.35
PPP	-1.68	1.08	3.24	-0.60	1.57
OPR	1.90	0.96	2.88	2.88	4.85
RAP	0.99	1.02	3.07	2.05	4.15
CHM	1.84	1.22	3.70	3.14	5.79
NMM	-3.56	1.15	3.47	-2.44	-0.19
FMT	-2.97	0.85	2.54	-2.13	-0.47
NFM	1.91	0.88	2.64	2.81	4.63
MAE	2.30	1.20	3.61	3.53	6.00
OIP	3.04	0.94	2.84	4.05	6.08
EGS	1.18	0.08	0.23	1.27	1.45
WTR	1.18	-0.50	-1.47	0.69	-0.26
CNS	-1.09	1.33	3.98	0.24	2.90
TRD	2.81	0.47	1.42	3.32	4.34
TRS	2.22	0.93	2.81	3.18	5.12
CMN	1.35	0.10	0.30	1.47	1.69
RAD	3.05	1.03	3.11	4.12	6.29
EDU	0.40	-0.14	-0.41	0.26	0.00
FIN	1.19	0.39	1.18	1.61	2.43
RES	1.37	0.30	0.90	1.68	2.30
PAD	0.62	-0.33	-0.99	0.29	-0.36
ISR	1.12	0.31	0.94	1.44	2.10
HTL	0.66	-0.21	-0.64	0.45	0.03
OSR	0.85	0.00	0.00	0.86	0.88

Source: Author's estimation based on AzCGE model

APPENDIX VI: Changes in output, import, and export prices by sectors, in percentage

Output prices

Sectors	Trade liberalization (sim 1)	Agriculture subsidy reform		WTO accession	
		Developing (sim 2a)	Developed (sim 2b)	Developing (sim 3a)	Developed (sim 3b)
AGR	0.65	-1.10	-3.30	-0.46	-2.67
FSH	0.89	0.22	0.65	1.11	1.58
OAG	1.53	0.82	2.45	2.37	4.04
OMN	0.42	0.54	1.63	0.97	2.09
MPR	0.08	0.38	1.15	0.47	1.27
AVF	0.72	0.73	2.19	1.47	2.96
SGR	-1.14	0.50	1.49	-0.65	0.35
VAF	0.98	0.75	2.27	1.75	3.29
MIL	0.56	0.37	1.11	0.94	1.70
OFD	0.67	0.46	1.38	1.15	2.10
BVR	1.25	0.78	2.34	2.05	3.64
TBC	0.98	0.73	2.19	1.73	3.23
TEX	-0.31	0.63	1.90	0.33	1.62
CAF	-0.76	0.62	1.85	-0.13	1.13
LEA	-2.03	0.60	1.79	-1.44	-0.25
LUM	0.43	0.73	2.18	1.17	2.65
PPP	-0.79	0.64	1.92	-0.14	1.15
OPR	1.48	0.81	2.43	2.31	3.97
RAP	0.04	0.62	1.86	0.67	1.94
CHM	-0.17	0.61	1.83	0.45	1.70
NMM	-1.09	0.77	2.30	-0.32	1.21
FMT	-0.44	0.59	1.77	0.15	1.35
NFM	1.18	0.74	2.23	1.93	3.45
MAE	0.87	0.82	2.47	1.71	3.38
OIP	-0.07	0.74	2.22	0.68	2.19
EGS	1.07	0.63	1.89	1.71	3.00
WTR	0.82	0.45	1.36	1.28	2.21
CNS	-0.40	0.93	2.78	0.53	2.40
TRD	1.07	0.55	1.67	1.64	2.79
TRS	1.25	0.63	1.89	1.89	3.19
CMN	0.68	0.30	0.89	0.98	1.59
RAD	0.90	0.53	1.59	1.45	2.53
EDU	0.48	0.10	0.30	0.59	0.81
FIN	0.84	0.30	0.90	1.15	1.78
RES	0.70	0.38	1.15	1.09	1.87
PAD	0.26	0.26	0.78	0.52	1.06
ISR	0.85	0.26	0.79	1.13	1.68
HTL	0.36	0.14	0.44	0.51	0.82
OSR	0.56	0.22	0.67	0.79	1.26

Source: Author's estimation based on AzCGE model

Import prices

Sectors	Trade liberalization (sim 1)	Agriculture subsidy reform		WTO accession	
		Developing (sim 2a)	Developed (sim 2b)	Developing (sim 3a)	Developed (sim 3b)
AGR	-0.27	0.81	2.44	0.54	2.18
FSH	0.52	0.81	2.44	1.34	2.99
OAG	1.53	0.81	2.44	2.36	4.02
OMN	-0.27	0.81	2.44	0.55	2.18
MPR	-4.14	0.81	2.44	-3.36	-1.78
AVF	-1.37	0.81	2.44	-0.57	1.05
SGR	-3.10	0.81	2.44	-2.30	-0.71
VAF	-0.98	0.81	2.44	-0.17	1.46
OFD	-1.19	0.81	2.44	-0.39	1.24
BVR	-3.52	0.81	2.44	-2.73	-1.15
TBC	-0.13	0.81	2.44	0.69	2.33
TEX	-3.66	0.81	2.44	-2.87	-1.29
CAF	-4.91	0.81	2.44	-4.13	-2.57
LEA	-4.76	0.81	2.44	-3.98	-2.42
LUM	0.41	0.81	2.44	1.23	2.88
PPP	-2.10	0.81	2.44	-1.30	0.30
OPR	-0.09	0.81	2.44	0.73	2.37
RAP	-0.88	0.81	2.44	-0.07	1.56
CHM	-2.84	0.81	2.44	-2.04	-0.45
NMM	-2.15	0.81	2.44	-1.35	0.26
FMT	-1.74	0.81	2.44	-0.94	0.67
NFM	-0.66	0.81	2.44	0.15	1.78
MAE	-0.57	0.81	2.44	0.24	1.87
OIP	-4.48	0.81	2.44	-3.70	-2.13
EGS	1.53	0.81	2.44	2.36	4.02
CNS	1.53	0.81	2.44	2.36	4.02
TRD	1.53	0.81	2.44	2.36	4.02
TRS	1.53	0.81	2.44	2.36	4.02
CMN	1.53	0.81	2.44	2.36	4.02
RAD	1.53	0.81	2.44	2.36	4.02
FIN	1.53	0.81	2.44	2.36	4.02
RES	1.53	0.81	2.44	2.36	4.02
ISR	1.53	0.81	2.44	2.36	4.02
OSR	1.53	0.81	2.44	2.36	4.02

Source: Author's estimation based on AzCGE model

Export prices

Sectors	Trade liberalization (sim 1)	Agriculture subsidy reform		WTO accession	
		Developing (sim 2a)	Developed (sim 2b)	Developing (sim 3a)	Developed (sim 3b)
AGR	1.53	0.81	2.44	2.36	4.02
FSH	1.53	0.81	2.44	2.36	4.02
OAG	1.53	0.81	2.44	2.36	4.02
OMN	1.53	0.81	2.44	2.36	4.02
MPR	1.53	0.81	2.44	2.36	4.02
AVF	1.53	0.81	2.44	2.36	4.02
VAF	1.53	0.81	2.44	2.36	4.02
OFD	1.53	0.81	2.44	2.36	4.02
BVR	1.53	0.81	2.44	2.36	4.02
TBC	1.53	0.81	2.44	2.36	4.02
TEX	1.53	0.81	2.44	2.36	4.02
CAF	1.53	0.81	2.44	2.36	4.02
LEA	1.53	0.81	2.44	2.36	4.02
LUM	1.53	0.81	2.44	2.36	4.02
PPP	1.53	0.81	2.44	2.36	4.02
OPR	1.53	0.81	2.44	2.36	4.02
RAP	1.53	0.81	2.44	2.36	4.02
CHM	1.53	0.81	2.44	2.36	4.02
NMM	1.53	0.81	2.44	2.36	4.02
FMT	1.53	0.81	2.44	2.36	4.02
NFM	1.53	0.81	2.44	2.36	4.02
MAE	1.53	0.81	2.44	2.36	4.02
OIP	1.53	0.81	2.44	2.36	4.02
EGS	1.53	0.81	2.44	2.36	4.02
CNS	1.53	0.81	2.44	2.36	4.02
TRD	1.53	0.81	2.44	2.36	4.02
TRS	1.53	0.81	2.44	2.36	4.02
RES	1.53	0.81	2.44	2.36	4.02

Source: Author's estimation based on AzCGE model