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Analysis of macroeconomic policies in Kazakhstan: A general equilibrium approach

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Abbreviations

CGE	Computable general equilibrium
CIF	Cost of insurance and freight
CIS	Commonwealth of Independent States
CU	Customs union
EEU	Eurasian Economic Union
EU	European Union
EurASEC	Eurasian Economic Community
FOB	Free on board
FDI	Foreign direct investments
FSU	Former Soviet Union
FTA	Free trade agreement
GAMS	General Algebraic Modelling System
GDP	Gross Domestic Product
GTAP	Global Trade Analysis Project
IEA	International Energy Agency
IMF	International Monetary Fund
KZT	Kazakh Tenge
OECD	Organization for Economic Cooperation and Development
PTA	Preferential trade agreement
PE	Partial equilibrium
RK	Republic of Kazakhstan
RTA	Regional trade agreement

SCO	Shanghai Cooperation Organization
USD	United States Dollar
WTO	World Trade Organization

1 Introduction

1.1 Problem statement

In the last two decades, Kazakhstan has achieved impressive economic growth, mainly due to the country's market economy reforms in the 1990s, direct foreign investment openness, a liberalized trade regime, and expanding oil production and exports. Located between China, Russia, and the EU, Kazakhstan pursued a multi-vector policy, maintaining and seeking close economic and trade ties with the Commonwealth of Independent States (CIS) and expanding trade with China and Europe.

The general macroeconomic situation in Kazakhstan is favorable but vulnerable to changes in external factors such as the economic situation in Russia and China and oil price fluctuations. This vulnerability is further intensified due to the features of the country's economy such as lack of economic diversification and current policymaking. Some of the main economic issues that Kazakhstan is facing are a high dependence of the economy on energy production and export, a lack of economic diversification, high subsidies in many sectors, consumer price control in most of the sectors, and regional income disparities. Economic growth so far has been powered solely by expanding fuel production and exports. The country's government initiated many programs and strategies targeted towards economic diversification, but so far they have not achieved the desired outcomes.

Kazakhstan is a landlocked country, located in close proximity to large, emerging economies such as China, EU, and Russia. Political and public discussions on the national and international level recently focused on the controversial topic of whether Kazakhstan should pursue further integration within the region or seek deeper trade ties with other regions such as the EU and China. Regional economic and trade integration with Russia and other CIS countries is one of the most contentious issues being publically debated in the country. So far Kazakhstan, largely due to its historical ties, has pursued regional economic and trade integration with countries of the former Soviet Union (FSU). Most of the trade agreements that have been concluded since 1991 have been among the CIS countries. Only a few countries in the CIS region have pursued trade integration with other regions. Until now, Kazakhstan specifically pursued intensive trade integration within the CIS region, particularly with Russia and Belarus. This resulted in the creation of the customs union in 2007 by Belarus, Kazakhstan, and Russia. A further step in the

process of integration was the establishment of the Eurasian Economic Union, which currently includes Belarus, Kazakhstan, and Russia and recently expanded to Armenia and Kyrgyzstan.

Kazakhstan is vastly endowed with natural resources and is an energy-rich country. Like the majority of other post-Soviet countries, Kazakhstan has high fossil fuel subsidies. IEA et al. (2010) identified 37 developing and transition economies that subsidize fossil fuel consumption and account for more than half of the global fossil fuel subsidies. Total fossil fuel subsidies in these countries in 2010 were 409 billion USD. The highest rate of subsidization is found specifically among oil and gas exporters such as the Middle East, North Africa, and Central Asia, including Kazakhstan. Fossil fuel subsidies are a burden on the government budget; it causes inefficient production and excessive energy consumption, a decrease in energy exports, a lack of investment into renewable energy and energy efficiency measures, and high CO_2 emissions. Complete removal or reduction of subsidies is politically and publicly a sensitive topic in developing countries such as Kazakhstan.

To analyze these policy issues, the economy and all the linkages between sectors and different actors need to be taken into account and analyzed in a wider context. Trade and energy policy reforms in the country context of Kazakhstan have impacts on other countries, particularly on main trade partners. The computable general equilibrium (CGE) approach allows one to analyze the impact on other countries. The CGE modeling approach provides the necessary modeling framework to analyze these issues. This approach in the context of policy analysis is not a tool for forecast but rather is a useful tool to provide a direction of change in the economy for different sectors and actors of the economy. The results of the analysis can be further used in policy discussions.

To the author's knowledge, there are few studies and no articles published in international scientific research journals applying a general equilibrium approach on Kazakhstan. To the author's knowledge, this is first application of the GTAP framework including a static GTAP model and GTAP database to the study of Kazakhstan's economy, which makes this study even more interesting. The various applications of the static model in this study expose weaknesses and strengths to this approach. This analysis provides insights into the applicability of such databases as GTAP in the analysis of the economy of Kazakhstan. As such, this study aims to analyze current and alternative trade policies as well as energy policies using a computable general equilibrium approach.

1.2 Aims of the study

Against the background of the aforementioned issues and employing a computable general equilibrium model and the global database, this study's main aim is to analyze the economy-wide effects of trade and energy policies in Kazakhstan, using the CGE model, particularly the Global Trade Analysis Project (GTAP) model and the global GTAP database. The specific objectives within the framework of this study are as follows:

- using the GTAP database and GTAP model to quantify comparative static economy-wide effects and selected sector effects of Kazakhstan's customs union (CU) membership with Russia and Belarus
- using the GTAP database and GTAP model to quantify comparative static economic effects and sector effects of the hypothetical free trade agreement (FTA) between Kazakhstan and China
- simulating and analyzing the economy-wide static effects of the removal of fossil fuel subsidies in Kazakhstan

In order to achieve the objectives mentioned above, several tools are applied. An overview of recent economic development in Kazakhstan and the existing trade and energy structure and policy in the country is provided. Moreover, a comprehensive literature review of previous CGE studies in Kazakhstan is conducted and discussed.

This study is a contribution to research on the current trade and energy policies in Kazakhstan. First, the analysis in this study widens the spectrum of earlier approaches to the study of CU effects in Kazakhstan by applying one of the latest versions of the GTAP databases with specific disaggregation of the CU members (Belarus, Kazakhstan, and Russia).

Second, this study specifically analyzes the case of trade integration between the emerging economy of China and the developing country, Kazakhstan. Chinese politicians have raised the potential FTA issue several times, though further discussions have not yet taken place. The following analysis looks at potential welfare implications, benefits, and challenges of a potential FTA between China and Kazakhstan. Understanding these economic and trade effects can contribute to the formulation of trade policy in Kazakhstan. The findings of this study can be applied to the economic analysis of trade policy formulations in other countries of the Central Asian region.

Third, this study, building on a limited existing data on energy subsidies in Kazakhstan and the latest version of the GTAP database, analyzes the static economic effects of subsidy removal. The purpose of this analysis is to show the direction of change as a result of energy reform in the country and contribute to energy policy discussion and formulation in Kazakhstan.

1.3 Structure of the study

The study is divided into six chapters and an executive summary. Chapter 2 provides an economic overview of Kazakhstan. The economic situation immediately after independence in 1991, the reforms undertaken in the 1990s, and economic recovery afterwards are discussed. Additionally, it looks at the current policies pursued by the government of Kazakhstan. The overview shows that the country pursued a wide range of macroeconomic reforms towards developing a market economy, and it has had impressive growth since the beginning of the 2000s largely due to expanding production and the export of oil. Furthermore, an overview of the agriculture and energy sectors, foreign trade, and trade policies in Kazakhstan is provided. Agriculture used to be a cornerstone of the Kazakh economy and an important part of the livelihood of the Kazakh people. After the collapse of the Soviet Union, the share of the agricultural sector drastically dropped, and numerous attempts to revive the sector have so far failed. The main bilateral trade partners of Kazakhstan are China, the EU, and Russia. Trade with other CIS countries has remained low, and at the same time, trade policy in recent decades has focused on regional integration. A recent major trade policy reform in Kazakhstan was the creation in 2007 of the CU with Belarus and Russia, which was further developed into the Eurasian Economic Union. The energy sector is the driving factor for the impressive economic growth in Kazakhstan. Kazakhstan has significant natural resources such as coal, gas, and oil. The country exports mostly fuel and its products and imports largely machinery, technical equipment, and agricultural products. Domestic energy prices are low and below the cost recovery level. Energy pricing has remained influenced by the Soviet legacy of heavily subsidizing energy prices. The rest of the chapter discusses the structure and features of the energy sector in the country and the current pricing system. This chapter is meant to provide background data and information on the economy of the country for a further analysis.

Chapter 3 presents a theoretical and methodological background to the study. First, theoretical aspects of trade policies such as the creation of the CU and welfare analysis of subsidies is provided. Furthermore, an overview of the (CGE) approach to modeling and the review of the main components and structure of the GTAP model are provided. CGE is a widely applied tool

to analyze trade and energy policies. The approach has it strengths as well as several limitations, which are briefly discussed in the chapter.

Chapter 4 covers empirical analysis including a literature review and the main simulations. This chapter reviews recent literature related to the topics studied, including empirical literature on the CU between Belarus, Kazakhstan, and Russia, studies on energy subsidies, and general empirical studies on Kazakhstan with a special emphasis on studies that used CGE or the partial equilibrium approach. It is followed by a description of the scenarios and overview of the GTAP database. Finally, the main results obtained through the GTAP model are reported. The simulation analysis results provide effects for Kazakhstan's overall welfare, GDP, trade balance, exports, imports and production by sector.

Chapter 5 concludes with discussion of the results of each individual scenario. Furthermore, obtained results are analyzed in light of the relevant literature with an emphasis on similarities and differences in the results of different studies. Taking into consideration obtained results, several policy implications are presented that could be taken into consideration by policy makers in Kazakhstan. As with any other empirical research, this study has research and methodological limitations and room for further improvement. In the final part of this study, several suggestions for further research related to these topics as well as methodology are discussed.

Lastly, Chapters 6 and 7 provide an executive summary of this study in English and German.

2 Kazakhstan's main macroeconomic and sector trends

2.1 Socioeconomic characteristics

This chapter provides an overview of the socioeconomic characteristics of Kazakhstan, including some of the main geographical, population, and employment indicators. Furthermore, a brief overview of an institutional structure in the country is provided. The rest of the chapter focuses on economic development since independence including economic reforms undertaken in the 1990s and an overview of the current economic features of the country. Finally, current government policies in Kazakhstan are described in order to understand the government's priorities. Government policies and strategies shape current and future economic development of the country and state the priority economic sector for further sustainable economic development.

Kazakhstan is a former Soviet Union country, located in the Central Asian region, bordering Russia, China and other Central Asian countries (Figure 2.1). Kazakhstan gained independence from the Soviet Union in December 1991. Kazakhstan is the ninth largest country in the world in territory, which is 2,724,902 square kilometers, and it is also the largest landlocked country in the world. Geographically Kazakhstan has diverse terrains: four-fifths of the territory is composed of deserts and steppes.

Source: CIA Factbook, 2015

Figure 2.1 Map of Kazakhstan

Table 2.1 summarizes basic indicators for the Central Asian countries, including Kazakhstan. Kazakhstan is the largest country in Central Asia by area and has the largest percentage of land suitable for agriculture. The population of Kazakhstan is more than 17 million people, and it is

the second largest populated country in the region after Uzbekistan. The country is one of the least densely populated countries in the world. The population density of Kazakhstan is 6.4 people per square kilometer of land area (World Bank, 2015).

Table 2.1 Geographical indicators of Central Asian countries

	Kazakhstan	Kyrgyzstan	Tajikistan	Turkmenistan	Uzbekistan
Area (sq. km)	2,724,900	199,949	142,550	488,100	447,400
Population (million people)	17	5.51	8.9	5.1	29.7
Agricultural land (sq. km)	2,091,150	106,085	48,550	326,600	266,600
Agricultural land (% of land area)	77.5	55.3	34.7	69.5	62.7

Source: Author's own compilation based on CIA (2015), Committee on Statistics (2013)

Kazakhstan is endowed with vast natural resources and large territories suitable for agricultural production. Almost 80% of the territory of Kazakhstan is suitable for agriculture. Kazakhstan is also among the top ten producers of wheat in the world (OECD, 2013). Kazakhstan has the 11th largest reserves of oil and natural gas in the world. It also has significant reserves of minerals and metals such as uranium, copper, and zinc (CIA World Factbook, 2015).

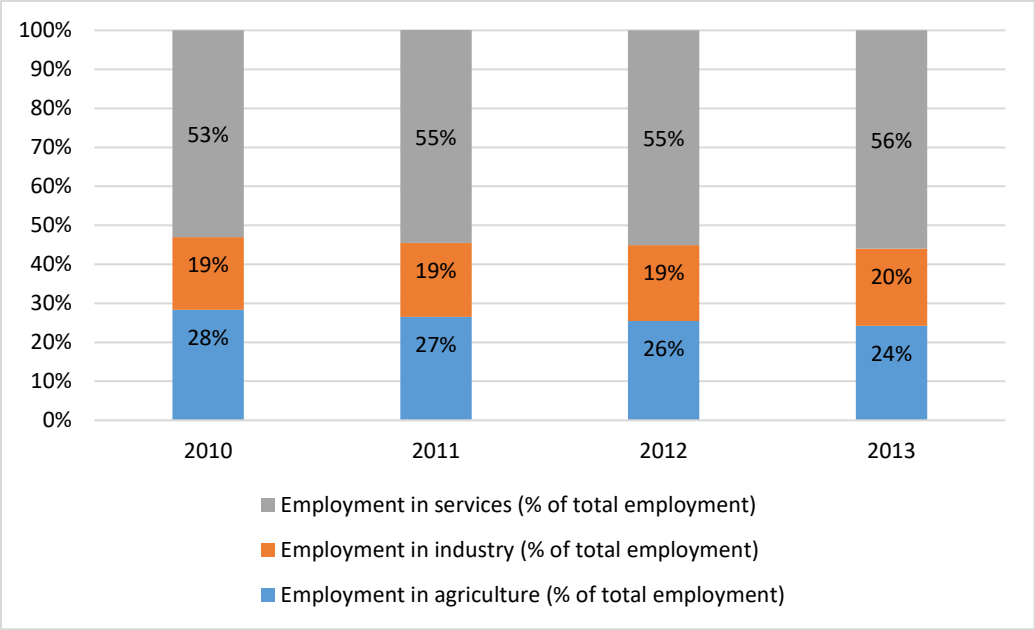
The rural population in Kazakhstan accounts for 40% of the total population, and a majority of the population lives in the cities (Table 2.2). Kazakhstan is an ethnically diverse country: the majority of the population, around 63%, are of Kazakh ethnicity, followed by Russians around 23%, and other ethnicities such as Ukrainians, Uzbeks, Uighurs, etc.

Table 2.2 Population dynamics Kazakhstan, 1991, 2000, and 2012

	1991	2000	2012
Urban population	9,404,000	8,413,400	9,277,600
Rural population	7,047,700	6,452,200	7,632,200

Source: Author's own compilation based on Committee on Statistics, 2013

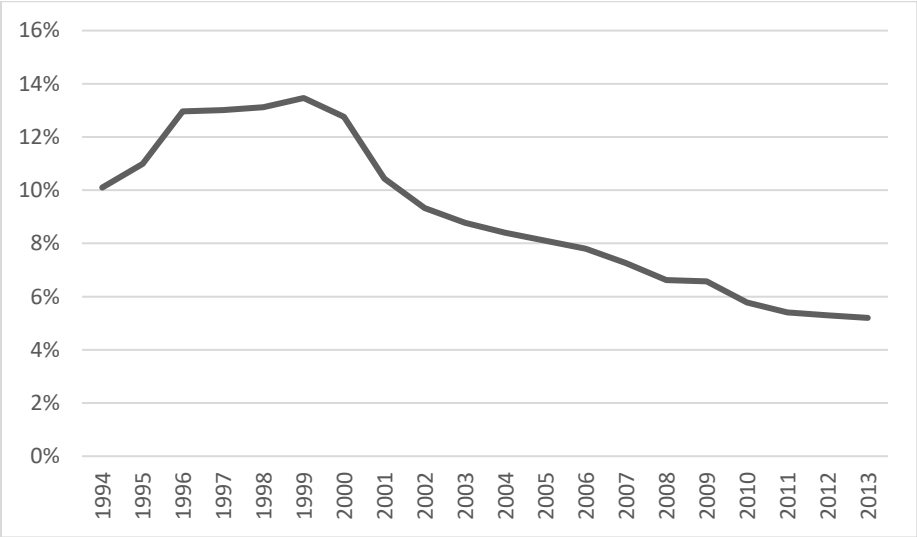
The labor force structure in Kazakhstan is depicted in Figure 2.2. In 2013 more than half of the labor force was employed in services, around 24% in the agriculture sector, and 20% in industry.



Source: Author's own illustration based on World Bank n.d.

Figure 2.2 Employment by sector in Kazakhstan, 2010-2013

Figure 2.3 shows that unemployment peaked in the 1990s when the overall economic performance in the country and in the post-Soviet region was deteriorating. Starting from the 2000s due to robust economic growth, the unemployment rate declined significantly, from 13% in the end of the 1990s to around 5% in 2013 (Committee on Statistics, 2013).



Source: Author's own illustration based on IMF, 2014

Figure 2.3 Unemployment rate (% of total labor force) in Kazakhstan, 1994-2013

2.2 Institutional structure

Kazakhstan is a presidential republic. The parliament is composed of the *Majilis* (the lower house) and the senate (upper house). The prime minister is a chair of the cabinet of ministers. The Table 2.3 below displays current central executive power bodies in Kazakhstan.

The government of the RK consists of 12 ministries, one agency and 16 *akimats*, which are the regional governments. A presidential decree from August 6, 2014 ordered restructuring of the governmental bodies and agencies. The previous 17 ministries, nine agencies, and 54 committees have been integrated into 12 ministries and 30 committees (Table 2.3). Through the process of government restructuring, the Ministry of Environment and Water Resources was integrated into the newly established Ministry of Energy. The Ministry of National Economy assumed duties of the Ministry of Economy and Budget Planning, the Ministry of Regional Development, the State Statistics Agency, the Agency for Regulation of Natural Monopolies, the Agency for Protection of Competition, and the Consumer Protection Agency (Ministry of Justice, 2014).

Table 2.3 Central executive power in the RK, 2015

Ministry of Internal Affairs	Ministry of Health and Social Development	Ministry of Foreign Affairs
Ministry of Culture and Sport	Ministry of Defense	Ministry of Education and Science
Ministry of Investment and Development	Ministry of National Economy	Ministry of Finance
Ministry of Agriculture	Ministry of Energy	Ministry of Justice

Source: Author's own compilation based the Ministry of Justice, 2014

2.3 Economic development

Kazakhstan was one of the major producers of raw materials in the Soviet Union, dependent largely on the imports of manufactured goods from other Soviet Republics. The country produced largely minerals, grain, wool, and cotton. After the collapse of the Soviet Union, Kazakhstan experienced severe economic decline. This was due to several factors basically beyond the control of the country. The suspension of the budgetary transfers from Moscow to Kazakhstan, discontinuation of the former system of monetary control, and the collapse of the demand for exports are some of these major factors (World Bank, 1993).

Since independence in 1991, Central Asian countries pursued different economic development strategies; however, initial economic and political conditions in the Central Asian countries

were similar. For example, the Kyrgyz Republic implemented rapid reforms and became one of the most liberal countries in the Central Asian region. Kyrgyz Republic was also the first FSU country to access the World Trade Organization (WTO) in 1998. Turkmenistan followed the path of strong state control and evolved into a totalitarian regime with strong control of all spheres of life, including the economy. Uzbekistan retained tight state control, however not to the same extent as Turkmenistan, and there have been few significant economic reforms in the country. Tajikistan was embroiled in the 1990s in a civil war, which slowed down economic and social reforms and developments. Kazakhstan, similar to the Kyrgyz Republic, pursued a more liberal regime, although the economy became more of an economy of favors and connections rather than moving towards becoming a real market economy (Pomfret and Anderson, 2001, Pomfret, 2006).

The economic structure in 1991 in Kazakhstan was characterized by the predominance of industry and agriculture[1]. Industry accounted for 41% of the GDP in 1991 and agriculture for 34%. Industry was dominated by mining and processing activities. Processing plants for ferrous and nonferrous metals, the production of heavy machinery and tools, refineries, and petrochemical plants contributed to the industrial production. Agriculture at that time played a significant economic role. The country mainly produced wheat, maize, livestock products, wool, and cotton. The economy of Kazakhstan was closely linked to Russia, and about 60% of the exports and two thirds of the total imports originated from Russia (World Bank, 1993).

Liberalization policies implemented by the government in the mid-1990s helped stabilize the economy. Interest rates and foreign exchange rates were liberalized, and the trade regime was reformed through the elimination of quantitative restrictions and rationalization of the import tariffs. The government took a path towards establishing a market economy. Small and medium-size enterprises were privatized. Privatization of large enterprises was conducted but not to the same extent as privatization of small and medium-size enterprises. Kazakhstan pursued a strict monetary policy in the 1990s that also contributed to economic improvement.

[1] A further overview of the agriculture and energy sectors is in section 2.5, chapter 2

Economic collapse in the 1990s

In the years after the Soviet Union collapse, Kazakhstan experienced a severe economic decline. Kazakhstan, as well as other post-Soviet countries, faced three major economic shocks, which are briefly discussed below.

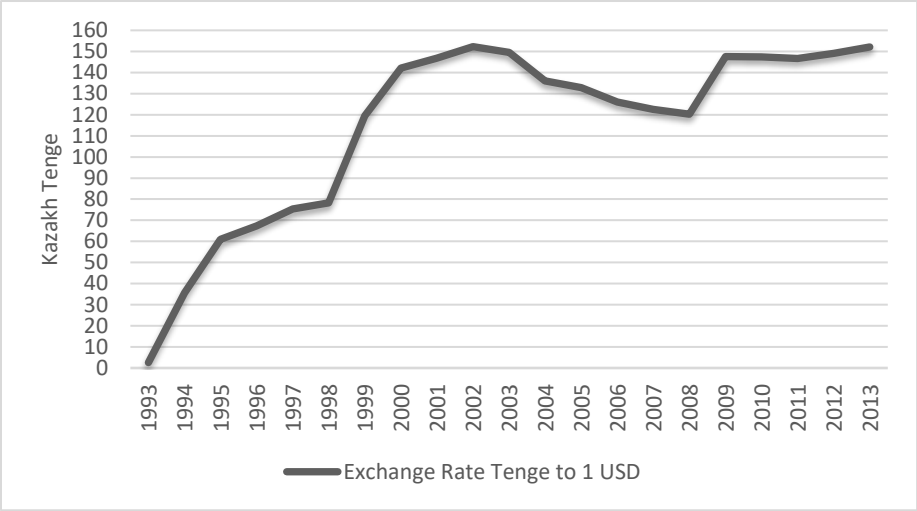
1. The dissolution of the Soviet Union revealed a lack of experience in the nationhood of Kazakhstan as well as in other Central Asian countries. Such conditions created difficulties in establishing the necessary national institutions. Moreover, the establishment of new national borders led a breakdown of the previously existing supply chains, which resulted in a shortage of production inputs and an overall collapse of the demand for exports.
2. The end of central planning created as a consequence years of organizational problems, which led to a severe decline in output in the country.
3. The dissolution of the Soviet Union was followed by hyperinflation. Prices increased rapidly due to this. In the early 1990s inflation as a percentage of the consumer price was between 1,381-1,877%. Starting in 1996, inflation began to decrease (see Table 2.4) (Pomfret et al. 2001).

Table 2.4 Inflation, consumer prices %, in Kazakhstan, 1991-2014

Year	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
Inflation, % of consumer price	79	1,381	1,662	1,877	176.2	39.2	17.4	7.1
Year	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Inflation, % of consumer price	8.3	13.2	8.4	5.8	6.4	6.9	7.6	8.6
Year	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	
Inflation, % of consumer price	10.8	17.2	7.3	7.1	8.3	5.1	5.8	

Source: Author's own compilation based on the Committee on Statistics, 2014, World Bank n.d., Pomfret, 2010

Until 1993 Kazakhstan still used the ruble as its currency. In November 1993, Kazakhstan introduced its own currency, the Tenge which served as an important factor towards gaining control over inflation and establishing a market economy (Pomfret, 1996). In the transition period, especially at the end of the 1990s Kazakh currency was volatile (see Figure 2.4).



Source: Author's own illustration based on the Committee on Statistics, 2014c

Figure 2.4 Exchange rate Kazakh Tenge, 1993-2013

Transition period

The period after year 1995 marks the beginning of the major economic reforms undertaken by the country's government. The Kazakh government in comparison to other Central Asian countries applied a more aggressive approach to liberalization. The government implemented reforms oriented towards establishing a market economy. Liberalization policies implemented by the government in the mid-1990s helped stabilize the economy (Alam and Baerji, 2000).

After a drastic decrease of output in 1991, the economy of Kazakhstan by 1996 started slowly recovering. In 1998 Kazakhstan was hit by the four economic external shocks: a fall in the oil prices and other commodity prices, sharp real depreciation of the Russian ruble, a decline in the emerging markets, and severe drought. These external factors influenced the policy response of the Kazakh government towards the changing economic environment. Policy responses included adjustments to the monetary, fiscal, and exchange rate policies (IMF, 1999).

The main elements of the transitional period in Kazakhstan are briefly described below. The main elements of the transitional period were privatization reforms, foreign investments, price liberalization, and the establishment of banking and customs systems (Felipe and Rhee, 2013).

- **Privatization**

Privatization is regarded as one of the main components of the transformation of the Kazakh economy. The process of privatization after the dissolution of the Soviet Union was not easy since state companies accounted for 87% of employment in 1991 in the country. As of 1991 Kazakhstan had 21,000 state-owned companies (Jermakowicz et al., 1996).

The Kazakh government implemented the State Privatization Program in three stages: 1) 1991-1992; 2) 1993-1996; 3) 1996-2000. Moreover, in 1995 the Civil Code, the Law 'On Privatization', was adopted in the country. The majority of the state enterprises that were privatized were small-scale enterprises; large enterprise privatization was not conducted to the same extent (see Table 2.5).

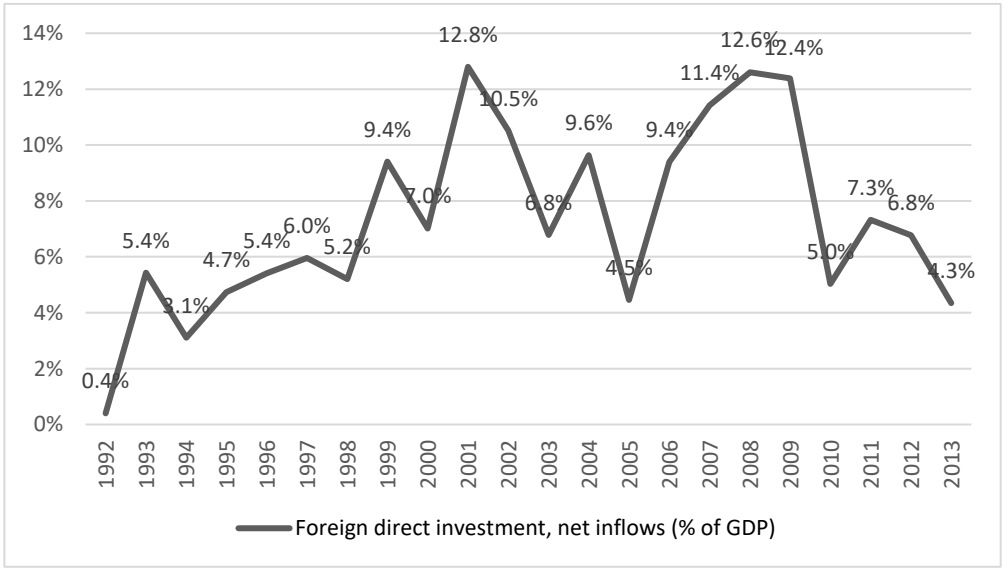
Table 2.5 Privatization of state enterprises (units) in Kazakhstan, 1994 -2000

	Before 1994	1994	1995	1996	1997	1998	1999	2000
Small-scale privatization	5,578	2,748	2,477	3,393	5,590	2,535	2,187	1,642
Mass privatization	…	…	147	497	1,122	516	131	79
Privatization in agriculture	…	918	513	138	18	9	0	0
Case-by-case privatization	…	…	5	28	47	13	0	3
Total	9,269	4,147	3,142	4,056	6,777	3,073	2,318	1,724

Source: Author's own compilation based on IMF, 2002, IMF 1999

- **Foreign direct investments (FDI)**

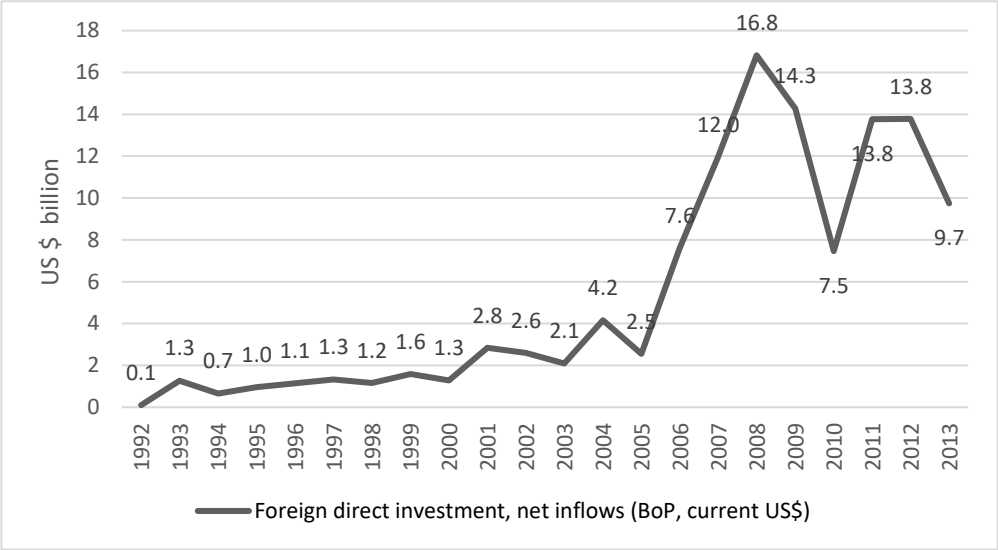
Kazakhstan attracted the highest FDI rate among the Central Asian countries. The largest share of FDI inflow was primarily concentrated in a few sectors such as oil and gas. The FDI as a net inflow as a % of the GDP in Kazakhstan steadily increased since the beginning of the 1990s and peaked in 2001 when FDI net inflow constituted 12.8% of the GDP. The inflow of the FDI decreased drastically during and after the global economic downturn in 2008 (Figure 2.5).



Source: Author's own illustration based on Committee on Statistics, 2014c

Figure 2.5 FDI net inflows as a % of GDP, Kazakhstan 1992-2013

According to the National Bank of Kazakhstan, the Netherlands is the largest investor in Kazakhstan with a total investment of $49 billion, followed by the United Kingdom with $24.7 billion in investments. China invested $18.2 billion and Russia $5.3 billion. Other countries such as France, the Virgin Islands, Japan, Switzerland, and Austria are among the top ten foreign investors in Kazakhstan (Weitz, 2013). Figure 2.6 shows how the total FDI inflows increased rapidly in 2005 from 2.5 billion USD to 16.8 billion in 2008.



Source: Own illustration based on Committee on Statistics, 2014c

Figure 2.6 FDI net inflows, current, in billions of USD, Kazakhstan 1992-2013

- **Development of the monetary system and price liberalization**

Kazakhstan pursued a strict monetary policy in the 1990s that largely contributed to the overall economic improvement in the country. Government spending was reduced from 35 percent of GDP in 1991 to around 22 percent by the end of the decade. Banking reforms can be considered one of the most successful reforms undertaken by the national government. Starting in 1996, the country introduced Western banking laws, modern payment systems, and privatization of the pension contributions (Hindley, 2008).

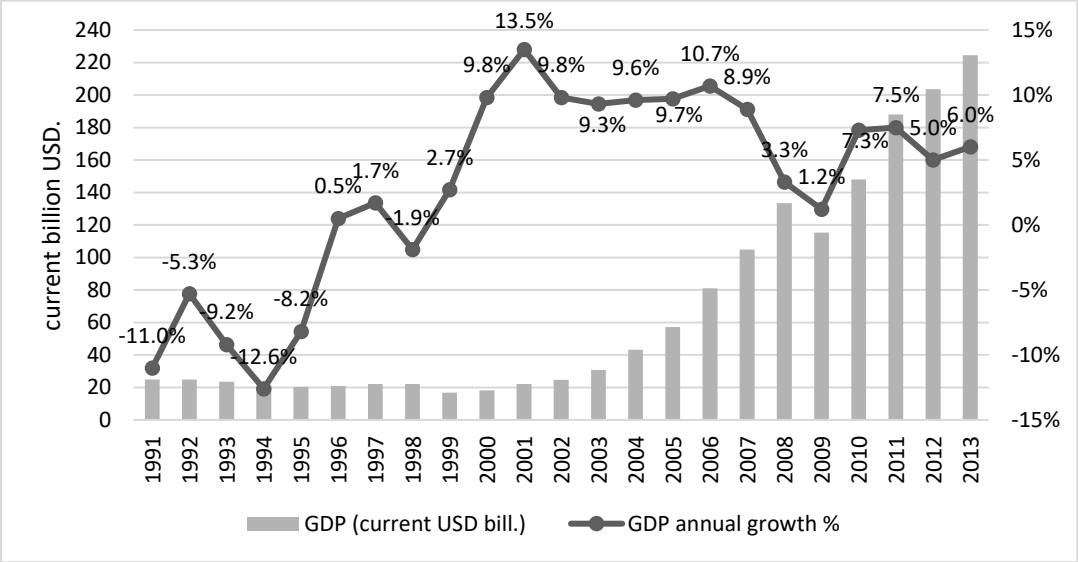
In November 1993, Kazakhstan introduced its own currency, the Tenge. Interest rates and foreign exchange rates were liberalized. In April 1999, Kazakhstan introduced a floating exchange rate (OECD, 2013).

Price liberalization required major adjustments to the previous Soviet controlled price systems. In January 1992, the national government liberalized 80% of the wholesale prices and 90% of the consumer prices. Retail prices rose rapidly in 1992, and in 1993 inflation reached 1,662% (World Bank, 1993).

Economic recovery

As a result of the reforms undertaken by the national government, the U.S. Department of Commerce in 2002 officially revoked its status as a non-market economy and officially declared in October 2011 that Kazakhstan's economy achieved the status of a market economy (Eicher, 2004).

From 1999, the economy of Kazakhstan started to recover. Figure 2.7 depicts impressive economic growth in Kazakhstan since 2000. Despite the financial crisis in 2009 and a slowdown in economic growth, the economy of Kazakhstan grew on average around 8% per annum. The GDP surged from around $20 billion in the 1990s to more than $220 billion USD in 2013. In the period between 1993 and 2012, the GDP per capita grew more than 17-fold from $696 in 1993 to $12,119 in 2012. The economic growth was largely driven by the sound macroeconomic policies, rapidly expanding oil and gas sector in the country, and a favorable investment climate and commodity prices[2]. The oil boom brought significant revenues to the state budget and increased living standards of the population; however, it led to increasing economic and social inequality (Felipe and Rhee, 2013).



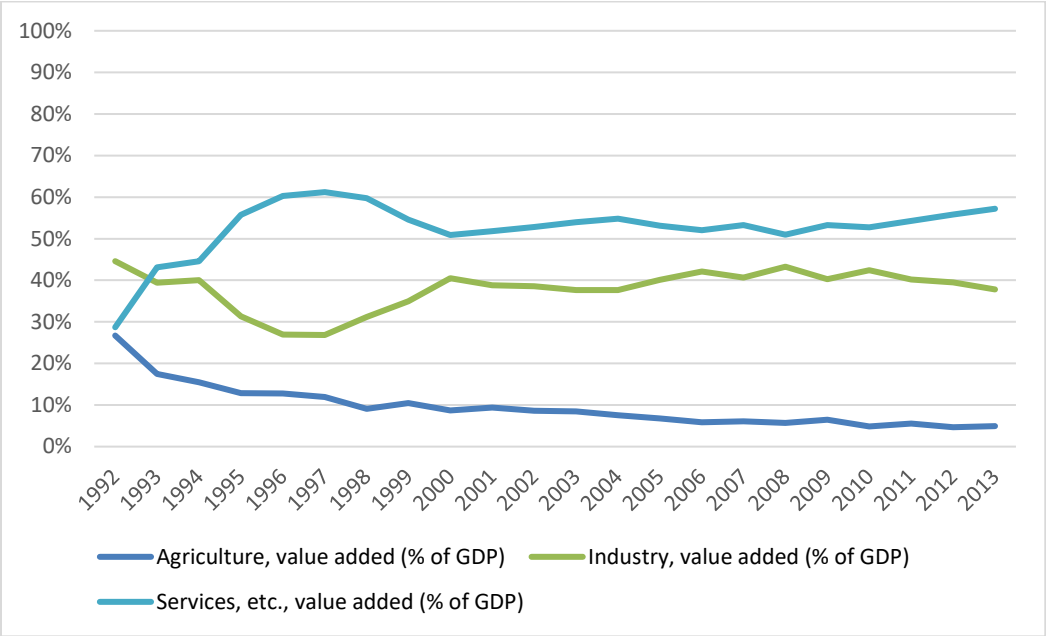
Source: Author's own illustration based on World Bank n.d.

Figure 2.7 GDP growth in Kazakhstan, 1991-2013

A reorientation of the economy towards extractive industries among others had negative effects on other sectors of the economy, especially on the agricultural sector. The share of the value

[2] Appendix A.1. provides further selected macroeconomic data on Kazakhstan.

added to the GDP of the agricultural sector decreased from 27% in 1991 to 5% in 2012 (see Figure 2.8).



Source: Author's own illustration based on World Bank n.d.

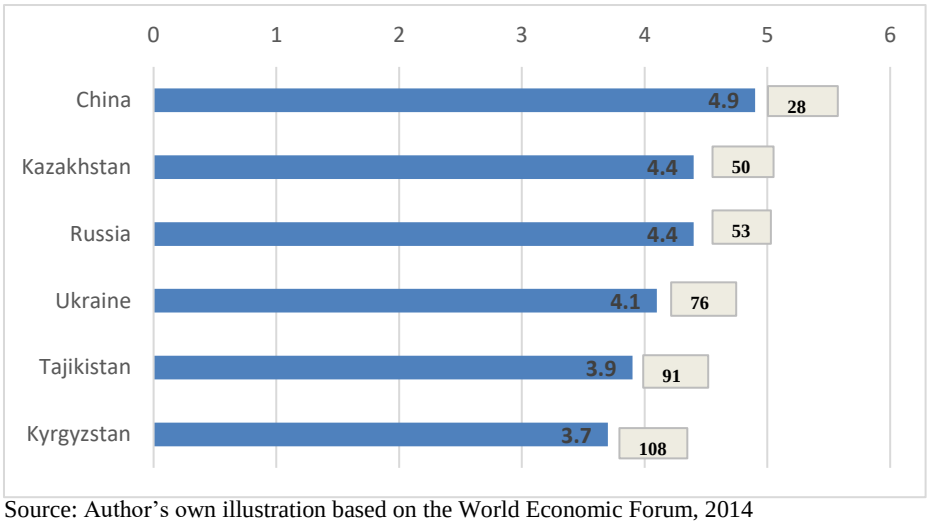
Figure 2.8 GDP composition by sector, Kazakhstan

International rankings

Due to its economic and financial reforms and the general economic strategies pursued by the government since the 1990s, the country was able to achieve a good standing in some of the international rankings. Among Central Asian countries Kazakhstan ranks as the top performer in many of the international rankings.

In 2013 in the Global Competitiveness Index, a competitiveness index developed by the World Economic Forum, Kazakhstan ranked 50th out of a total of 144 countries and had an overall score of 4.4. (Figure 2.9). In 2013 in the Index of Economic Freedom[3], Kazakhstan ranked 68th out of total 178 countries, and the country received an economic freedom status of 'modestly free' (Heritage Foundation, 2014).

[3] The Index of Economic freedom is based on 10 indicators from four major areas: rule of law, limited government, regulatory efficiency, and open markets.



Source: Author's own illustration based on the World Economic Forum, 2014

Figure 2.9 Global competitiveness index and ranking comparison, 2014

2.4 Current government policies

The president and the government of Kazakhstan initiated numerous strategies for the economic and social development of the country. Recent strategies largely targeted improving economic, environmental, and social conditions in the country. A major goal set by the president was to join the top 30 developed countries in the world by 2050. Another important strategy and goal that has been repeatedly emphasized is economic diversification and decreasing economic dependence on the export of fuels.

The main strategy *"Kazakhstan-2050"* was presented in December 2012**.** The president of Kazakhstan, Nursultan Nazarbayev in his address to the nation on January 17, 2014 called this project 'Eternal Kazakhstan'.

The strategy focused on seven main areas:

1. A new economic policy covering the issues of managerial potential in the public and private sectors, favorable investment climate, new industrialization program, infrastructure development, natural resource management, and agricultural development and support.
2. Entrepreneurship development policy covering the area of small and medium enterprise development and public-private partnerships.
3. A new social policy concerning employment, migration, targeted social assistance, mother and child care, and health of the nation.
4. A knowledge and skill development policy including technical and vocational education, technology transfer, and youth initiative.

5. Public service delivery and an improved governance policy covering the areas of state strategic planning, professionalism of civil service, decentralization of power through local self-governance, anti-corruption legislation improvement, and a reform of enforcement agencies.
6. Balanced foreign policy aimed at promoting national interest and strengthening regional and global security.
7. Multi-ethnic and multi-religious society approach aimed at maintaining and developing a multinational society with equal rights of all ethnicities, the role of the Kazakh language, and a multi-confessional, tolerant approach to religion (Nazarbayev, 2014).

"The strategic plan for the development of the Republic of Kazakhstan until the year 2020" was approved by the President in 2010. The plan outlines following key directions and five key indicators:

Key directions:

1. Policies for post-crisis adaptation.
2. Economic diversification through industrialization and infrastructure development.
3. Investments into human capital.
4. Improving society, housing, and communal services.
5. Intensifying international consent, safety, and stability of international relations.
6. Strengthening interethnic consent, security, and stability of international relations (Akorda, 2014).

Key indicators of the plan:

- By 2020 Kazakhstan will become a diversified economy and economically stronger after the crisis.
- Kazakhstan will be among the 50 most competitive countries of the world and attract a large FDI in non-primary sectors.
- By 2020 Kazakhstan will have sufficient human capital and infrastructure to develop a diversified economy.
- By 2020 the national economy will increase in real terms by more than one-third in relation to the 2009 level.
- Decreasing the share of population with incomes below a living wage to 8% by 2020 (Akorda, n.d.).

Kazakhstan heavily relies on the income from production and export of the extractive industries; therefore, the government developed strategies targeted specifically towards economic diversification. Currently the main program for economic diversification is the *Strategy of Innovative Industrial Development of Kazakhstan for 2003-2015*. The strategy shapes the goals for economic diversification in order to shift from extractive industries towards processing by the year 2015 (Akorda, n.d.).

The major objectives of the strategy include tripling labor productivity by 2015, achieving 8% of the average annual growth rate of processing industries, increasing the productivity of the processing enterprises, orienting towards a business-friendly environment, enabling the development of high-tech enterprises, export diversification, and general integration into the regional and global economy (Akorda, n.d.).

Recent developments in the world, including a drastic drop in commodity prices including crude oil and difficult external factors such as a weakened economic situation in Russia, sanctions imposed on Russia, geopolitical difficulties in the region, and the slowdown of economic growth in China affected the economy of the country. Economic growth slowed significantly, and real GDP growth in the country dropped to 1.2% in 2015, 4.3% in 2014 compared with 6% growth in 2013. Depreciation of the Russian ruble led to the inflow of Russian imports, affecting domestic industries and exports. Exports decreased by more than 40% and imports by around 30% from 2014 to 2015. Significant depreciation of the Kazakh currency was also observed: from USD/KZT 152.13 in 2013 to USD/KZT 332.01 according to the most recent data for 2016. As a result of the economic downturn, Kazakhstan introduced several measures such as currency adjustments and greater exchange rate flexibility. In August 2015, the government of Kazakhstan decided to move to the floating exchange rate regime with inflation targeting, which was previously fixed and pegged to the US dollar. Moreover, Kazakhstan had to strain its fiscal policies mainly by reducing capital spending. Due to decreasing oil revenues, the government had to revise the budget. A privatization program was introduced, which plans to sell total 106 state companies (EBRD, 2016).

This section presents an overview of the economic performance of Kazakhstan since the collapse of Soviet Union in 1991. Some of the major changes in the economic structure since 1991 include a drastic decline in agricultural output and an increasing dependence on the export of fuels. After a sharp economic decline in the beginning of the 1990s, the Kazakh economy recovered largely due to the policy reforms and increased output and export of oil. Policy

reforms had a clear orientation towards a market economy. Statistical data on the economy and recent literature emphasize that the reforms for economic diversification have so far been unsuccessful.

2.5 Sector overview

The previous section provided an overview of the economic development of Kazakhstan since independence in 1991 and the current macroeconomic conditions in the country. Furthermore, recent developments in the agriculture and energy sectors and trade are discussed. Both sectors are particularly important; the energy sector is currently a driver of economic growth, and the agricultural sector is a priority sector for economic diversification. The overview in this section is meant to provide background information for further analysis.

2.5.1 Agricultural sector

Agriculture was always an integral part of the Kazakh economy and is currently a strategic sector for economic diversification. Livestock production was an indispensable part of the lifestyle and tradition of the Kazakh people. Kazakhstan possesses a large amount of agricultural land. Around 77% (in 2012) of the total land area is classified as agricultural land (refers to the share of land that is arable, under permanent crops, and under permanent pastures), making around 2,079,750 (sq.km) agricultural land. Arable land comprises around 8.5% (in 2012) of total land area. The agricultural sector is still the largest sector in terms of employment, with 26% of the economically active population working in agriculture in 2012 (World, Bank n.d.).

After gaining independence in 1991, Kazakhstan had a difficult transition from a centrally planned economy to a market economy. This transition and general restructuring of the economy and major industries had a drastic impact on the agricultural sector. The agricultural share of the GDP was 34% in 1990 and fell to 5% in 2012. The transition period led to the deterioration of the terms of trade and collapse of the agricultural support system.

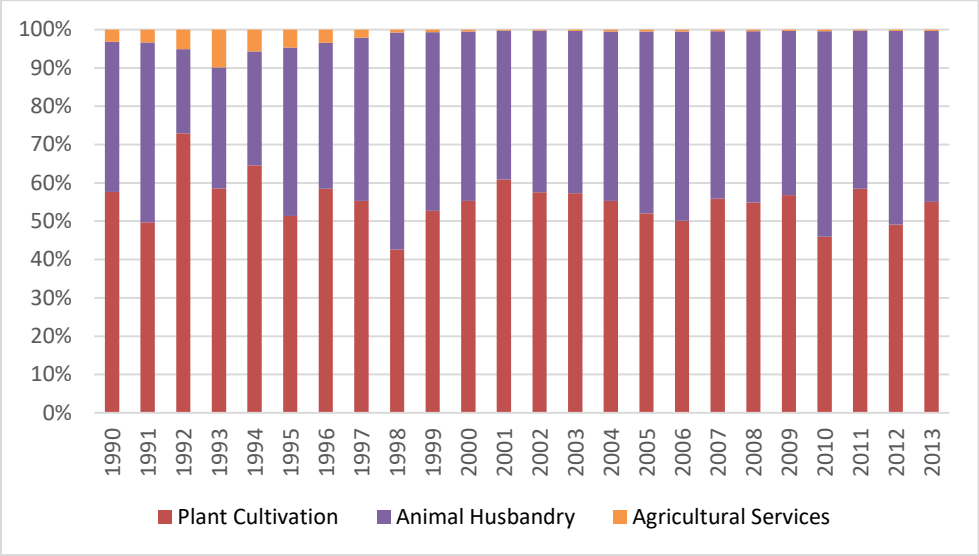
The period of transition also included land and farm ownership reforms. These reforms significantly affected farm structure development in the country. Two thirds of the total agricultural output in 1990 was generated by large enterprises, while in 2011 it accounted only for one third of the agricultural output. The number of agricultural operations increased from 5,000 in 1990 to 188,616 in 2012. The land ownership structure significantly changed as well. Whereas only 0.6% of total land in 1990-1992 belonged to the individual farms, in 2011 the

share increased to 53%. The number of operating individual farms increased from 324 in 1990 to around 182,419 in 2011 (OECD, 2013).

The current agricultural system in the country can be categorized into two main geographical regions:

1) The north and northeast regions are dominated by the large-scale agricultural enterprises that specialize in grain and oilseed production.

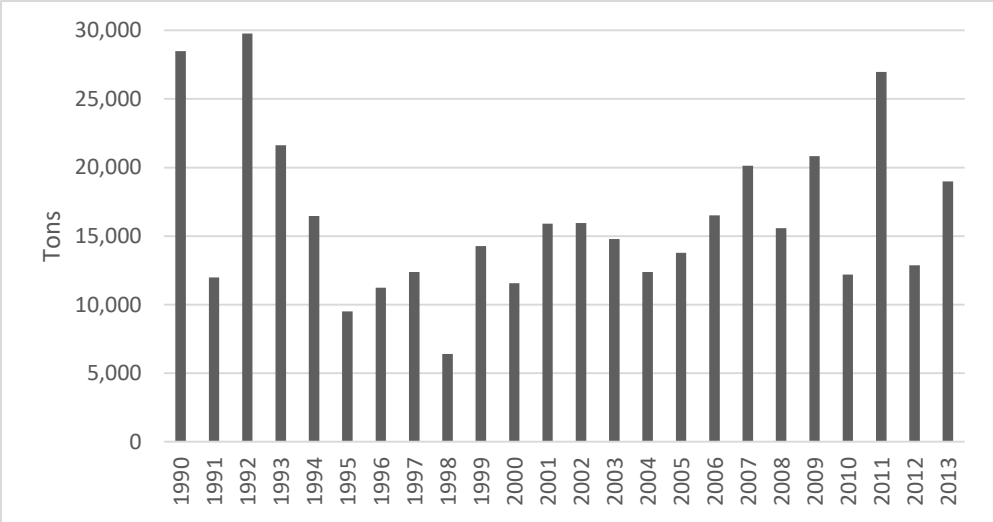
2) Small-scale farming in the south and southeast regions of Kazakhstan.



Source: Author's own illustration based on the Committee on Statistics, 2014a

Figure 2.10 Agricultural GDP by contribution (%) in Kazakhstan, 1990-2013

Agricultural GDP contribution by percentage is largely dominated by plant cultivation and animal husbandry (Figure 2.10). Grain production and exports, particularly wheat, are especially important in Kazakhstan. Kazakhstan is among top ten largest wheat producers and exporters in the world. The north and northeast regions are major producers of wheat in the country (see Figure 2.11 for details on total grain production). Around 80% of wheat is produced in three regions of the country: Akmola, Kostanay, and North Kazakhstan. Grain is produced mostly by the larger agricultural enterprises (69% in 2011) (OECD, 2013).

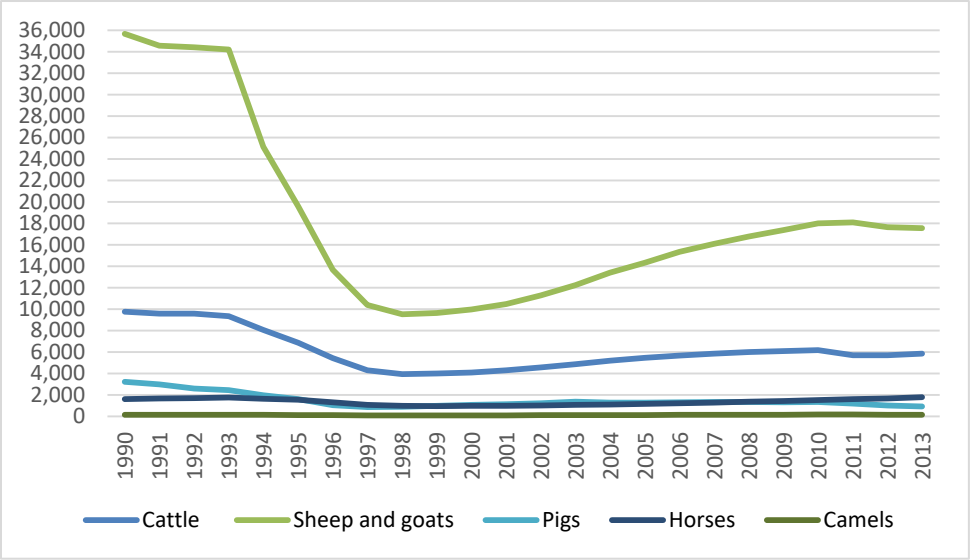


Source: Author's own illustration based on the Committee on Statistics, 2015

Figure 2.11 Total grain production in Kazakhstan, 1990-2013

Livestock has been an important part of the agricultural sector in Kazakhstan. In 1990 livestock contributed 60% towards total agricultural GDP; in 2013 the share decreased to around 45%. After the transition process from a planned to a market economy, the livestock industry experienced a drastic decline in output. Several factors influenced this trend in the livestock sector. Demand and supply shocks and agricultural privatization reforms are some of the reasons for the decline in livestock production. On the demand side, a sudden drop in consumer income, high inflation rates, price increases, and price liberalization caused a sharp decrease in demand for livestock. The consumption of livestock dropped by 40% between 1990 and 1998. The supply side was hit by price liberalization and increasing prices for inputs such as fuels and feed ingredients. Moreover, after privatization reforms, the livestock production, previously dominated by the large-scale producers, started to be dominated by the peasant farmers and household farmers (Syzdykov, Aitmambet, and Dautov, 2015).

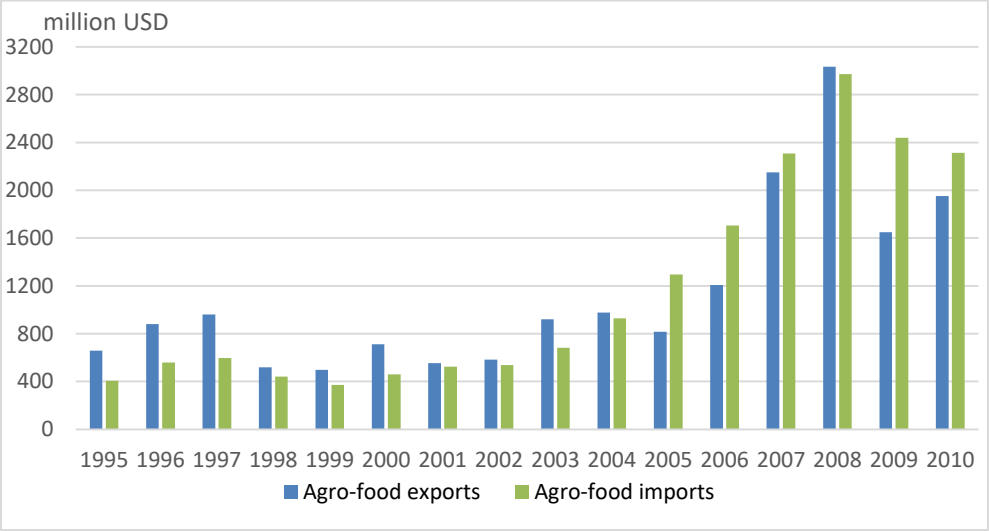
The number of cattle, camels, sheep, pigs, and horses fell dramatically in the 1990s and has since not recovered to the previous levels (Figure 2.12). Since 2000 there has been a stable rise observed in the livestock number, though it still has not reached the level of 1990.



Source: Author's own illustration based on the Committee on Statistics, 2015

Figure 2.12 Livestock number (thousand heads) in Kazakhstan, 1990-2013

Agricultural exports and imports constitute a low share in Kazakhstan's total exports and imports. Imports accounted in 2013 for 9.5% of the total. Exports of agricultural products accounted only for 3.2% of the total exports (Committee on Statistics, 2014b).

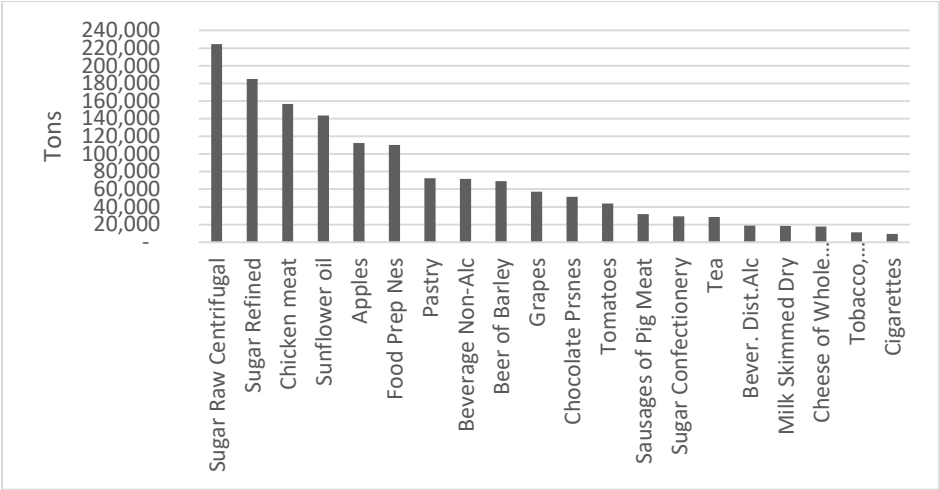


Source: Author's own illustration based on UN Comtrade, 2014

Figure 2.13 Agricultural-food imports and exports, Kazakhstan, 1995-2010

Kazakhstan is a net-importer of agricultural products. Analyzing development since the 1990s, it can be observed that Kazakhstan was a net exporter until 2004, afterwards Kazakhstan was predominantly a net importer (see Figure 2.13). Kazakhstan is a net importer of almost all food and beverage products except for wheat, flour, and vegetable oils. Detailed agricultural imports are depicted in Figure 2.14, showing that sugar, chicken meat, apples, and sunflower are the main imports. CIS countries are the main exporters of agricultural products to Kazakhstan. Meat

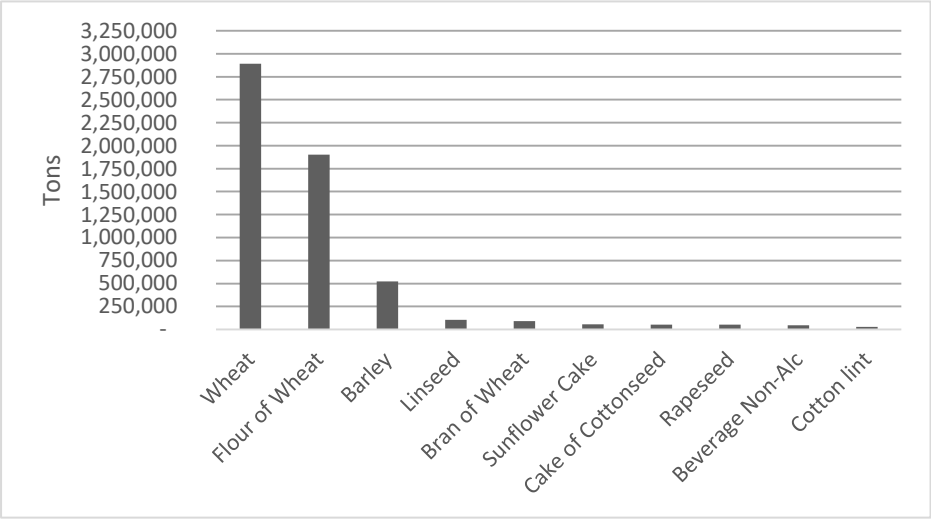
imports are primarily from the United States. There is an increasing role of agricultural imports from China, particularly of fruits (FAO, 2012).



Source: Author's own illustration based on FAO, 2014

Figure 2.14 Agricultural imports Kazakhstan, 2011

Kazakhstan's agricultural export structure consists primarily of wheat and flour (see Figure 2.15). Kazakhstan is an important producer and exporter of high-quality wheat. The average annual production is about 13 million tons. Due to weather conditions and other factors, wheat production varies between 10 and 17 million tons. Between 2 to 8 million tons of wheat per year is exported. Around 75 percent of all wheat is produced in three administrative regions located in the north-central part of the country: Kostanai, Akmola, and North Kazakhstan (USDA, 2010).



Source: Author's own illustration based on FAO, 2014

Figure 2.15 Main export commodities Kazakhstan, 2011

The agricultural sector is one of the priority areas for the country's economic development and strategy for diversification. On February 18, 2013, the national government approved a seven

year plan *Agricultural Development for 2013-2020*. The program was developed specifically considering current conditions such as increased competition due to the customs union and expected accession into the WTO. The total funding envisioned for the program is about $20.5 billion. The main objective of the program is to create the necessary conditions for the development of the agricultural sector and to increase the competitiveness of the agribusiness sector in Kazakhstan. The main goals of the program are the following:

1. Financial rehabilitation
2. Improving the availability of products, services, and operations for agribusiness
3. Developing the state system to provide support to the agribusiness
4. Improving the system of state regulation of agribusiness

The program includes the following targets to be achieved by the end of the program:

1. Increase physical output of the agricultural sector by 1.5 fold
2. Increase agricultural labor productivity by 3 fold
3. Increase the export earnings from the sale of agricultural products by 20%
4. Enable food self-sufficiency of main food products by 80% of the internal market
5. Attract more than 10 trillion tenge from private investments into the agricultural sector (Ministry of Agriculture, n.d.)

The main institution responsible for the development and implementation of the program of agricultural development is JSC "National Management Holding "KazAgro." The holding includes seven companies: "Food Contract Corporation," JSC "KazAgroFinance," JSC "Agrarian Credit Corporation," JSC "Fund for Financial Support of Agriculture," JSC "Stock-raising Products Corporation," JSC "KazAgroGarant," JSC "KazAgroMarketing (FAO, 2012).

2.5.2 Energy sector

The most important sector in terms of GDP contribution and export shares in Kazakhstan is the energy sector, particularly the production and export of oil. The energy sector, specifically oil, has been a major driver of economic growth and consumer income growth. The oil sector constitutes about one fifth of the total GDP in the country (Felipe et al., 2013). The oil sector attracted the largest share of total investments.

Kazakhstan is an energy-rich country (Table 2.6). It has significant reserves of natural gas, oil, coal, and uranium. Considering the total oil production, the country ranks 18th in the world. The country ranks 12th in the world in the estimated total net exports of oil. It has the second largest

reserves of oil (3.9 billion tons as of the end of 2014), after Russia, among the FSU countries and 1.5 trillion cubic meters of proven natural gas reserves. Kazakhstan has a 1.8% share of the world total reserves of oil and 0.8% share of the world natural gas reserves (BP, 2015).

Table 2.6 Reserves of oil and gas in Kazakhstan (as of the end of 2014)

	Proven reserves of oil (billion tons)	Share of world total reserves (%)	Proven reserves of natural gas (trillion cubic meters)	Share of world total reserves (%)
Kazakhstan	3.9	1.8	1.5	0.8

Source: Author's own compilation based on BP, 2015

Kazakhstan's share in the world's total exports of natural gas is around one percent. In 2012 the country produced 416 billion cubic feet of natural gas, and domestic consumption of natural gas was 387 billion cubic feet (Table 2.7).

Table 2.7 Natural gas flows, Kazakhstan (2009-2012)

	2009	**2010**	**2011**	**2012**
Production	388	307	401	416
Consumption	255	303	436	387
Import	216	371	378	372
Exports	350	374	343	402

in billions of cubic feet, natural gas

Source: Author's own compilation based on U.S. Energy Information Administration

Kazakhstan possesses significant reserves of coal (Table 2.8). The share of coal exports from Kazakhstan in total global exports ranges between 2-3% (2008-2012).

Table 2.8 Coal flows, Kazakhstan (2008-2012)

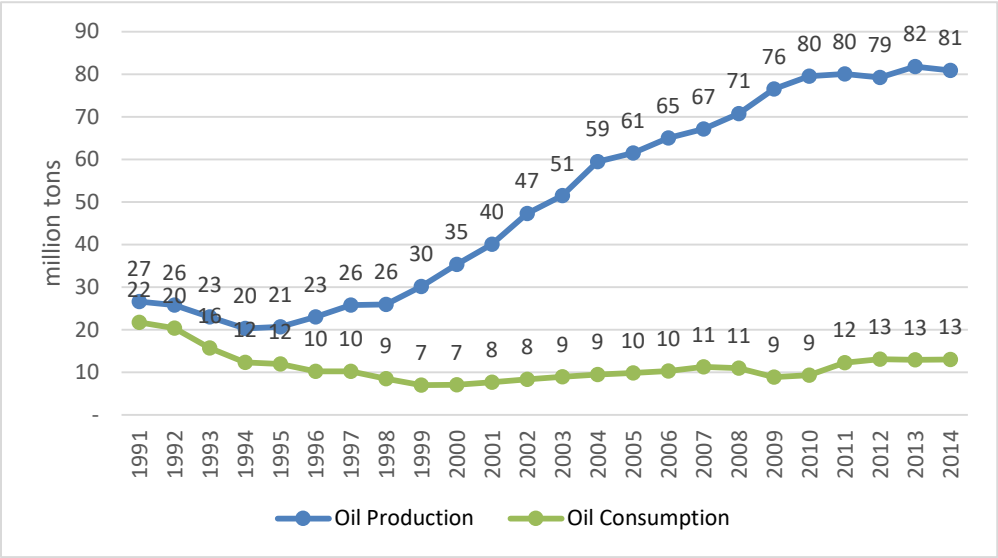
	2008	**2009**	**2010**	**2011**	**2012**
Production	122,436	111,173	122,278	128,364	138,918
Consumption	87,043	80,357	86,714	95,375	104,787
Import	1,155	1,047	1,156	1,036	1,047
Exports	36,538	31,568	34,604	33,477	35,178

in thousands of short tons, coal

Source: Author's own compilation based on U.S. Energy Information Administration

Oil production has continued to expand since Kazakhstan gained independence in 1991. Oil consumption at the same time stayed low and even decreased (Figure 2.16). It is expected that

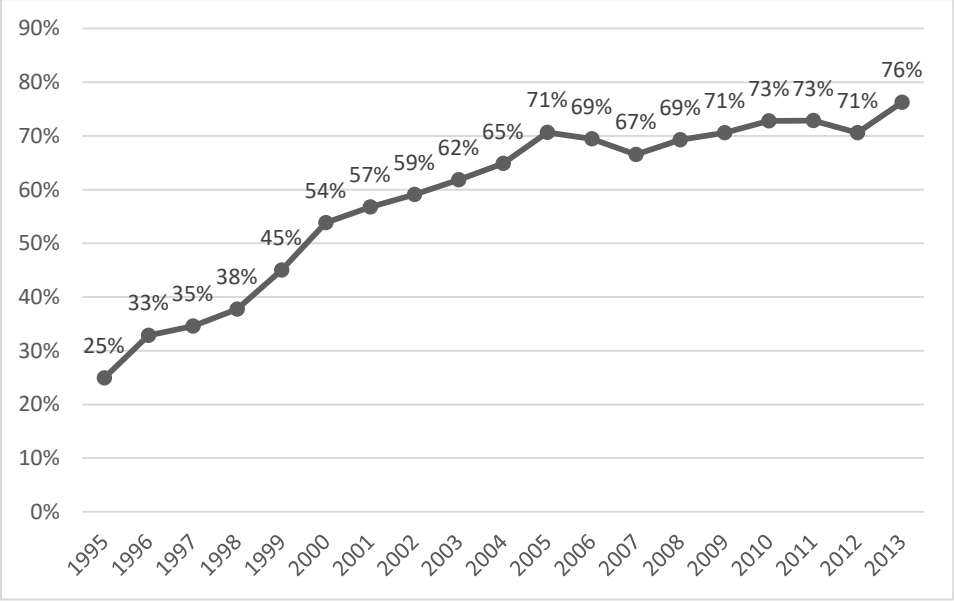
oil production and export will continue to drive the economic growth in Kazakhstan.



Source: Author's own illustration based on BP, 2015

Figure 2.16 Total oil production and domestic consumption Kazakhstan, 1991-2014

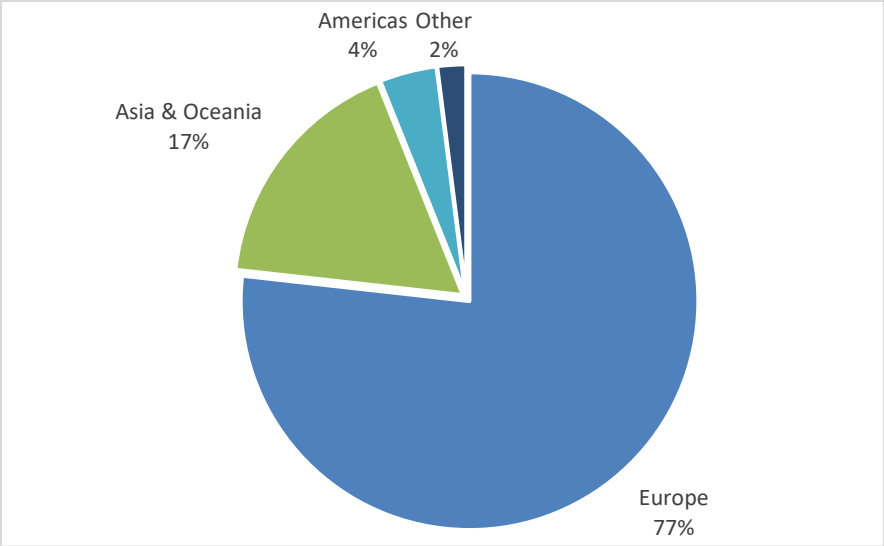
The importance of fuel exports has grown drastically since the beginning of the 1990s. In 1996 fuel exports constituted 25% of the total merchandise exports. In 2013 exports of fuel accounted for 76% of the total (Figure 2.17). Kazakhstan mainly exports light and sweet crude oil (EIA, 2015).



Source: Author's own illustration based on World Bank (n.d.)

Figure 2.17 Fuel exports as a % of merchandise exports in Kazakhstan, 1995-2013

Figure 2.18 shows that the main export destination of oil is the European market, which makes up around 77% of total exports and is followed by Asia (17%), primarily China.



Source: Author's own illustration based on EIA, 2015

Figure 2.18 Crude oil exports by destination, 2013 Kazakhstan

Table 2.9 compares the energy intensity in Kazakhstan with the energy intensity in the EU and the world average. The Kazakh economy is highly energy intensive. The energy intensity of industry is highest among all sectors in the country.

Table 2.9 Energy intensity in Kazakhstan, the world, and the EU (2000, 2005, and 2013)

	2000			2005			2013		
	Kaz	**World**	**EU**	**Kaz**	**World**	**EU**	**Kaz**	**World**	**EU**
Industry	0.23	0.13	0.11	0.19	0.13	0.10	0.19	0.12	0.09
Agriculture	0.082	0.049	0.122	0.057	0.047	0.116	0.053	0.039	0.108
Transport	0.026	0.036	0.025	0.017	0.034	0.024	0.017	0.029	0.021
Services	0.010	0.019	0.017	0.006	0.019	0.017	0.016	0.017	0.016
Primary energy intensity[4]	0.278	0.190	0.141	0.242	0.180	0.134	0.227	0.160	0.115
Final energy intensity[5]	0.175	0.123	0.090	0.137	0.114	0.085	0.126	0.100	0.074

*(koe/$05p, kg of oil equivalent)
Source: Author's own compilation based on Enerdata, 2015

Around 47% of primary energy resources are consumed by the power sector, including generation, transmission, and distribution. The power sector is characterized by low efficiency in generation, high losses, and outdated technology and equipment. Energy consumption in the industry is influenced by energy-intensive industries such as oil and gas, iron and steel, as well as industry and mining. As in most other sectors, these industries are characterized by outdated

[4] Ratio between the total energy consumption of a country and its GDP
[5] Ratio of final energy consumption over GDP

technologies and low efficiency (KAZENERGY Association and Energy Charter Secretariat, 2014).

Table 2.10 reports that almost 16% of energy products are consumed by the residential sector and 8.9% by the commercial sector. Industry is the major consumer of energy products and accounts for almost 60% of the total consumption. Transport accounts for almost 12% and agriculture almost 2% of the total energy consumption.

Table 2.10 Energy consumption by sector in 2013, Kazakhstan

thousand tons of oil equivalent (ktoe)

	Coal	Crude oil	Oil products	Natural gas	Biofuels and waste	Electricity	Heat	Total	Total %
Industry	11,920	3,337	1,776	1,534	0	3,856	2,036	24,459	58.3%
Transport	35	0	4,646	0	0	255	0	4,936	11.7%
Residential	1,273	0	1,555	540	46	918	2362	6,694	15.8%
Commercial	718	0	950	502	0	603	973	3,746	8.9%
Agriculture	159	0	448	21	0	68	89	785	1.8%
Other	625	0	247	0	20	0	604	1,496	3.5%
Total	14,730	3,337	9,622	2,597	66	5,700	6,064	42,116	100%

Source: Author's own compilation based on Committee on Statistics RK, 2014; IEA, 2014

Table 2.11 presents data on energy consumption subsidies[6] in Kazakhstan that are also further used in the simulation scenario. The IEA provides the most comprehensive database on energy subsidies in Kazakhstan. In this scenario, the subsidies data by IEA (2006) and the World Bank (2006) were used in updating the database for tax data.

Table 2.11 Consumption subsidies in Kazakhstan, 2005 (as a % of reference energy price)

	Consumer subsidy
Coal	86
Electricity	24
Oil and petroleum products[7]	30
Gas and gas manufacturing and distribution	33

Source: Author's calculations based on IEA, 2006 and World Bank, 2006

Subsidization of fossil fuel consumption in Kazakhstan, as well as in many other former Soviet Union countries dates back to the Soviet Union times. Among other former Soviet Union countries (FSU) that have high subsidies are Kyrgyzstan, Russia, Uzbekistan, Turkmenistan,

[6] Calculated using the price gap approach (more information in section 3.1.2)

[7] Oil and petroleum subsidy is a weighted average of the consumption of gasoline, diesel, as well as light and heavy fuel oil

and Ukraine (Table 2.12). For example, Uzbekistan has an average subsidization rate of almost 60%, and fossil fuel subsidies account for 14.3% of the total GDP. Turkmenistan has an average subsidization rate of 68.4%, and the total fossil fuel subsidies account for 16.3% of the total GDP (IEA et al. 2015). Data and information on energy subsidies, particularly in developing countries, is limited and largely unavailable.

Table 2.12 Energy subsidy comparison

	Average subsidization rate %	Total subsidy as a share of GDP, %
Uzbekistan	58.8	14.3
Turkmenistan	68.4	16.3
Azerbaijan	23.6	2
Russia	19.6	2.1
Saudi Arabia	78.6	9.5

Source: IEA/OECD, 2015

The total share of subsidies in Kazakhstan as a share of the GDP in 2011 was 3.3%. The average subsidization rate was 32.6%, and the subsidy per person amounted to $359.30 (Table 2.13). Kazakhstan has artificially lower end user prices that are below the full cost of supply and are significantly lower than world market prices (IEA, OPEC et al. 2011). The average subsidization of 32.6% means that consumers in Kazakhstan pay only 67.4% of the full price (Table 2.13).

Table 2.13 Fossil fuel subsidies in Kazakhstan, 2011

Average subsidization rate	32.6%
Subsidy (USD/person)	359.30

Source: IEA, 2012

Table 2.14 shows that subsidies in Kazakhstan are mostly targeted at oil and petroleum products and electricity, and by observing the dynamics since 2007, the total subsidies have been increasing. The estimated differences in subsidies by year can be explained by the volatility of energy prices, changes in domestic policies and exchange rates (IEA et al. 2011).

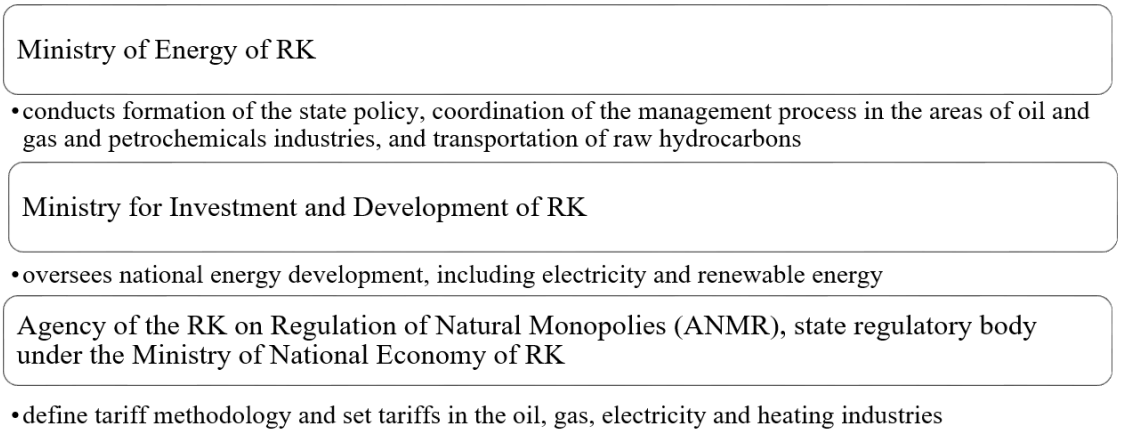
Table 2.14 Subsidy by fuel in Kazakhstan 2007-2011 (in billions of USD)

	2007	2008	2009	2010	2011	2012	2013
Oil and petroleum products	1.29	1.65	0.41	2.03	2.5	1.7	2.1
Electricity	0.29	0.77	0.73	1.69	2.5	2.4	0.7
Natural gas and distribution	0.17	0.29	0.21	0.22	0.9	0.8	0.8
Coal	0	0	0.47	0.38	3.2	2.8	2.4
Total	1.8	2.7	1.8	4.3	9.1	7.7	6

Source: Author's calculations based on IEA, 2013

Consumer subsidies for energy predominate in Kazakhstan. Consumer subsidies result in long-term and short-term economic losses. In the case of Kazakhstan, low prices of crude oil and diesel have motivated producers to export more oil and diesel. This caused diesel shortages several times. These shortages have caused the government to take actions such as importing more from Russia or imposing an export ban on diesel (ENV/EPOC/EAP, OECD 2013).

Figure 2.19 presents the main institutional bodies involved in energy sector regulation, which include several Ministries of the RK. The RK Ministry of Energy is the central executive body responsible for forming state policy and coordinating management processes in the area of energy. Moreover, the RK Ministry of Investment and Development is involved in overseeing national energy development. The RK Agency for the Regulation of Natural Monopolies, which functions under the authority of the Ministry of the National Economy sets tariffs in the oil, gas, electricity, and heating sectors.



Source: Author's own illustration based on national data

Figure 2.19 Relevant institutional structure in Kazakhstan: energy

The Concept of the Transition to a Green Economy adopted on May 30, 2013 by the decree of the President of the RK and strategy "Kazakhstan 2050" pave way towards new economic and social development. Transition to the Green Growth economy is an important factor towards achieving the goal of joining the group of 30 most developed countries in the world. The policy

sets goals for several sectors for the years 2020, 2030, and 2050. The concept includes the following sectors: water, agriculture, energy efficiency, energy generation, air pollution, and waste utilization sectors. Two of the key sectors in the Green Growth concept are the energy sector and energy efficiency.

The main goals and indicators within the concept related to the energy sector are the following:

- Reducing the energy intensity of the GDP from the baseline year 2008 25% by 2020, 30% by 2030, and 50% by 2050.
- The share of renewable energy in total energy generation will not be less than 3% for wind and solar energy by 2020, 30% by 2030, and 50% by 2050 (Decree of the President of the Republic of Kazakhstan, 2013).

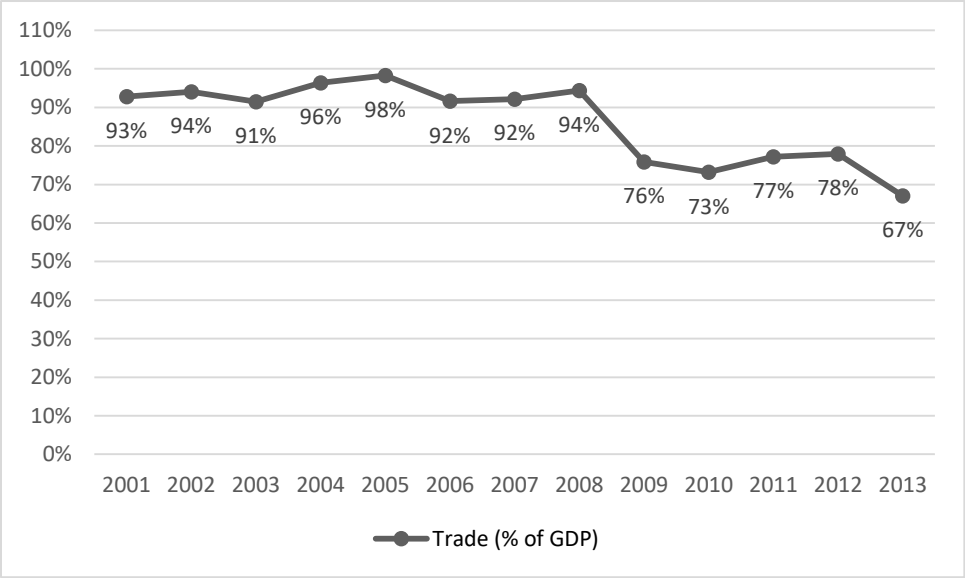
Some of the important legislative documents related to energy efficiency and a reduction of energy intensity are the Law on Energy Saving and Energy Efficiency and the program "Energy Efficiency 2020."

Analyzing the descriptive information presented above shows that the role of agriculture has considerably decreased since 1991. Currently, agricultural exports are concentrated on the exports of wheat. Programs such as *Agricultural Development for 2013-2020* with total investments of $20 billion aim to boost the performance of the agricultural sector in the country and contribute to overall economic diversification.

Kazakhstan has vast natural resources, particularly of energy resources such as oil and natural gas. The production and exports of oil have been the main factor of the impressive economic growth in the country. The economy of the country is vulnerable to the fluctuations of the world oil prices. Kazakhstan has one of the highest energy intensities of the GDP in the world. Energy consumption is highly subsidized through the use of indirect subsidies by keeping domestic user prices lower than the price of the full cost of supply.

2.6 Foreign trade

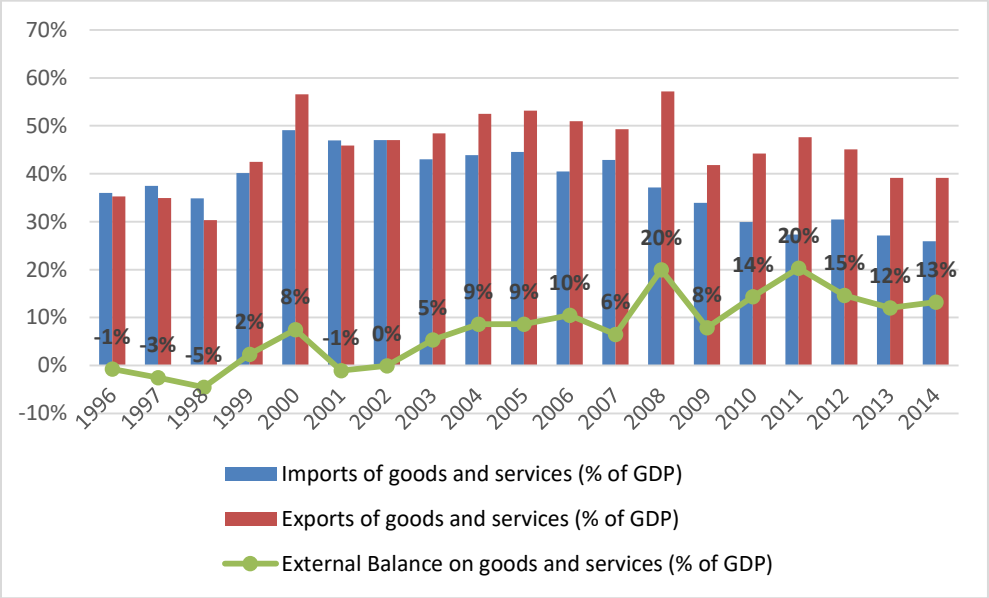
Kazakhstan ranked 44th in world merchandise exports and 56th in world merchandise imports as of 2014 (WTO, 2014). Figure 2.20 depicts trade as a percentage of the GDP in Kazakhstan. In 2013, trade constituted 67% of GDP.



Source: Author's own illustration based on the World Bank n.d.

Figure 2.20 Trade as a % of the GDP, Kazakhstan, 2001-2013

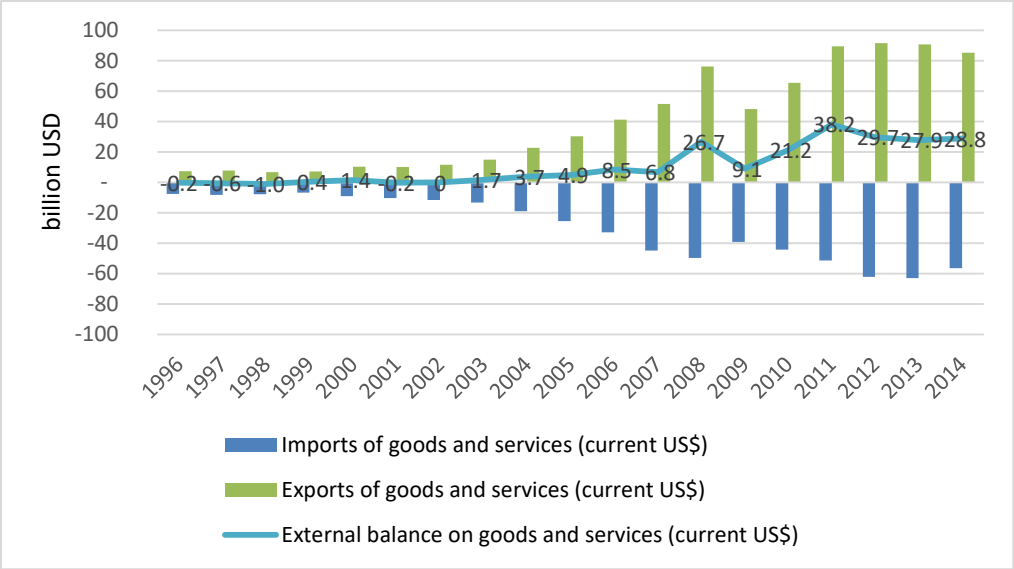
Figure 2.21 and Figure 2.22 depict that Kazakhstan has maintained a positive trade balance since the economic recovery in the beginning of 2000s.



Source: Author's own illustration based on the Committee on Statistics, 2014a

Figure 2.21 Imports, exports, and external balance as a % of the GDP in Kazakhstan, 1996-2014

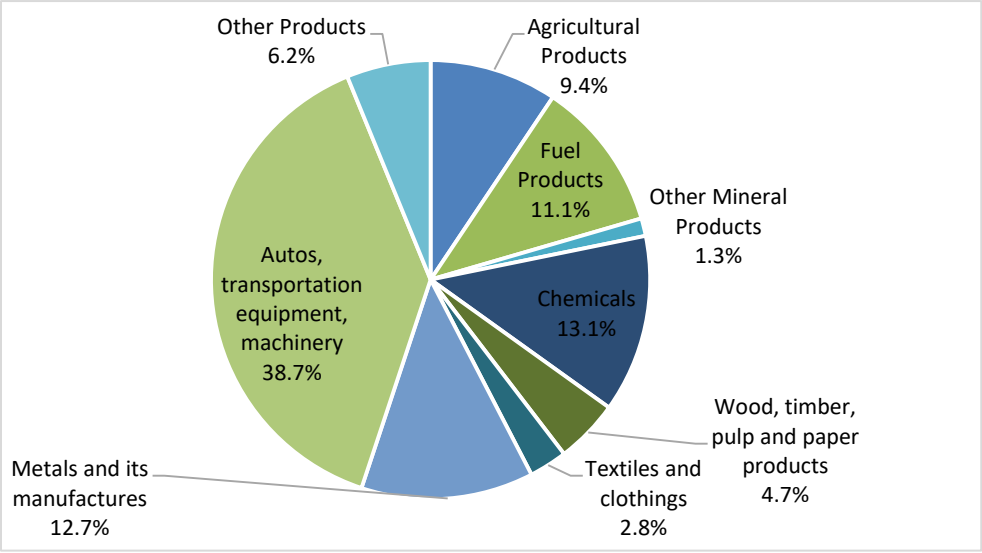
Over the last decade, exports in the country increased sharply. The value of exports increased from around US $7 billion in 1996 to US $85 billion in 2014 (current USD). Kazakhstan imported almost $57 billion in goods and services in 2014. In 2014 Kazakhstan ran a trade surplus in an absolute dollar value of $28.8 billion and relative to its total trade (Figure 2.22).



Source: Author's own illustration based on the World Bank n.d.

Figure 2.22 Trade Kazakhstan (current USD), 1996-2014

Figure 2.23 shows that the top imports of Kazakhstan are automobiles, transportation equipment, machinery (38.7%), metals and its manufactures (12.7%), fuel products (11.1%), and chemicals (13.1%). Agricultural and food products comprise 9.4% of total imports (Committee on Statistics, 2014b).

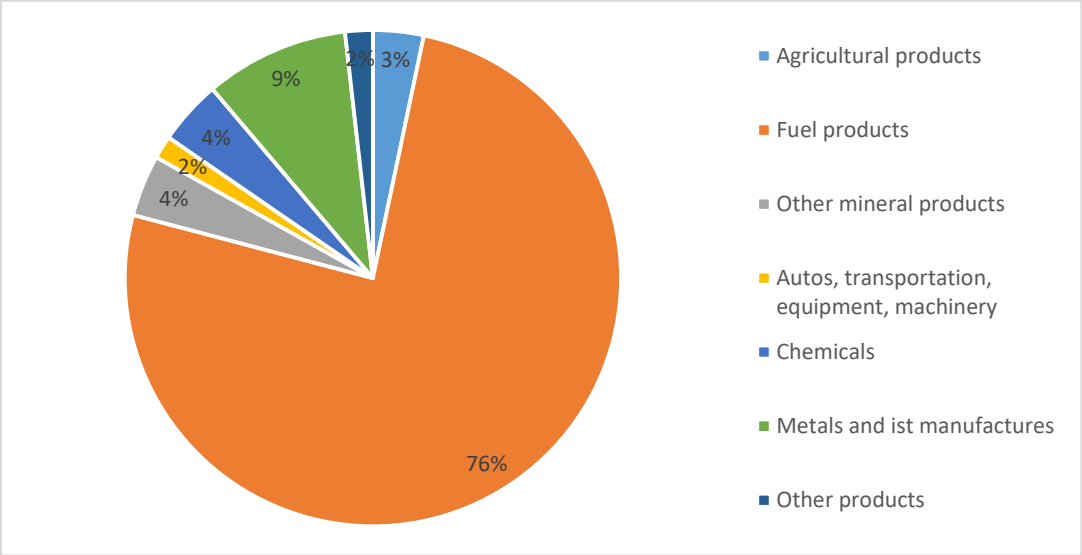


Source: Author's own illustration based on the Committee on Statistics, 2014b

Figure 2.23 Kazakhstan's import structure, 2013

The export structure of Kazakhstan can be explained by its abundance of mineral resources. The fuel sector has been the driving force of the economic growth in Kazakhstan and the sector with the largest FDI flow. Figure 2.24 shows that exports are concentrated in very few products, particularly oil and slightly less gas. Oil and gas exports grew between 2000 and 2010 on average by 23% per year, reaching US $32 billion. Kazakhstan's top exports are fuel products

(75.8%), followed by metals and its manufactures (9.4%). Agricultural products account for 3.3% of total exports. So far Kazakhstan has not been successful in diversifying its export structure (Vashakmadze, 2012).



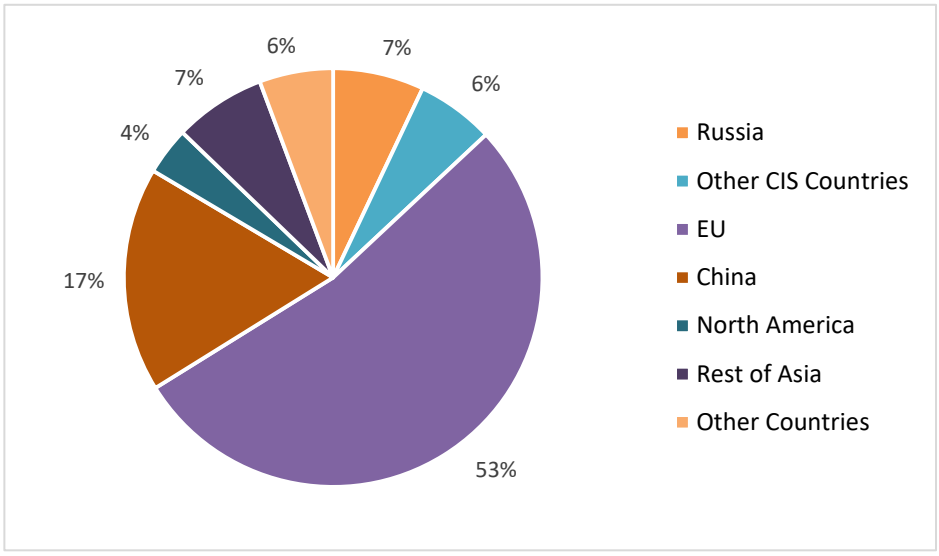
Source: Author's own illustration based on the Committee on Statistics, 2014b

Figure 2.24 Kazakhstan's exports by sector, 2013

Between 2000 and 2010, oil and gas exports grew by 23% per year. Non-resource exports are growing slowly but also increasingly concentrate on just a few products. Almost two thirds of the non-energy and minerals exports of Kazakhstan are concentrated in just five products out of an overall 1,200 products. The five products are refined copper, ferrous alloys, radioactive chemical elements, unwrought zinc, and wheat (Vashakmadze, 2012).

An increasing product concentration on fuel export is currently one of the major challenges of Kazakhstan. The necessity to diversify exports was recognized by the government of Kazakhstan, but policies implemented were unsuccessful so far. The lack of export product diversification is not the only issue in Kazakhstan; limited diversification of trade partners has also been an issue.

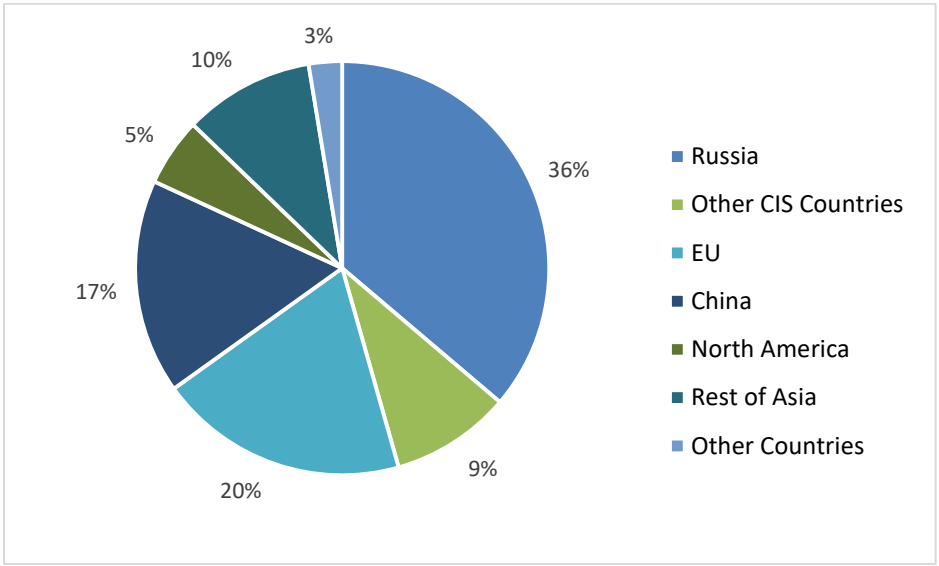
In 2013 Kazakhstan's largest export partners were the US and China (Figure 2.25). Kazakhstan's next largest export partners were Russia (7%) and other CIS countries (6%).



Source: own illustration based on Committee on Statistics, 2014b

Figure 2.25 Kazakhstan's export destinations, 2013

Russia was the top-ranked import source (36%) for Kazakhstan's imports in 2013 (Figure 2.26). The European Union (20%) and China (17%) are the second and third largest import sources for Kazakhstan's imports in 2013. Nine percent of the total imports of Kazakhstan originate from CIS countries.



Source: Author's own illustration based on the Committee on Statistics, 2014b

Figure 2.26 Main import origins, Kazakhstan, 2013

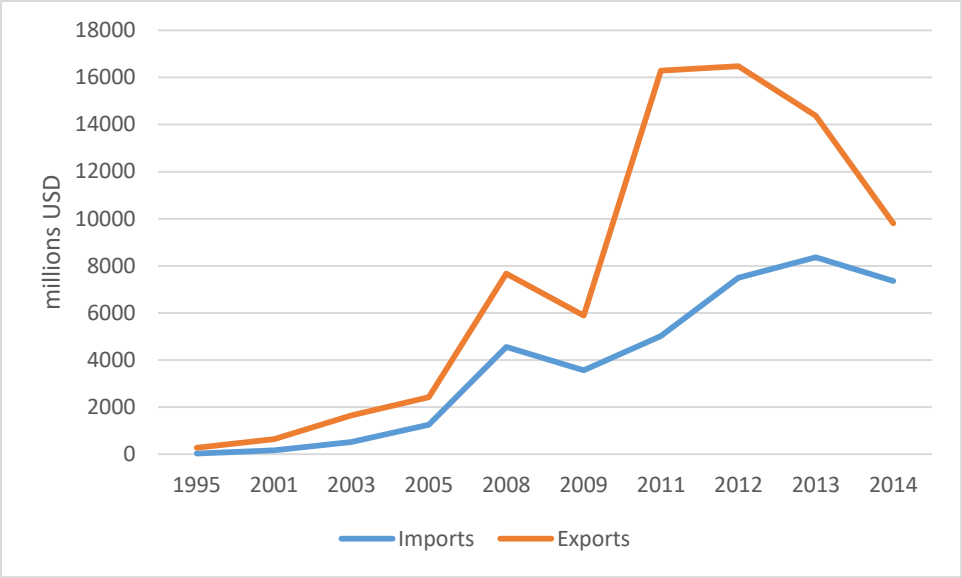
Kazakhstan – China trade

China has been rapidly expanding its role as an economic partner in the Central Asian region. The Shanghai Cooperation Organization (SCO), which includes countries such as China, Kazakhstan, Kyrgyz Republic, Tajikistan, and Uzbekistan, supports trade between Kazakhstan and China. China is an important economic and trade partner for the Central Asian countries, and goods traded between Central Asia and China increasingly diversified in comparison to Kazakh trade with other regions. The importance of the Central Asian region for China has been frequently emphasized by the government of China. Chinese president Xi Jingping in his visit to Astana, Kazakhstan in September 2013 announced a new initiative, the Silk Road Economic Belt (Olcott, 2013).

The development of a Silk Road Economic Belt is carried out under the principles proposed by President Xi Jingping. The five principles are 1) enhance policy communication, 2) improve road connections, 3) promote trade facilitation, 4) increase monetary cooperation, and 5) increase people-to-people relationships. Moreover, the presidents of Kazakhstan and China set a strategic goal to increase the volume of bilateral trade to US $40 billion by 2015 (Kazinform, 2013, Ministry of Foreign Affairs, the People's Republic of China, 2013).

As part of the Silk Road Economic Belt initiative, China plans to invest in upgrading infrastructure networks connecting China with Europe. The infrastructure network will go through Kazakhstan. Moreover, Kazakhstan and China have set up a free trade zone, the International Center of Boundary Cooperation (ICBC) along the Kazakh-Chinese border. Further free trade zones and investment projects along the border of China and Kazakhstan are in discussion (OECD, 2016).

Figure 2.27 indicates that trade between China and Kazakhstan since the beginning of the 1990s has significantly expanded. If in 1995 exports to China constituted only 5.7% of the total exports, in 2008 the share of exports to China increased to 10.8% and in 2013 to 17.4% of the total exports from Kazakhstan. In 1995, imports from China constituted only 0.9% of the total imports to Kazakhstan. Imports from China increased rapidly, and in 2008 12% of the total imports originated from China, which in 2013 grew to 16.8 per cent (Committee on Statistics, 2014a).



Source: Author's own illustration based on UN Comtrade, 2014

Figure 2.27 Trade between Kazakhstan and China 1995-2014

The main exports from Kazakhstan to China are raw materials, and exports and imports of non-oil products have started to increase. Imports from China to Kazakhstan are more diversified (OECD, 2016).

Table 2.15 summarizes bilateral import tariffs between China and Kazakhstan. Higher tariffs in both countries are concentrated in the agro-food sector. It shows that Kazakhstan faced a 24.9% tariff on its exports of grains and crops, 19.3% on vegetables and fruits, 11.6% on meat and livestock, and 11.9% on beverages and tobacco to China. China on the other hand faced the highest tariffs on its exports of beverages and tobacco (29.8%), dairy (13.5%), meat and livestock (13.4%), processed food (13.6%), and vegetables and fruits (16.3%).

Table 2.15 Weighted average import tariffs between China and Kazakhstan

Sector	China-Kazakhstan[a]	Kazakhstan-China[b]
Wheat	0.0	0.0
Grains&Crops	24.9	10.8
Dairy	0.0	13.5
Meat & Livestock	11.6	13.4
Processed Food	8.2	13.6
Beverages & Tobacco	11.9	29.8
Vegetables & Fruits	19.3	16.3
Energy	0.4	4.9
Manufacturing & Chemicals	2.2	6.6

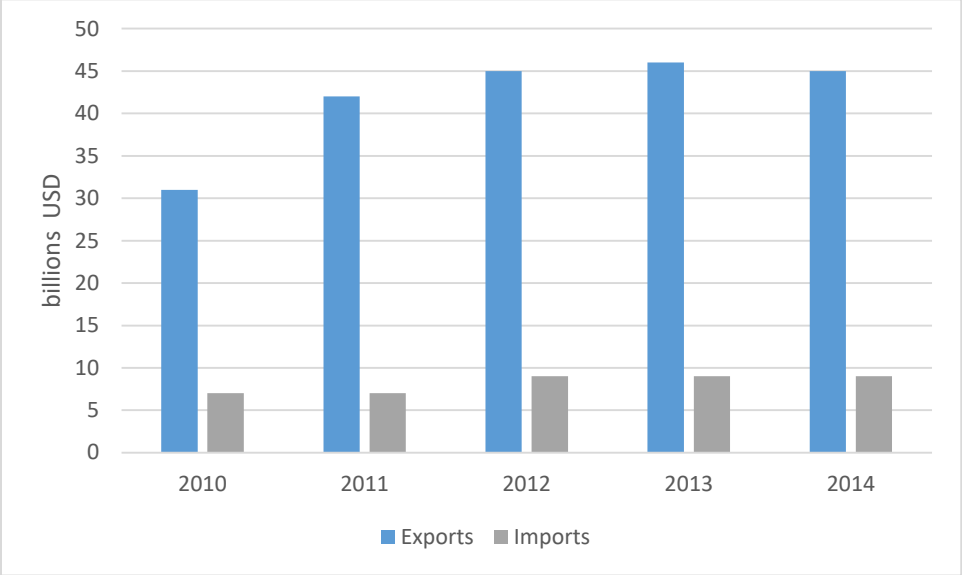
a Weighted average tariffs imposed by China on imports from Kazakhstan

b Weighted average tariffs imposed by Kazakhstan on imports from China

Source: GTAP database 8.1

Kazakhstan–EU trade

EU is the main trade partner of Kazakhstan; a 50% share of all exports goes to the EU. Figure 2.28 depicts that in US dollars, Kazakhstan exports more than it imports from the EU. In 2014 Kazakhstan's exports to the EU accounted for US $44 billion.



Source: Author's own illustration based on the Committee on Statistics, 2014b

Figure 2.28 Kazakhstan-EU bilateral trade (billions of USD)

Table 2.16 shows the structure of Kazakh exports to the EU and imports from the EU to Kazakhstan by sector. The largest share of the country's total exports to the EU are mineral fuels, which makes around 93%. Imports from the EU to Kazakhstan are more diversified. The largest share consists of machinery and equipment and chemical products.

Table 2.16 Kazakhstan-EU bilateral trade by sector, 2013

	Share in total exports (%)	Share in total imports (%)
Food and live animals	0.5	3.2
Beverages and tobacco	0	0.8
Crude materials, inedible, except fuels	0.7	1
Mineral fuels, lubricants and related materials	93.4	1.2
Animal and vegetable oils, fats and waxes	0	0.1
Chemicals and related prod.,n.e.s.	1.5	18.5
Manufactured goods classified chiefly by material	2.5	9.1
Machinery and transport equipment	0.1	51.4
Miscellaneous manufactured articles	0	13.3
Commodities and transactions n.c.e	0.2	0.9
Other	1	0.5
Total	100	100

Source: Author's own compilation based on the European Commission, 2015

Trade and cooperation between Kazakhstan and the EU are governed by a partnership cooperation agreement signed in 1995. This agreement has been in force since 1999. It provides the basis for trade liberalization and further economic cooperation and integration. The agreement lays the groundwork for economic cooperation in several areas (Francois and Machin, 2009).

Kazakhstan-CIS trade

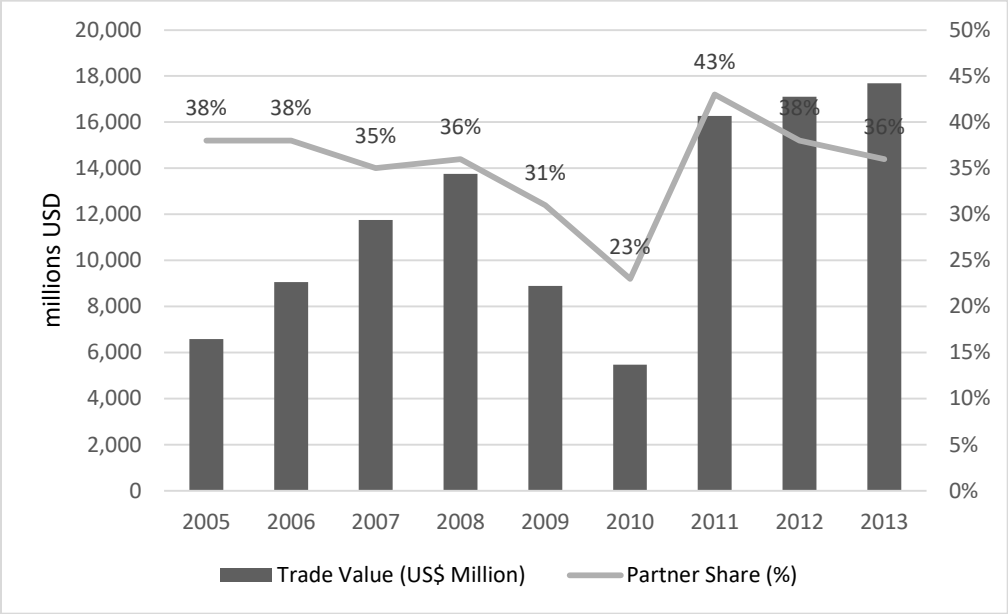
Since independence in 1991, the share of trade with other CIS countries has declined, and the remaining trade with CIS countries can be attributed to the historical ties that existed in the Soviet Union. Total trade with CIS countries, including Russia, makes up around 25% of the total trade, and imports from CIS countries dominate the exports. For Kazakhstan the most important trade partner within the CIS region is Russia. Around 37% of all imports originate from Russia (Table 2.17). In percentage shares, Ukraine is the second largest trade partner (3.2% of total trade) for Kazakhstan in the CIS region. Trade with the Central Asian countries, both imports and exports, so far has been marginal and constitutes a small share in the overall external trade of the country. The largest trade partner in the Central Asian region is Uzbekistan, which makes around 1.6% of total trade.

Table 2.17 Total exports and imports CIS-Kazakhstan, 2013

	Total trade (millions of USD)	**Share in total trade (%)**	**Exports (millions of USD)**	**Share in total exports (%)**	**Imports (millions of USD)**	**Share in total imports (%)**
Kyrgyzstan	1,028	0.8	677	0.8	351	0.7
Tajikistan	569	0.4	497	0.6	73	0.1
Uzbekistan	2,115	1.6	1,145	1.4	970	2.0
Belarus	757	0.6	58	0.1	698	1.4
Russia	23,847	17.9	5,875	6.9	17,972	36.8
Armenia	8	0.0	805	0.0	7	0.0
Azerbaijan	438	0.3	364	0.4	74	0.2
Moldova	83	0.1	45	0.1	38	0.1
Turkmenistan	397	0.3	177	0.2	219	0.4
Ukraine	4,311	3.2	2,041	2.4	2,270	4.7
Total CIS countries	**33,554**	**25.1**	**10,881**	**12.8**	**22,672**	**46.5**

Source: Author's own compilation based on the Committee on Statistics, 2014a

Imports from Russia constituted 36% of the total imports in 2013. The value of imports has increased considerably since 2005, though imports largely due to the financial crisis dropped drastically in 2009-2010 (Figure 2.29).



Source: Author's own illustration based on World Bank, 2014

Figure 2.29 Imports from Russia to Kazakhstan, 2005-2013

The structure of imports from CIS countries consists primarily of mineral products, fuels, metals and metal products, machinery and mechanical appliances, vehicles, instruments and apparatuses, and animal and plant products as well as food products. Kazakhstan's exports to CIS countries include mineral products, fuel, animal and plant products, food products, as well as metals and metal products (Table 2.18).

Table 2.18 Exports and imports Kazakhstan-CIS countries by sector (2013)

Sector Groups	imports from CIS countries	exports to CIS countries
	CIS, %	CIS, %
Total	**100**	**100**
Animal and plant products, prepared foodstuffs	13	17
Mineral products including;	25	46
Fuels	23	29
Products of chemical or allied industries	10	9
Raw hides and skins, leather, furskins	0	0
Wood and articles from wood, pulp of wood, paper and paperboard	3	0
Textiles and textiles products	2	1
Footwear, headgear and clothing items	0	0
Construction materials	2	0
Metals and its products	16	18
Machinery and mechanical appliances, vehicles, instruments and apparatus	24	8
Other goods	4	0

Commodity Nomenclature of the external trade of CU.
Source. Committee on Statistics, 2014b

2.7 Trade policy

Since the breakup of the Soviet Union, most CIS countries including Kazakhstan focused their trade policies towards regional integration in hopes to rebuild economic and trade ties that existed in the Soviet Union. Only a few countries in the CIS region pursued trade initiatives outside of the CIS region.

The numerous agreements signed among the CIS countries resulted in what is often referred to as a 'spaghetti bowl' of trade agreements, and around 31 out of 39 bilateral FTAs are between two countries in the region. Moreover, numerous regional trade agreements (RTA) are concluded solely among CIS countries. The only agreement that was largely considered to be successful in terms of functioning is a customs union (CU) between Belarus, Kazakhstan, and Russia (Cusolito and Hollweg, 2013). Kazakhstan is a signatory of a number of FTAs (Table 2.19). Some are fully implemented; others are only partially implemented or negotiations launched. Free trade, which includes agricultural products, was maintained only with a few countries, including Russia, Azerbaijan, the Kyrgyz Republic, and the Ukraine (OECD, 2013).

Table 2.19 List of FTAs and trade agreements, Kazakhstan

FTA with Kazakhstan	Status
Kazakhstan-Kyrgyz Republic	since 1995
Kazakhstan-Moldova	since 1995
Kazakhstan-Uzbekistan	since 1997
Kazakhstan-Ukraine	since 1998
Kazakhstan-Georgia	since 1999
Kazakhstan-Armenia	since 2001
Kazakhstan-Azerbaijan	signed 1997, not yet in force
Kazakhstan-Mongolia	signed 2007, not yet in force
Kazakhstan-Pakistan	proposed 2003, in consultation
Kazakhstan-Jordan	proposed in 2007, in consultation
Customs union of Russia/Belarus/Kazakhstan-New Zealand	proposed 2010, in consultation
Customs union of Russia/Belarus/Kazakhstan-Vietnam	negotiations launched
Customs union of Russia/Belarus/Kazakhstan-India	negotiations launched
Customs union of Russia/Belarus/Kazakhstan-European Free Trade Association (EFTA)[8]	negotiations launched

Source: Author's compilation

[8] EFTA includes Switzerland, Liechtenstein, Norway, and Iceland

Numerous bilateral trade agreements signed between CIS countries have not achieved significant trade liberalization between these countries. FTA agreements signed include full tariff elimination and elimination of quotas; however, it also includes many exceptions, which can be specified each year, and this includes sectors that account for a substantial part of trade between the countries. Generally, these bilateral FTA agreements had little effectiveness and were characterized by their narrow coverage, complex rules of origin, and incomplete implementation of the agreements (Hindley, 2008).

Table 2.20 lists the regional trade, general agreements, and organizations that Kazakhstan signed or in is in the process of negotiation and membership. The same case as with the FTA most of the agreements are negotiated with the CIS countries and until now most of them have been considered unsuccessful in terms of implementation and coverage. Agreements and organizations include the Commonwealth of Independent States, Shanghai Cooperation Organization, Economic Cooperation Organization, the customs union, Single Economic Space, and the Eurasian Economic Union. The most controversial in public and political debates is the customs union between Belarus, Kazakhstan, and Russia and further integration into the Eurasian Economic Union, which is more comprehensive than the customs union.

Table 2.20 Regional agreements and organizations including Kazakhstan

Regional agreements and organizations	Date	Member states
Commonwealth of Independent States (CIS)	1991	Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyz Republic, Moldova, Russia, Tajikistan, Ukraine, Uzbekistan
Eurasian Economic Community (EurAsEC)	2000	Belarus, Kazakhstan, Kyrgyz Republic, Russia, Tajikistan, Uzbekistan
Economic Cooperation Organization (ECO)	1985	Afghanistan, Azerbaijan, Iran, Kazakhstan, Kyrgyz Republic, Pakistan, Tajikistan, Turkey, Turkmenistan, Uzbekistan
Central Asian Cooperation Organization (CACO)	1994, since 2002 part of EAEC	Kazakhstan, Kyrgyz Republic, Russia, Tajikistan, Uzbekistan
Shanghai Cooperation Organization (SCO)	1996	China, Kazakhstan, Kyrgyz Republic, Russia, Tajikistan, Uzbekistan
Customs Union (CU)	2010	Belarus, Kazakhstan, Russia
Single Economic Space (SES)	2012	Belarus, Kazakhstan, Russia
Eurasian Economic Union	2015	Belarus, Kazakhstan, Russia

Source: Author's compilation based on Hindley, 2008; Ministry of Economy and Budget Planning of Kazakhstan

Commonwealth of Independent States

In December 1991, the presidents of Belarus, Russia, and Ukraine signed an agreement in Belarus to create the Commonwealth of Independent States. The agreement was accepted by other FSU countries in 1991. The agreement set up framework for the future development of the common economic space and cooperation among these countries and established a free trade area. In 1993 member countries agreed to create a program of gradual integration and possibly establish a monetary union. In 1994 an agreement on the creation of free trade was signed, but the common list of exemptions was not agreed upon among the countries. In 1999 the agreement was amended, and exemptions were allowed to be settled bilaterally (Eurasian Economic Commission, 2013).

The CIS agreement was not successful in reviving and expanding trade among the CIS countries. The new CIS FTA was signed on October 18, 2011. The CIS FTA was signed by eight CIS members; Belarus, Ukraine, Russia, Kazakhstan, Armenia, Kyrgyzstan, Moldova and Tajikistan. Uzbekistan joined the CIS FTA in 2013.

Eurasian Economic Community (EurAsEC)

The EurAsEC treaty was signed in 2000, and its members are Belarus, Kazakhstan, the Kyrgyz Republic, Russia, and Tajikistan. Uzbekistan joined in 2006. The goal of EurAsEC is to develop common external economic policies, tariffs, the free movement of goods and services, a harmonized legal base, a common infrastructure, and coordinated tax, monetary, and currency policies. During the Interstate Council meeting in 2006 the presidents of Belarus, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, and Uzbekistan made a decision to establish within the framework of EurAsEC a customs union. The initial members of the customs union were announced and included Belarus, Kazakhstan, and Russia. Additional countries will be able to join the customs union when the necessary economic conditions are met (Eurasian Economic Center, n.d.).

Economic Cooperation Organization (ECO)

ECO was established in 1985 by Iran, Pakistan, and Turkey. The purpose of the organization was to promote economic, technical, and cultural cooperation in the member states. In 1992 Central Asian countries (Kazakhstan, Kyrgyzstan, Uzbekistan, Tajikistan, and Turkmenistan) as well as Afghanistan and Azerbaijan joined the Organization. Projects and activities developed within the organization focus on several areas such as trade and investment, transport and telecommunications, energy, agriculture, and human development. However, due to the low level of financial resources, investments within the member states have remained low (ECO, n.d.).

Shanghai Cooperation Organization (SCO)

The SCO was established in 2001 by China, Kazakhstan, the Kyrgyz Republic, Russia, Tajikistan, and Uzbekistan. India, Iran, Mongolia, and Pakistan are observer nations. SCO is a treaty-based organization. Its main goals are mutual security and border management, promoting cooperation in trade, politics, economy, science, and technology. It was initially structured as an intergovernmental network with annual meetings of the heads of the governments and ministers. Emphasis on economic cooperation has been growing within the organization, which led to the creation of the SCO Inter-Bank Association and the SCO Business Council (Bailes, Dunay, Guang and Troitskiy, 2007).

The SCO free trade zone was initially proposed by the Chinese Prime Minister Wen Jiabao in 2002 at the first meeting of the SCO trade ministers. At the SCO Summit in 2015 Li Keqiang,

Chinese Premier of the State Council proposed specific measures to set up SCO free trade zone (Kazinform, 2013). China stressed that such a free trade zone would be the largest in the world with a regional total population of around 1.5 billion people. Russian analysts pointed out that free trade with China will result in Chinese economic dominance in the Central Asian region, increasing the market share of Chinese products and possible labor migration from China to Central Asia and Russia. Russia on the other hand, considering all the risks of trade liberalization, proposed an intensified energy partnership of the SCO members instead of full trade liberalization (Bailes et al. 2007).

Regional initiatives such as the Silk Road Economic Belt proposed by China and supported by the Eurasian Economic Union have recently become a focus of SCO discussions.

Customs Union and Single Economic Space

In October 2007 a treaty was signed by Belarus, Kazakhstan, and Russia to establish the customs union. The CU included the original three countries with a total population of 170 million people and a territory of more than 20 mil. sq. km.

In July 2010 a common customs code, customs rules and a common external tariff was implemented in the member countries. Within the agreement, a CU commission was established, which is responsible for the functioning and development of the CU at the supranational level.

In July, 2011 the next step of customs union development took place: the customs checks at the internal borders between Belarus, Kazakhstan, and Russia were removed. With this step, the unified customs area was established, and customs control and clearance were placed at the external borders of the CU (Eurasian Economic Commission, 2013).

In January 2012 CU country members signed an agreement towards the creation of the Single Economic Space (SES), which will integrate the countries and economies even further. SES has a goal of achieving free movement of goods, services, capital, and labor. Within the SES, 17 agreements were signed in 2012: “Agreement on Unified Principles and Rules of Competition,” “Agreement on Unified Rules for State Support to Agriculture,” “Agreement on Unified Rules for Granting Industrial Subsidies,” “Agreement on Coordinated Macroeconomic Policy,” “Agreement on Free Flow of Capital on Financial Markets,” etc. (Eurasian Economic Commission, 2013).

The Eurasian Economic Commission was established in 2012, which took over the responsibilities of the CU Commission. It became a main regulatory body of the CU and the SES. The activities of the Eurasian Economic Commission include the following areas: tariffs and non-tariff customs regulation, customs administration, technical regulation, sanitary, phyto-sanitary, and veterinary measures, establishing trade regimes in respect of third countries, macroeconomic competition and energy policies, industrial and agricultural policy, natural monopolies, state and municipal purchases, international trade in services and investment, transport, currency policy, protection of intellectual property, migration policy, and others (Eurasian Economic Commission, 2013).

Eurasian Economic Union (EEU)

On May 29, 2014 Belarus, Kazakhstan, and Russia signed a treaty to create the Eurasian Economic Union. The official launch of the EEU was in January 1, 2015. The treaty lays the groundwork for the creation of common market for services, labor, goods, and capital. The free movement of goods was already implemented in the customs union agreement. The common market for services, labor, and capital was planned under the auspices of the Single Economic Space. The Eurasian Economic Union intends to combine all these goals together and include further integration. The three countries plan to coordinate their economic policies together, create a unified market for gas and oil, and unify financial markets by 2025. Moreover, a common system of agricultural subsidies is planned by 2016 and a common electricity market by 2019. On January 2, 2015 Armenia became fourth member of the EEU when the Treaty on Armenia's accession to the Eurasian Economic Union came into force (Eurasian Economic Commission, 2015a). On August 12, 2015 Kyrgyzstan became a fully pledged member of the EEU after the Treaty on the Accession of Kyrgyzstan to the Treaty on the Eurasian Economic Union came into force (Eurasian Economic Commission, 2015b).

The president of the RK Nursultan Nazarbayev had emphasized numerous times that the creation of the EEU follows solely an economic and not political agenda. The creation of the EEU would help Kazakhstan achieve the following goals: gaining access to the EEU market of around 170 million people, activating cross-border trade with Russia, enabling access by Kazakh companies to Russian and Belarussian government contracts, developing regional and global logistics and transportation routes, and forming a single financial market by 2025 (Hett and Szkola, 2015).

Within the EEU several initiatives on free trade agreements are under discussion. Officially, the EEU is negotiating free trade agreement with Vietnam. In November, 2013 Turkish President Recep Tayyip Erdogan announced that Turkey wants to join customs union with Russia (Hett et al. 2015).

The EEU is interested in building partnerships with Asia and the Pacific. On May 8, 2015, a joint statement was issued about the integration of the EEU and the Silk Road Economic Belt. The SCO serves as a platform for further dialogue on the initiative. The May declaration mentioned that the long-term goal is advancing towards a free trade zone between the EEU and China (Gabuev, 2015).

WTO Accession

In 1996 the Working Party for Kazakhstan's Accession into the WTO was established. Bilateral market access negotiations started in October 1997. Several other CIS countries are already members of the WTO: Armenia since 2003, Kyrgyzstan since 1998, Georgia since 2000, Moldova since 2001, Ukraine since 2008, Russia since 2012, and Tajikistan since 2013.

The talks have been continuing since then, and in the recent negotiating meetings from 2010-2015, the following issues were brought up that still hindered Kazakh accession into the WTO. Kazakhstan's membership in the CU/EEU and consequent implementation of the external tariff of the CU was identified as a major obstacle of the country's accession into the WTO. Other factors identified that hinder accession are issues of state-owned companies, tariff rate quota volumes, export duties, discriminatory VAT preferences, technical regulations, and trade-related investment measures (WTO, 2013).

WTO membership would bring Kazakhstan many long-term benefits, including greater and more secure new markets for Kazakh products, and it will increase the attractivity of Kazakhstan for foreign investors. Openness to imports, especially services, will boost Kazakh economic competitiveness (Heal and Mladenovic, 2014).

So far Kazakhstan has failed to diversify its trade partners and export structure enough. The recent developments in the trade policy in Kazakhstan demonstrate that the country is pursuing deeper regional integration with other CIS countries, specifically with Belarus, Russia, and the Central Asian countries. Largely for historical and political reasons, regional trade integration has prevailed. Despite 20 years of trade policy initiatives, no RTAs exist between Eurasian countries (all CIS countries) and the EU or any country of the East Asia and the Pacific region.

There is a strong preference for regional integration in the Eurasian region in order to establish trade and economic links that existed during the Soviet Union (World Bank, 2013; Cusolito et al. 2013).

Numerous bilateral and multilateral agreements in the CIS are often referred to as a 'spaghetti bowl'. Most of the bilateral trade agreements were not ratified and therefore did not enter into force. At the same time, bilateral agreements that entered into force were ineffective due to the narrow coverage, complex rules of origin, and incomplete implementation. In many cases, goods that are subject to exemptions make up the major part of bilateral trade between the parties of the trade agreement; moreover, the rules of origin are complicated, and for many importers, claiming preferential tariffs provided within the agreement is not worth it. One of the main reasons why these bilateral and multilateral RTAs do not function is that effective enforcement and dispute settlement measures are not present or implemented (ADB, 2006).

Tariff structure in Kazakhstan

Before joining the customs union, Kazakhstan had one of the most liberal trade regimes among the CIS countries. After joining it, Kazakhstan had to increase most of its tariffs in order to adjust them to the CU common external tariff (CET). The CET was largely adjusted to Russia's import tariffs.

The CU CET and Kazakhstan's tariff structure have adjusted; as Russia entered the WTO in 2012 the CET was lowered in over 1,100 tariff lines. Moreover, further regional integration such as the aforementioned Eurasian Economic Union are affecting the trade structure in Kazakhstan. Kazakhstan's accession into the WTO will further lead to tariff reductions (Sarsenov and Dorsati, 2013).

Table 2.21 compares the simple average and weighted average tariffs in Kazakhstan before and after joining the CU with Belarus and Russia. Both simple and weighted average tariffs increased in 2010 and slightly decreased in 2011.

Table 2.21 Simple and weighted average tariffs, Kazakhstan 2008-2012, %

	2008	2010	2011	2012
Simple average	4.48	7.56	7.43	7.51
Trade weighted average	2.22	4.4	3.2	3.75

Source: Author's own calculations based on the World Bank, 2014

Kazakhstan effectively adapted Russia's tariff profile, and import tariffs overall increased due to the CU; at the same time import tariff rates of Belarus and Russia only slightly changed.

Estimations of the increase in import tariffs in Kazakhstan due to the implementation of the CET vary depending on the methodology, aggregation level, and nomenclature used. Table 2.20 compares simple and weighted average tariffs by sector in Kazakhstan in 2008, 2010, and 2012. Table 2.22 presents data based on the GTAP database aggregation level and is calculated based on the GTAP nomenclature. The data presented below is further considered and applied in the methodology and simulation analysis. For most of the sectors presented, both simple and weighted average tariffs increased. The sectors that decreased simple and weighted average tariffs include vegetable and fruits as well as grains and crops.

Table 2.22 Simple and weighted average tariffs by sector in Kazakhstan, %

	Year	Simple average	Weighted average		Year	Simple average	Weighted average
Beverages and tobacco	2008	6.38	2.06	**Processed food**	2008	9.36	2.37
	2010	9.39	4.38		2010	10.21	3.69
	2012	8.28	2.8		2012	9.67	2.99
Dairy	2008	9.85	0.95	**Vegetable and fruits**	2008	5.48	4.66
	2010	10.23	2.44		2010	5.62	3.11
	2012	10.34	3.15		2012	5.47	1.8
Grains and crops	2008	4.38	2.12	**Livestock and meat products**	2008	8.09	8.81
	2010	4.44	2.71		2010	13.26	22.47
	2012	3.89	2.5		2012	12.18	15.02
Wheat and meslin	2008	0	0	**Chemicals light heavy manufacturing, textiles**	2008	4.13	2.39
	2010	3.75	0.48		2010	7.36	4.73
					2012	7.35	3.98
Energy	2008	3.69	0.24				
	2010	3.68	0.39				
	2012	3.31	0.26				

Source: Author's calculations based on the World Bank, 2014

Isakova, Koczan, and Plekhanov (2013) present empirical results of the changes in imports due to the tariff changes after implementing the CU CET. The authors found that on average the tariff rates in Russia and Belarus decreased. Kazakhstan was the country most affected by the CET; on average Kazakhstan's tariffs increased. Kazakhstan had the lowest effective tariff rates before the CU of all three countries.

Jandosov and Sabyrova (2011a) calculated the indicative tariff protection level in Kazakhstan before and after joining the CU. The authors used a 10-digit product level dataset to compute *ad valorem* equivalent tariff rates. Their results showed that around 47% of tariffs increased, 49% of tariffs did not change, and around 5% of tariffs on products decreased. The authors indicated that prior to the CU, Kazakhstan's tariffs were not high by international standards:

6.78% as a simple average and 5.52% as a trade-weighted average. The highest tariffs were for consumer products such as tobacco, food, and beverages, textiles, and footwear. Intermediate inputs and capital equipment however had lower *ad valorem* equivalent (AVE) rates. Comparing tariff rates before and after the CU, the authors indicated that the simple average AVE tariff rate increased from 6.78% to 12.31%, and the trade-weighted average went from 5.52% to 12.66%. The sectors with the highest protection remained the same as before the CU: motor vehicles (66%), furniture (32%), tobacco (28%), food and beverages (26%), and apparel (19%). Intermediate inputs and capital equipment remained on the lower range of the protection rate. The authors found that the largest increase in weighted average AVE tariff rates was in sectors such as automobiles, furniture, apparel, wood products, basic metals, etc.

Jandosov and Sabyrova (2011b) estimated applied tariff protection levels in Kazakhstan before and after the CU. In the first part of the analysis, indicative tariff protection levels were estimated. In this analysis several factors were included: preferential tariff regime for the CIS countries, preferential treatment of certain goods from developing and least developed countries, and transitional tariffs that were negotiated for Kazakhstan within the CU for 2010-2014. The calculations were based on the 10-digit product level of the "Product Nomenclature of Foreign Economic Activity of the Customs Union." The results of the calculation show that the tariff protection level as a result of the CU increased significantly. The simple mean AVE tariff increased from 6.45% to 12.10%, and the weighted mean AVE tariff rate increased from 4.30% to 12.67%.

Non-trade tariff measures (NTM)

As in many other CIS countries, NTMs are widespread and cumbersome in Kazakhstan. Cumbersome regulatory and procedural measures slow down the development of trade and undermine the ability of companies to develop internationally. Data on NTMs in Kazakhstan is scarce and difficult to obtain. Prior to the CU, Kazakhstan was considered an open economy with low tariff levels and planned to harmonize NTMs with the EU.

Since independence Kazakhstan took steps to reduce technical and regulatory barriers to trade. Prior to the CU Kazakhstan had initiated many steps to harmonize NTMs with those of the EU. After joining the CU Kazakhstan's regulations and standards were adjusted to match Russia's, which resulted in increased protectionism. The SPS and TBT standards, which are related to and influenced by the Soviet GOST standards, especially became more stringent. These

standards are known to hinder innovation and implementation of new products and processes (Heal and Mladenovic 2014).

A joint study by the ITC/UNECE (2014) conducted an in-depth analysis of the NTMs in Kazakhstan using a survey method. The following measures towards improving NTMs were identified:

- Improve transportation infrastructure.
- Provide more logistical services to traders.
- Reduce the number of document requirements.
- Provide better border controls.
- Develop a system of standardization, technical regulations, and quality control (ITC and UNECE, 2014).

According to the Doing Business Survey developed and published yearly by the World Bank Group, Kazakhstan ranked 186th out of 189 countries in 2014 in the category trading across borders[9]. Other Central Asian countries such as Tajikistan and Uzbekistan have ranked poorly as well: 188th and 189th, respectively (Doing Business, 2013).

Table 2.23 compares indicators of the non-tariff measures related to export and import procedures in Kazakhstan and in OECD countries. Indicators demonstrate that export and import procedures in Kazakhstan are costly and time consuming and require a large number of documents.

Table 2.23 Export and import procedures, Kazakhstan 2014

Indicator	Kazakhstan	OECD
Documents to export (number)	10	4
Time to export (days)	81	11
Cost to export (USD per container)	4,885	1,070
Documents to import (number)	12	4
Time to import (days)	69	10
Cost to import (USD per container)	4,865	1,090

Source: Author's own compilation based on Doing Business, 2013

[9] Trading across borders measures the time and costs, though excluding tariffs, to import and export a standardized cargo of goods by sea transport. Rankings are based on three indicators that have the same weight in calculation of rankings; documents required to export or import, time required to export or import (includes obtaining all documents, inland transport and handling, customs clearance, inspections, technical control, etc.), and costs required to import or export (all fees that are necessary to export or import a good, excluding bribes and tariffs).

The ranking can be partly explained by the high costs of importing, the land-locked geographical position of the country, and the long distance to the world markets such as the EU, which is an important export market for Kazakhstan. Another reason for the poor score is a weak institutional basis, which is seen by the number of documents necessary to import or export goods (World Bank, 2012a).

Table 2.24 presents detailed export and import procedures, the duration in days, and costs in the country. The most cumbersome export and import procedures in terms of duration are document preparation, which takes 21 days, and inland transportation and handling (46 days to export and 35 days to import).

Table 2.24 Export and import procedures in Kazakhstan, 2014

	Nature of export procedures		**Nature of import procedures**	
Export/import procedures	Duration (days)	Cost (USD)	Duration (days)	Cost (USD)
Document preparation	21	330	21	310
Customs clearance and technical control	9	425	9	425
Port and terminal handling	5	330	4	330
Inland transportation and handling	46	3,800	35	3,800
Total	81	4,885	69	4,865

Source: Author's own compilation based on Doing Business, 2013

The Index of Economic Freedom, which includes trade freedom, is published yearly by the Heritage Foundation. Trade freedom is an aggregate measure of the absence of tariffs and non-tariff measures of export and import of goods and services. The trade freedom score consists of two parts: trade-weighted average tariff and NTMs. In the case of Kazakhstan the average tariff considered is 3.4 percent. In 2014 Kazakhstan scored 78.2 and ranked 81st out of a total of 186 countries (Table 2.25) (Heritage Foundation, 2014).

Table 2.25 Index of Economic Freedom: trade freedom indicator, Kazakhstan, 1998-2014

	1998	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Score	61	61	67	65	65	65	65	65	69.2
Ranking	82	88	68	81	83	86	86	95	80
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	
Score	69.2	86.2	86.2	85.9	80.9	79.6	78.2	78.2	
Ranking	101	11	16	41	74	77	80	81	

Source: Author's own compilation based on the Heritage Foundation, 2014

In the Global Enabling Trade Index, developed and published by the World Economic Forum, Kazakhstan ranks 94th out of a total of 138 countries. The index is calculated using four indicators: market access, border administration, infrastructure, and operating environment. Analyzing the scores by each index, the worst rank was for the border administration (rank 127th out of 138) and market access (rank 108th out of 138). Moreover, a survey that was conducted among the business executives in the country revealed the eight most problematic factors for importing into Kazakhstan. The top three factors listed by the score weighted from highest to lowest are corruption at the border, burdensome import procedures, and tariffs (World Economic Forum, 2014).

Looking at the various international indicators and rankings for Kazakhstan, it is evident that Kazakhstan and other Central Asian countries face major obstacles towards a more open trade regime. NTMs are one of the major obstacles to the expansion of trade in Kazakhstan. Moreover, a lack of transport infrastructure and limited transport routes to world markets hinder trade expansion.

This chapter covered a sector description and presented the current trade structure and trade policy in Kazakhstan. Kazakhstan is largely dependent on the production and export of oil. The role of agriculture has drastically decreased, and exports of agricultural products are focused primarily on wheat.

The trade policy after independence has largely focused on maintaining trade ties with other FSU countries. Numerous trade and cooperation agreements within the CIS region have been signed but were left only partially implemented and enforced and were characterized by overlapping memberships and narrow coverage. The customs union was established by Belarus, Kazakhstan, and Russia in 2010, and the EEU in 2015 which was joined by two more members: Kyrgyzstan and Armenia. As of 2016, Kazakhstan has not initiated any RTAs or FTAs with the EU or East Asia and the Pacific.

3 Theoretical and Methodological Background

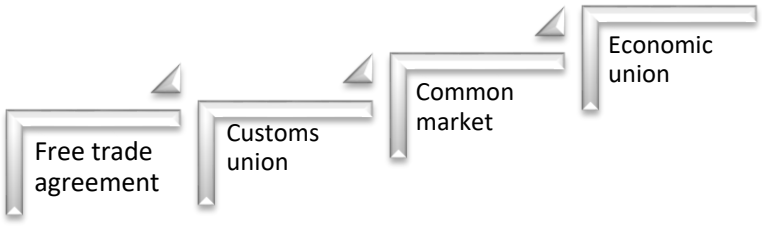
3.1 Theoretical analysis

The purpose of this chapter is to provide an overview of the theoretical basis of the research. First, general trade theory relevant to this dissertation is discussed. Various forms of trade integration and economic effects of trade agreements and trade liberalization are described. Furthermore, the main theoretical basis for the discussion of energy subsidies is briefly presented. Finally, an overview of modeling methods with a specific emphasis on CGE modeling is discussed. The main components of the CGE model are presented. Types of CGE models including single country, multiregional, dynamic, and static models are briefly discussed. Every economic method has its limitations; several limitations of the CGE approach are listed as well. The main CGE model, the GTAP model, is presented in detail. This includes an overview of the main actors and accounting relationships, behavioral parameters, closures, and the main output of the model simulations.

3.1.1 Trade policy

Various forms of trade agreements including bilateral, regional and multilateral agreements and trade policy have been discussed and studied extensively. Empirical studies show that trade liberalization enhances welfare and leads to increased trade (Robinson and Thierfelder, 2002).

Preferential trade agreement (PTA) is a general term that describes economic integration between countries, where two or more member countries form a union with tariffs lower for the goods produced in the union countries than outside (Krueger 1999, Panagariya 2000). Figure 3.1 illustrates several stages of economic integration and forms of PTAs categorized into several groups: free trade agreements, customs union, common markets, and economic union.



Source: Author's own illustration

Figure 3.1 Stages of economic integration

Free trade agreement (FTA) is a preferential trading arrangement where tariffs are lowered relative to other members, but maintained against the non-members of an arrangement. A customs union is a preferential arrangement in which all tariffs between members are eliminated, and a common external tariff is established. A common market is a customs union plus free movement of factors of production such as labor and capital between member countries. An economic union is a customs union plus adoption of common economic laws. The main difference between an FTA and a CU is the trade barriers imposed on countries that are not in the agreement.

Andriamananjara (2011) emphasizes that there are political and economic motives behind establishing a CU. Countries can consider establishing one as a step towards further integration into a political union. In the case of economics, countries can be driven by reasons such as pooling market power and coordinating trade policies. The key element that distinguishes a CU from an FTA is a CET. In the case of a CU, member countries adjust their tariff structure towards non-member countries. Defining a CET rate can lead to either a more liberal trade regime or to higher protectionism, which in effect determines the economic effects of a CU. If a member country has a higher CET than its previous tariff regime, it can result in decreased welfare in the member country. The higher CET usually occurs when a more developed country, or an economically larger country, wants to protect its industry, and a less developed / economically smaller country has to adopt the higher tariff regime of the economically larger country. In this case a less developed country will either have to pay for more expensive imports from CU non-member countries or switch to the less efficient supplier within the CU. If a CET leads to a more liberal trade regime for a country, the trade diversion effects can be decreased. The decreased import tariffs lead to increased imports from CU non-member countries, and switching imports from CU member countries will be less attractive, and will thus reduce trade-diverting effects.

WTO (2011) emphasizes several economic and political reasons for establishing a PTA, which are listed below:

- Avoiding “beggar-thy-neighbor effects”
- Gaining credibility
- Increasing market size
- Increasing policy predictability
- Signaling openness to investments

- Ensuring deeper commitments
- Political reasons

There are two essential questions concerning the effects of PTAs:

1) The effect of a PTA on welfare, trade, production, and consumption of PTA members and the rest of the world

2) The effect of a PTA on the open multilateral trading system and whether it delays or advances multilateral trade liberalization (Krueger 1999, Robinson et al. 2002).

The two questions are connected: one is concerned with static welfare effects and the other with dynamic welfare effects of the trade agreement. Even if a PTA offers short-term gains, it could still result in a long-term decrease in welfare when country members rebalance their focus from multilateralism towards regionalism. However, if forming a PTA is a step towards multilateral liberalization, the short-term losses due to the PTA might be compensated by long-term gains.

With regards to the two questions discussed above, two opposing views on PTAs and multilateral liberalization can be identified: PTAs as a building block for multilateral liberalization and PTAs as an obstacle towards multilateral trading system. Not all PTAs are beneficial to its members; there are real examples of where PTAs were both beneficial and detrimental. The EU is one example where PTAs and multilateral liberalization together succeeded. Chauffour and Maur (2011) identify three issues concerning PTAs: trade diversion effects, the impact on third parties, and systemic effects. Trade diversion effects have been discussed previously. The impact on third parties concerns the discriminatory effects on countries excluded from the agreement. This could be, for example, when countries decide to adopt European standards instead of international ones. The systemic effects concern the question of whether PTAs are building blocks or stumbling blocks towards multilateral liberalization. The answer to this issue is not clear since there are economists who argue that PTAs are stumbling blocks towards liberalization, and there are those that argue that a PTA is a component of liberalization.

Viner (1950) described the uncertainty of the effects of the CU by using static partial equilibrium concepts of trade creation and trade diversion. The trade creation concept was explained thus: an increase in trade volume is shifted from a higher to lower cost producer, which increases welfare for the members of the union. Trade diversion can be defined as trade volume increasing when lower cost producing is shifted from outside the union to the higher

cost production within the union, which decreases welfare for the union members. The net balance between trade creation and trade diversion effects determines whether the agreement enhances or deteriorates welfare.

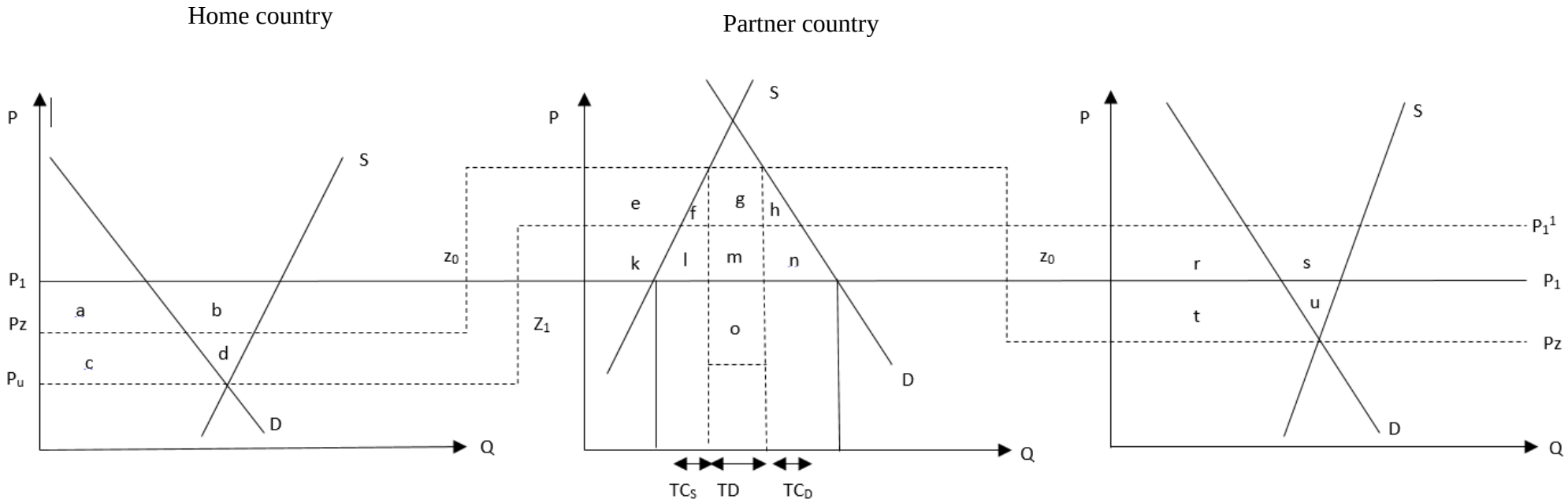
If a CU member country imports more from a lower cost-producing CU member, trade creation effects predominate and further increase consumption and production efficiency. Consumers within a CU can buy goods at lower prices. Moreover, this enhances production specialization in the region. Trade diversion in turn reduces global production efficiency and distorts optimal trade flows (Koo and Kennedy, 2005).

Through the establishment of a CU two effects as already mentioned can be observed: trade creation and trade diversion. Figure 3.2 illustrates the different effects an introduction of import tariffs and the creation of a customs union including implementation of a CET can have on the third country, home, and partner country.

The first level depicts the impact of import tariff implementation in comparison to free trade. After implementation of import tariffs, prices rise to the level indicated by P_z. Imports into the home country decrease in comparison to free trade. Implementing import tariffs results in a total negative surplus in third countries, the partner country, and at home. Consumers are worse off after the introduction of import tariffs; the welfare for consumers in the home country, as measured by the consumer surplus, is indicated by the area *-e-f-g-h-k-l-m-n*. Welfare for producers in the home country measured by the producer surplus is positive indicated by area *+e+k*. Third and partner countries both have negative total surpluses.

Level two illustrates customs union creation of home and partner countries in comparison to import tariffs. Implementation of a customs union between home and partner countries with P_1^1 and P_u price levels represents a CET towards the third country. Exports of a third country to the home country decrease, and exports of partner countries increase as a result of CU, which is a trade diversion effect. Partner countries export more with a higher price, while third countries export less with lower export prices. The creation of a CU results in a consumer surplus for the home country depicted by an area marked as *+e+f+g+h*, a loss in producer surplus indicated by area *-e*, and losses in government revenues by an area *-g-m-o*. A producer surplus in the partner country improves by an area indicated by *+t+r+s+u*, and overall welfare improves by an area indicated by *+s+u*. Losses in producer surplus in the third country are indicated by an area *-c-d*, and total surplus loss in the third country is indicated by an area *-d*.

Level 3 compares a CU to the import tariff scenario. Losses in total surplus in third and home countries are observed. Area *-b-d* indicates losses in total surplus in the third country, and area *= -f-l-h-n+o* indicates losses in total surplus in the home country. The partner country has gains in total surplus indicated by an area *+s*.



Source: Author's own illustration based on Rübel, 2013

Figure 3.2 Trade effects

1. Level: Import tariffs in comparison to free trade

Consumer surplus = +a	Consumer surplus = -e-f-g-h-k-l-m-n	Consumer surplus = +t
Producer surplus = -a-b	Producer surplus = +e+k	Producer surplus = -t-u
Government revenue = 0	Government revenues = +g+m+o	Government revenue = 0
Total surplus = -b	Total surplus = -f-l-h-n+o	Total surplus = -u

2. Level: customs union (z_1) in comparison to import tariff

Consumer surplus = +c	Consumer surplus = +e+f+g+h	Consumer surplus = -t-r
Producer surplus = -c -d	Producer surplus = -e	Producer surplus = +t+r+s+u
Government revenue = 0	Government revenue = -g-m-o	Government revenue = 0
Total surplus = -d	Total surplus = +f +h -m -o	Total surplus = +s + u
Loss from trade diversion (TD)	Gains from trade creation (TC) / Loss from trade diversion (TD)	Gains from trade creation (TC)

3. Level customs union in comparison to free trade

Total surplus = -b - d	Total surplus = -l -m -n	Total surplus = +s

3.1.2 Energy subsidies

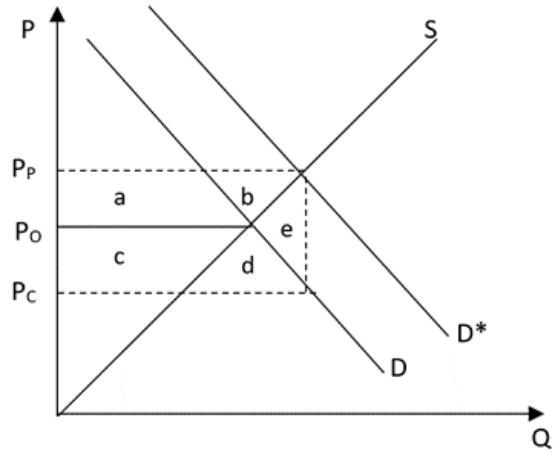
There is a vast amount of literature on the issue of subsidies in the energy and fossil fuel markets. International organizations such as the IEA, IMF, OECD, and the World Bank advocate for worldwide reform of fossil fuel subsidies. Energy subsidies are defined as *"any government action that lowers the cost of production, raises the revenue of energy producers, or lowers the price paid by energy consumers"* (IEA, OECD, World Bank, 2010:5).

There are generally two types of subsidies: consumer and producer subsidies. Consumer subsidies occur, including firm use of energy subsidies as an intermediate input and households, when domestic prices are below benchmark prices. Consumer subsidies are usually meant to keep energy prices low, protect and stimulate certain sectors of the economy, and protect poorer households. Such subsidies usually take the form of large price gaps, predominate in non-OECD, Eastern European, and countries of the former Soviet Union. Producer subsidies occur when prices received by suppliers are above benchmark prices. Such subsidies predominate in developed countries more than in developing countries. Subsidies take various forms of support measures including direct financial transfers to consumers or producers, tax exemptions and rebates, trade restrictions, price control, and market access limits (Burniaux et al. 2011, Ellis, 2010, IMF, 2013).

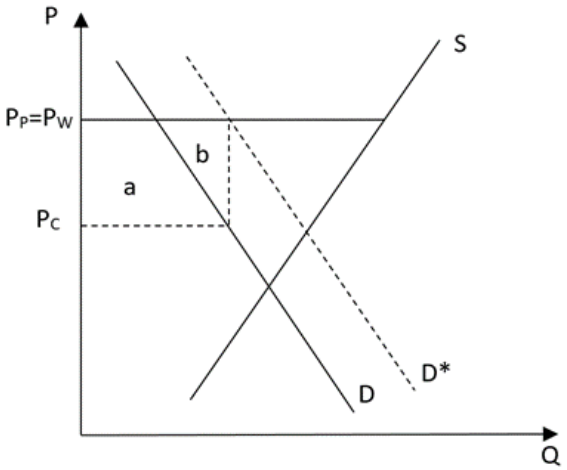
There are various implications of fossil fuel subsidies on the economy, environment, and society. Subsidies according to the joint report of the IEA, OECD, and the World Bank (2010) *"encourage wasteful consumption, exacerbate energy price volatility by blurring market signals, incentivize fuel adulteration and smuggling, and undermine competitiveness of renewable and more efficient energy technologies"* (2010:9).

Some of the major economic effects include a fiscal burden on the state budget, a wasteful consumption of energy, a creation of market distortions, a negative impact on the environment, decreasing investments in energy infrastructure, decreased incentives to invest in renewable energy, a rapid depletion of natural resources, and decreasing energy exports in cases where the country exports energy (IMF, 2013). Moreover, subsidies reduce the export availability of fossil fuel-exporting countries and reduce subsequent revenues. Subsidies can influence the concentration of economic activities in the energy-intensive sectors, possibly leading to unemployment (Birol et al. 1995, Kosmo, 1989). Though subsidies are meant to protect poorer households, they largely benefit high-income consumers (IEA et al. 2011; IMF, 2013; Birol et al., 1995).

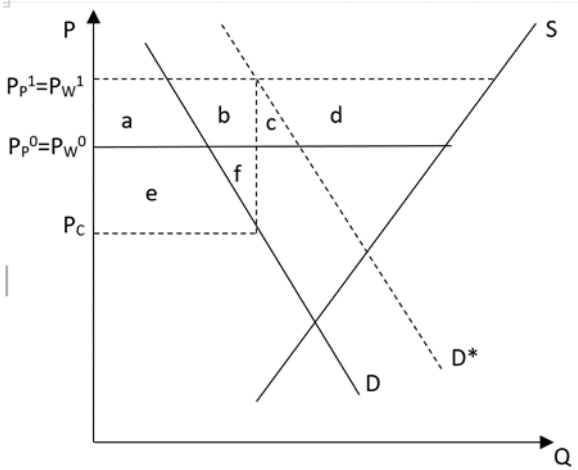
Figure 3.3 depicts three cases of consumer subsidies: in a closed economy, in an open economy (export case, a small country assumption), and in an open economy (export case, a large country assumption). In the first left figure, an original equilibrium is given by the intersection of the supply curve, *S* and the demand curve, *D* and the market price, P_0. Introducing a consumer subsidy assumed in a closed economy shifts the demand curve upward, *D**, producer price to P_P, and price paid by consumer, P_C. Introducing a subsidy raises the market price to P_P, and the price paid by the consumer is the market price minus the subsidy denoted as P_C. Producer surplus is marked by an area $+a+b$ and consumer surplus by an area $+c+d$. The state expenditures are given by a rectangular area - $[+a+b+c+d+e]$ (Table 3.1). Total welfare loss is marked by an area $-e$. In the next figure, a small open economy export case that introduces a consumption subsidy is considered. Consumers gain a consumer surplus given by an area $+a$. Government expenditures are marked by an area - $[+a+b]$. Since this is a small country assumption, the rest of the world and the prices would not be affected. Total welfare loss is marked by an area $-b$. In the last figure, *a* assumed consumption subsidy is introduced into an open, large country under the assumption that the country is an exporter. Introducing the consumption subsidy results in a consumer surplus given by the area *e*, a producer surplus marked by area $+a+b+c+d$, government expenditures depicted in an area - $[+a+b+e+f]$. Total welfare effects are marked by an area $+c+d-f$, where the area $c+d$ is the positive terms of trade effects, and the area *f* is welfare loss due to distorted consumer prices.



1. Consumer subsidies in a closed economy



2. Consumer subsidies in an open economy (export case, assuming a small country



3. Consumer subsidy in an open economy (export case, assuming a large country)

Source: Author's own illustration

Figure 3.3 Consumer subsidies effects

Table 3.1 Consumer subsidies: welfare effects

ΔCS= +c+d	ΔCS=+a	ΔCS= +e
ΔPS=+a+b	ΔPS= 0	ΔPS= +a+b+c+d
-[ΔSt.Exp.]= - [+a+b+c+d+e]	-[ΔSt.Exp.]= - [+a+b]	-[ΔSt.Exp.]= - [+a+b+e+f]
Δw=-e	Δw=-b	Δw = +c+d-f

Source: Author's own illustration

Measurement of subsidies is one of the main challenges. One of the common approaches to calculate energy subsidies is a price gap approach. This approach uses producer support estimates and consumer support estimates, which measure net budgetary and net market transfers and has so far had limited application in the energy sector. This is due to the data requirements such as data on production and price levels, which are difficult to obtain (Ellis, 2010).

The basic principle of the price gap approach is to quantify deviations between domestic and world prices for certain commodities. The formula for calculating subsidies using the price gap approach is as follows:

(1) Subsidy = reference price – end use prices

The equation compares domestic prices for end use with world prices for energy, referred to as a reference price. The end use price as indicated by the IEA (1999) is the actual price the energy consumer pays regardless of whether they are households, manufacturers, service providers, or power-generating companies. The calculations based on the price gap approach rely on averaging across time, which means providing a single value for a year, averaging across regions though prices might differ within different regions of the country, and averaging across a product. Such data usually provides lower bound estimates of the subsidies, which means analysis of the energy reform effects can be underestimated.

Reference prices vary depending on whether a country is a net importer or net exporter. For net exporting countries, the reference price is based on an export parity price, which is the price of a product at the nearest international hub, adjusted for quality differences, and if necessary minus freight costs and insurance back to the net exporter, plus costs of internal distribution and marketing. The reference price also varies depending on whether the product is internationally traded such as oil and gas, or whether the product is not traded such as electricity. For the non-traded product electricity, the reference price is a cost recovery price for the domestic producer. The price gap approach has been widely used in multi-country assessments and is the most widely used approach in quantifying fossil fuel subsidies (Ellis, 2010; IMF, 2013; Koplow, 2009).

Such an approach has its advantages and limitations. The main advantage of such an approach is its simplicity and fewer data requirements, which is especially relevant for countries that lack accurate information on government activities in the energy sector. The format of the price gap approach allows one to track short-term market distortions, and the data can be easily

implemented into macroeconomic models, which enables further analysis of the economic effects of energy reforms in countries. Data based on the price gap approach also has limitations such as the accuracy of price-gap measurements, especially when establishing world reference prices. Assumptions have to be made in establishing reference prices, especially for commodities such as electricity that are usually not traded internationally. Moreover, world prices themselves could be affected by distortions. Since price gap ony measures net effects of policies on prices, it misses information on fiscal transfers that leak into other factors of production but at a particular point in time do not influence the market prices of commodities (Koplow, 2009).

3.2 Overview of the modeling method

The quantitative analysis of national and international policy issues has been widely conducted using either partial equilibrium or general equilibrium models. Partial equilibrium models focus on one particular sector of the economy, and they do not take into account inter-linkages between sectors as CGE models do. Partial equilibrium models include only markets of interest and exclude all others. Such models have been particularly important in the analysis of international agricultural policy reforms and have been widely applied in analyzing the benefits of agricultural liberalization. There are a number of well-known and widely implemented partial equilibrium models in policy analysis, for example the Agricultural Trade Policy Simulation Model (ATPSM) developed by the UNCTAD, the Static World Policy Simulation Model (SWOPSIM) by the US Department of Agriculture, the SMART model, and others. On the other hand, a general equilibrium approach has several advantages over partial equilibrium modeling: the most important is capturing effects between the regions and sectors. A major advantage of the partial equilibrium model is that it requires less data than the general equilibrium model.

This chapter discusses the main methodological approach employed in this thesis. Each methodological approach has its advantages and limitations. The choice of an appropriate methodology in this study has been largely motivated by the desired scope of the research questions and availability of the data. The next part introduces the main features of the general equilibrium models. A static multiregional, multisector, standard GTAP model is applied in this thesis and is described in detail in this chapter. Finally, the main technical characteristics of the GTAP model are presented.

3.2.1 Overview of CGE modeling

The first roots of economy-wide modeling can be traced to the Leontief's input-output system[10]. After Leontief, numerous economists took the next stage of development towards programming the models Sandee (1960), Evans (1972), and others. However, such input-output models lacked the foundation of the behavior of economic agents (Dixon and Rimmer, 2010).

The origins of CGE modeling go back to Leif Johansen and his work *A Multisectoral Study of Economic Growth* (1960). In his work, Johansen focused on the 22-sector model of Norway, and it was the first time individual agents' behavior was explicitly identified. In this model households maximized utility subject to their budget constraints, and industries minimized costs subject to their production function constraints. The outcome of the model was determined through the actions of the agents in the model adjusted through price changes that equalized supply and demand in factor and product markets (Dixon et al. 2010, Dixon and Jorgenson, 2012).

Since Johansen's model, the field of CGE modeling rapidly developed. Currently, CGE models are applied in various areas of economic policy analysis and include single and multi-country models, as well as static and dynamic types of models. Single-country models focus on the effects of policy changes in one country, while multi-regional models focus on the inter-regional impacts. Static models allow the modeler to analyze the effects of a policy change at one period of time, while dynamic models take into account the longer time period.

3.2.2 Description of the CGE model

CGE modeling accounts for all the linkages between sectors and different actors of the economy, which means that a policy change in one market or sector has an impact on all other markets. The linkages function through various channels, for example through consumers or producers (Piermartini and Teh, 2005).

CGE model can be defined as *"…a system of nonlinear simultaneous equations representing the constrained optimizing behavior of all agents as producers, consumers, factor suppliers, exporters, importers, taxpayers, savers, investors, or government"* (Kilkenny, 1991:1).

[10] See Leontief, W. (1936) 'Quantitative Input and Output Relations in the Economic System of the United States', The Review of Economic and Statistics,18, pp. 105-25 and Leontief, W. (1941) The Structure of American Economy, 1919-1929. Cambridge, (mors): Harvard.

CGE modeling usually includes following components: input-output data or a social accounting matrix (SAM), elasticity parameters, theoretical specifications, a solution algorithm, and interpretation of the results. The CGE model can be described by presenting the following four major components. First, economic actors or agents in the model have to be identified. Standard CGE models generally include economic actors such as households, producers, the government, and the rest of the world. Second, the behavior of economic actors or agents needs to be determined. In most standard CGE models, producers maximize profit subject to technological constraints, and households maximize utility subject to income constraints. Third, signals by which agents make their decisions need to be specified. This could be for example, prices as signals. Fourth, the institutional structure of the economy needs to be identified (Dixon and Parmenter, 1996).

As with any other economic method, the CGE method has its strengths and limitations. The importance of CGE modeling is emphasized for three reasons: first, it emphasizes the duality of pricing and resource allocation; second, CGE models represent the interdependence of different parts of economic systems; third, CGE models provide a unifying framework within which major economic theories such as the theory of value, welfare economics, pure theory of international trade, and the theory of economic growth can be shown as having a common origin (Simpson, 1975). Other major advantages of CGE modeling are its strong theoretical foundation, household focus, finite resources and accounting consistency, inter-industry linkages, economy-wide perspectives (Hertel, 1999), and welfare analysis. In contrast to partial equilibrium modeling, CGE can be used to determine income (Piermartini et al. 2005).

Applications of CGE models

CGE modeling has been widely applied in policy analysis both in developed and developing countries. It should be emphasized that CGE modeling is applied largely not as a forecasting tool but rather as a tool to provide the direction of change due to the policy change. The use of a CGE model can be best described by the following:

"The model is used as a simulation laboratory for doing controlled experiments, which are designed to explore the empirical importance of the links between policy changes and economic outcomes. The scenarios are not necessarily designed to be realistic in the sense that they are "likely" to occur. Rather, they are meant to inform policy makers about the relative strength of potential impacts of policy changes. Nor are they designed to provide "forecasts" since the

variables being held constant in order to isolate important causal chains are unlikely to be constant in the real world" (Devarajan and Robinson, 2013: 286).

CGE modeling is already widely used in the analysis of trade policies in developed countries, and recently the application of such models has been spreading to developing countries. The application of CGE models ranges from the analysis of trade policies and tariff changes, regional integration, taxation, public expenditure, social security, demography, immigration, technology, labor markets, the environment, and resources for financial crises (Devarajan et al. 2013; Dixon et al. 2010). CGE models provide a theoretical, consistent framework for analyzing trade policy issues that enables one to identify groups that win and lose, sectors that will grow or contract due to the trade policy change, and the effects on employment that factor returns and measure overall welfare (Piermartini et al. 2005, Shantayanan and Robinson, 2013, Burfisher, 2011). CGE models have been applied to the analysis of trade liberalization, agricultural trade liberalization, multilateral tariff reforms through WTO, the creation and effects of NAFTA and other regional trade agreements, EU expansion, Doha Round, etc.

CGE modeling has been applied in four different ways for policy analysis in developing countries:

- Measurement: CGE modeling is a useful way to provide estimates of the quantitative measurement of policy changes.
- Directions of change: in some policy analysis, the direction of change is the main focus of the analysis, and CGE models are good tool to provide such information.
- Evidence to nourish public debate: CGE model simulation results can serve as evidence to strengthen public debate on certain issues and provide evidence for policy analysis and formulation. CGE model results can then be compared and supported by other modeling techniques.
- Comparative analysis across countries: CGE models provide policy makers perspective and experience from other countries when considering specific policy reforms, which enables them to further analyze common ground as well as differences across different countries (Devarajan et al. 2013).

Dervis, de Melo, and Robinson (1982) identify three ways in which a CGE model can contribute interesting insights into trade policy analysis:

- The CGE model allows one to quantify the effects of trade policies on resource allocation and economic structure and can provide information on sectors that can potentially develop a comparative advantage.
- CGE models can provide estimates of the effects of alternative trade policies and therefore provide the effects of trade policy on welfare.
- CGE models allows one to track the distribution effects among household groups and private and public sectors due to changes in trade policy.

3.2.3 Limitations of the CGE model

Despite the popularity of CGE models in economic policy analysis, there are several limitations of a general equilibrium approach that are often mentioned in the literature. The most frequent issues mentioned, among others, are weak econometric foundations of the models, the choice of behavioral parameters, and the difficulty in explaining the results produced by CGE models.

First, the results produced by a CGE model are not unconditional predictions but rather are simulations. Second, though the models are quantitative, they are not empirically estimated. Third, results are sensitive to the selected values of elasticities used and the way in which the changes in the trade policy are implemented. Fourth, it is difficult to measure the tariff equivalents of NTBs and barriers to trade in services (Lloyd and Maclaren, 2004).

A weak econometric foundation and the selection of appropriate parameters upon which models are based having impact and even driving the results are one of the main disadvantages identified (McKitrick, 1998, Arndt et al. 2002). Sensitivity analysis and the selection of appropriate baseline parameters helps validate the CGE modeling results (Boys and Florax, 2008).

One frequently brought up limitation of the CGE is the difficulty of interpreting the results, the so called “black box” (Devarajan et al. 2013). Moreover, the choice of data and scenario specifications in the model can result in different outputs of the model (Piermartini et al. 2005).

3.2.4 Types of the CGE models

The area of a CGE modeling has been rapidly expanding and now includes a variety of models. CGE models are generally categorized into single or multi-country models and static or dynamic type of models. Static models are applied when the focus of the analysis is on the policy effects at one point in time. Static models compare new equilibrium to the base equilibrium, and only one solution in the model is calculated. Dynamic models on the other

hand calculate a full model solution for each time period and can capture the path of economic adjustments over time. Dynamic models have higher data requirements and are more costly to build and run. Static models are often preferred due to time and costs and when the focus of the analysis is on the final impact of economic change (Burfisher, 2011).

Single and multi-country CGE models differ depending on the regional focus. Single-country models are usually much more detailed in terms of sectors and households representation and are usually applied for the analyses of country-specific policies and issues that are expected to have a small effect on other regions. Multi-country models are less detailed in the presentation of sectors but are especially useful in the analysis of multilateral policies (Bergman, 2005).

Table 3.2 lists selected major multiregional models that are widely used in the analysis of environmental, migration, trade, and other policy issues. The list provided below is not exhaustive but rather provides an overview of a variety of CGE models that are currently used in policy analysis.

Table 3.2 List of the CGE multiregional models

Model	Source
GTAP	GTAP Book: Hertel, Thomas.W., Ed., 1997. *Global Trade Analysis: Modeling and Applications*. Cambridge University Press, Massachutes, USA
MIRAGE	CEPII (Centre d'Etudes Prospectives et d'Informations Internationels) Bchir, H., Decreux, Y., Guerin, J. L., & Jean, S. (2002). MIRAGE, a Computable General Equilibrium model for trade policy analysis. CEPII Working Paper No. 2002-17.
MEGABARE	ABARE. K. Hanslow, M. Hinchy. The MEGABARE model: Interim documentation ABARE (Australian Bureau of Agricultural and Resource Economics), Canberra (1996)),
ORANI	Center of Policy Studies, Australia.
MONASH	Center of Policy Studies, Australia. Peter B. Dixon and Maureen T. Rimmer. 2002. " Dynamic, General Equilibrium Modelling for Forecasting and Policy: a Practical Guide and Documentation of MONASH". North-Holland.
LINKAGE	World Bank. Van der Mennsbrughe. 2005. LINKAGE Technical Reference Document. The World Bank.
GLOBE	Scott McDonald, Karen Thierfelder, Terrie Walmsley. McDonald, Robinson & Thierfelder, 2007. GLOBE: A SAM based global CGE model using GTAP Data. US Naval Academy Department of Economics. Department of Working Papers.

MICHIGAN Model of World Production and Trade	The University of Michigan. Deardorff, Alan V. and Robert M. Stern. 1986. The Michigan Model of World Production and Trade: Theory and Applications, Cambridge: MIT Press.

Source: Author's own compilation

3.3 Description of the GTAP model

This section of the chapter provides an overview of the main components of the Global Trade Analysis Project (GTAP) model, which is the main model used further in this study. The GTAP database and GTAP model were developed by GTAP in 1992 at Purdue University, West Lafayette, USA. The first database and model were made available to the public in 1993 (Hertel, 2012).

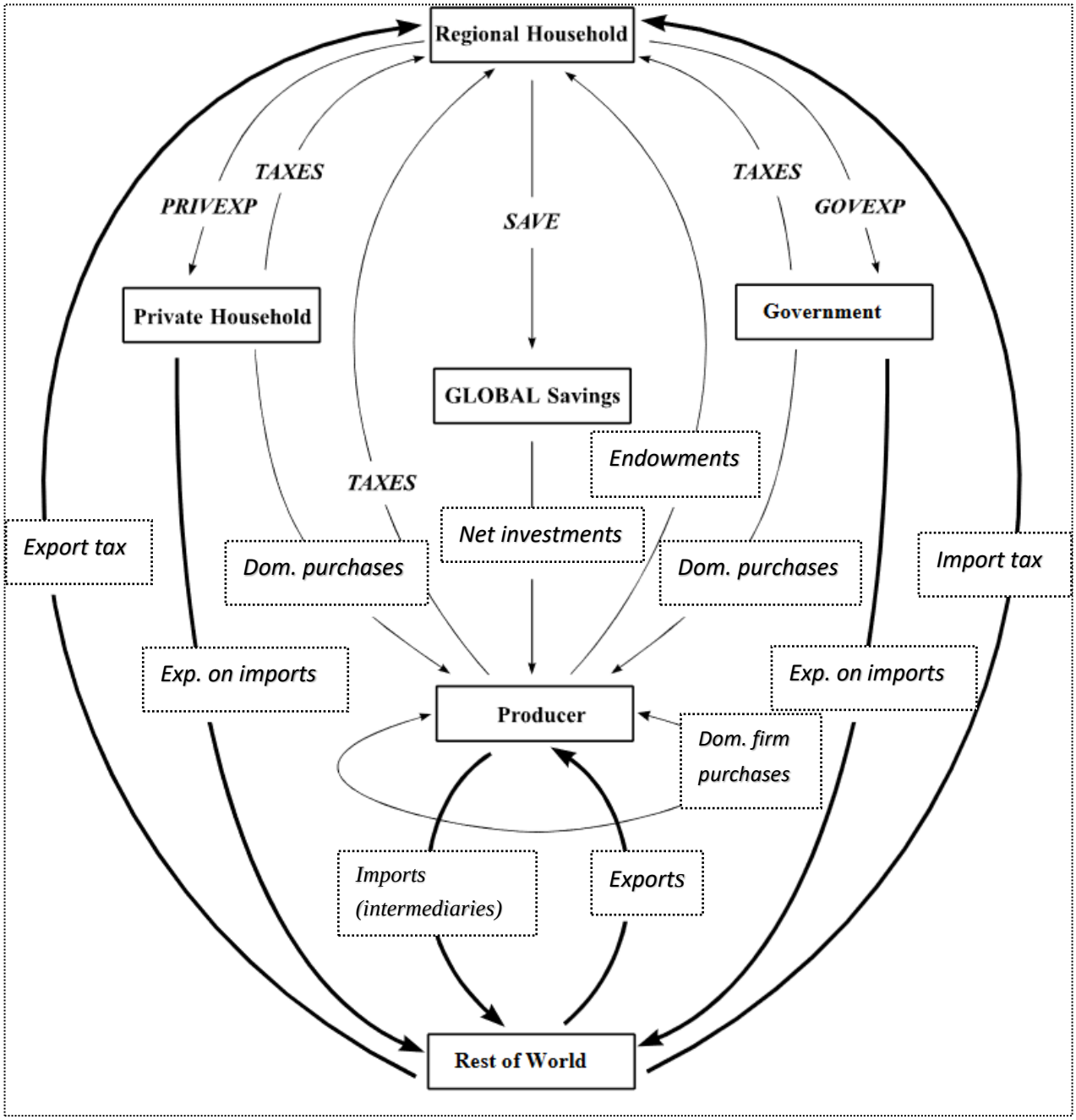
The GTAP model has been widely applied in a wide range of policy analyses, including issues such as economic integration, reduction in trade costs, and liberalization policies in agricultural and other sectors. The majority of the studies applying this model have focused on the liberalization of merchandise trade. The model was also applied for the analysis of numerous FTAs. The enlargement of the number of EU member countries was also one of the areas where the model and GTAP database were applied. The GTAP model was recently extended to analyze in detail environmental, energy, land, water, migration, and poverty issues (Hertel, 2012).

3.3.1 Overview of the GTAP model

The standard GTAP model is a static, multi-sector, multi-regional model. This model is described in detail in Hertel (1997). It has a competitive economic environment and a profit and utility-maximizing behavior of consumers and producers. The model is based on two sets of non-linear equations: accounting relationships and behavioral equations.

- Accounting relationship equations make sure that receipts and expenditures of every agent are balanced.
- Behavioral equations are based on a microeconomic theory (Brockmeier, 1996).

The GTAP model is complex and includes numerous equations and variables. Figure 3.4 depicts a simple graphical overview of the model with a focus on accounting relationships; it also illustrates linkages between different agents in the model (Brockmeier, 1996).



Source: Adapted from Brockmeier, 1996

Figure 3.4 Graphical overview of the GTAP model

Regional household

The regional household collects regional income. This household maximizes a Cobb-Douglas utility function by distributing regional income among three components of final demand: the private household, government, and savings. Aggregate utility for the regional household is depicted in the equation below and includes per capita utility from private consumption, per capita utility from government consumption, and per capita real saving.

*(2) INCOME(r) * u(r) = PRIVEXP(r) * up(r) + GOVEXP(r) * [ug(r) - pop(r)]+ SAVE(r) * [qsave(r) - pop(r)] ;*

where *INCOME(r)* = total expenditures = net income in region *r*; *u(r)* = per capita utility from aggregate household expenditures in region *r*; *PRIVEXP(r)* = total consumption expenditures by private households in regin *r*; *up(r)* = per capita utility from private household expenditures in region *r*; *GOVEXP(r)* = government expenditures in region *r*; *ug(r)* = aggregate utility from government household expenditures in region *r*; *pop(r)* = population in region *r*; *SAVE(r)* = value of (net) savings in region *r; qsave(r)* = quantity of savings demanded in region *r*.

Government consumption expenditure

(3) VGA(i,r) # government consn expenditure on i in r at agents' prices #;

Formula (all,i,TRAD_COMM)(all,s,REG)

VGA(i,s) = VDGA(i,s) + VIGA(i,s);

Coefficient (all,r,REG)

GOVEXP(r) # government expenditure in region r #;

Formula (all,r,REG)

GOVEXP(r) = sum(i,TRAD_COMM, VGA(i,r));

where *VDGA* is the value of a government's expenditures on domestic tradable commodity *i*, in region *r*, evaluated at agent's prices; *VIGA* = the value of a government's expenditures on imported tradable commodity *i*, in region *r*, evaluated at agents' prices.

Private consumption expenditure

(4) VPA(i,r) # private hhld expenditure on i in r valued at agents' prices #;

Formula (all,i,TRAD_COMM)(all,s,REG)

VPA(i,s) = VDPA(i,s) + VIPA(i,s);

Coefficient (all,r,REG)

PRIVEXP(r) # private consumption expenditure in region r #;

Formula (all,r,REG)

PRIVEXP(r) = sum(i,TRAD_COMM, VPA(i,r));

where *VPA* = the sum of *VDPA* and *VIPA*; *VDPA* = the value of expenditure on domestic tradable commodity *i*, by private household in region *r*, evaluated at agents' prices; *VIPA* = the value of expenditures on imported tradeable commodity *i* by companies in sector *j* of region *r* evaluated at agents' prices.

Saving

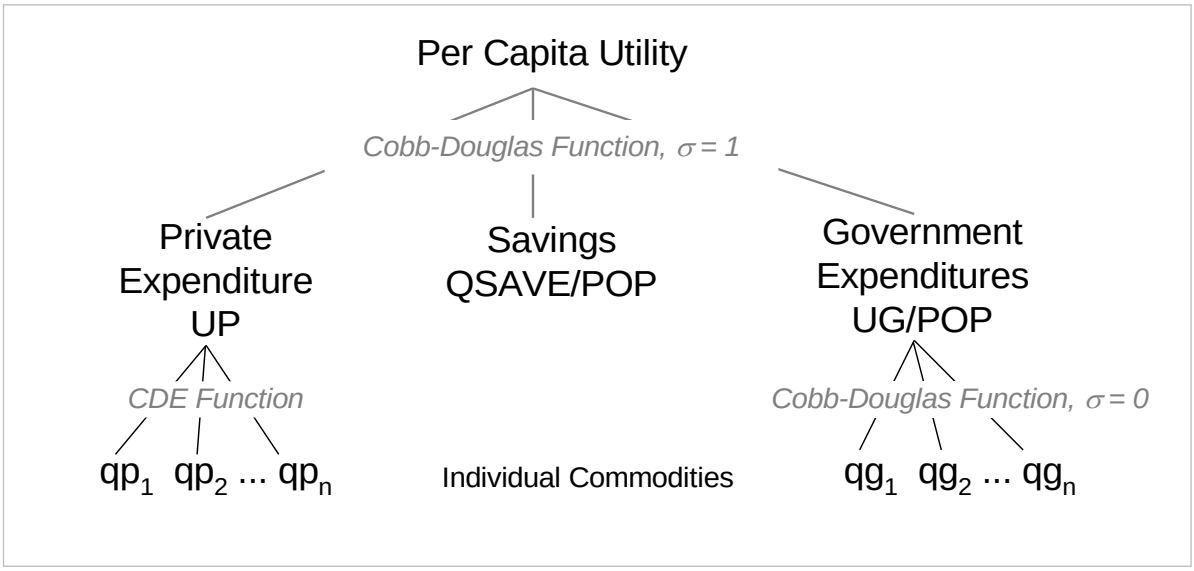
(5) SAVE(r) # expenditure on NET savings in region r valued at agents' prices #;

Update (all,r,REG)

*SAVE(r) = psave(r) * qsave(r);*

with: *psave(r)* = price of savings in region r; *qsave(r)* = a regional demand for NET savings.

The regional household maximizes welfare from current consumption, future consumption, and the provision of public goods (Figure 3.5). Instead of modeling private consumption, government expenditures, and savings separately in the final demand, they are all incorporated into the household utility function. Therefore even if private consumption rises, regional welfare might fall if a policy change negatively affects the savings and government expenditures (Hertel, 2012).



Source: Hertel, 1997

Figure 3.5 The regional household in the GTAP model

On the first level, the regional household has an aggregate Cobb-Douglas per capita utility function in this form:

(6) $$U = C \prod U_i^{B_i}$$

where U = the regional household's utility; C = a scale parameter; U_i = utility level of the i^{th} agent; B_i = distribution parameter for the i^{th} agent (private household, government, and savings).

The second level of demand includes private expenditures, government expenditures, and savings. Private consumption is non-homothetic in GTAP. Private consumption behavior is

modeled using a constant difference of elasticities (CDE) minimum expenditure function. The CDE expenditure function of private household demand has the following form:

(7) $$G(z,u) = \sum_{i=1}^{N} B_i u^{b_i e_i} z^{b_i} \equiv 1$$

where G is the general form of an expenditure function, z normalized price vector, u private household's utility, b_i are N parameters that determine substitution possibilities among commodities ($0< b_i <1$, or $b_i<0$), e_i are N expansion parameter (>0), B_i scale parameter (>0) to specify function.

CDE function was first proposed by Hanoch (1975). He proposed the need for intermediate functional forms that are more flexible than the linear expenditure system (LES) and CES functions and more parsimonious in parameters. He imposed implicit addivity on the underlying preferences. The CDE functional form allows consumption shares of different commodities and price elasticities to change at different income levels.

The behavior of government spending is modeled using a Cobb-Douglas utility function. Cobb-Douglas expenditure shares are constant across all commodities. The third component of a final demand is global savings. Savings are investment driven. The global bank was introduced into the model due to the data deficiency. There is no global database that covers bilateral investment flows and ownership of capital stocks (Hertel, 1997).

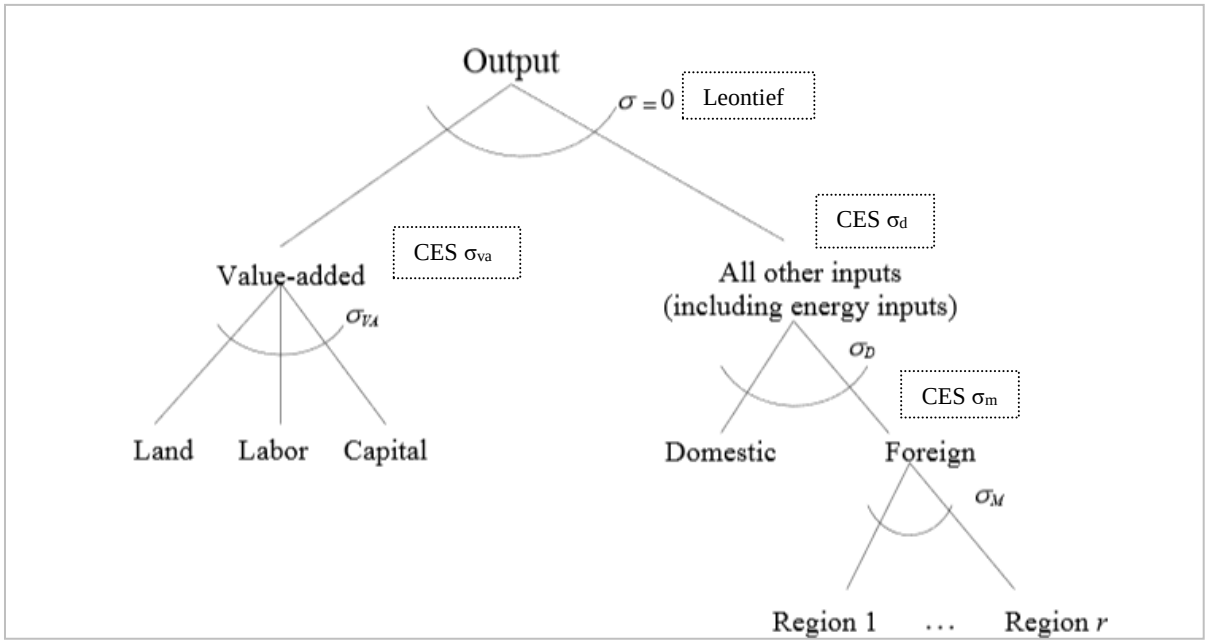
3.3.2 Production structure of the GTAP model

Producers' decisions regarding the amount of inputs and levels of outputs used in production are determined by the behavioral equations in the model. In standard GTAP model settings, producers have a profit and utility-maximizing behavior. A producer's behavior is modeled as a nested CES function. Production technology is represented by the CES function form (Burfisher, 2011).

(8) $$Y = \alpha \left(\sum_{i=1}^{j} \delta_i x_i^{-\rho} \right)^{\frac{-1}{\rho}}$$

where Y is total output, α the efficiency parameter, δ_i the distribution parameter of $_I$ input, x_i the i^{th} input. The elasticity of substitution is constant, $\sigma = 1/(1+p)$.

The production side is represented by a nested production structure (see Figure 3.6). The two branches are value-added and intermediate inputs. On the left side is a value-added nest that includes these factors of production in the model: land, labor (skilled and unskilled), and capital. On the right side are intermediate inputs, which are further categorized into domestic or imported intermediate inputs. Value-added and intermediate inputs are combined at the top nest of a final output.



Source: Truong T., Kemfert C., Burniaux J. 2007

Figure 3.6 GTAP production structure

In a standard GTAP model, all companies use capital, as well as skilled and unskilled labor. Land is used only in agricultural production and natural resources in sectors such as forestry, fishing, oil, gas, and other mineral sectors. Capital is the only primary factor subject to depreciation. The supply of land, labor, and natural resources is fixed in the standard GTAP model (Banse, 2013).

Primary factors are distinguished between perfectly mobile and "sluggish" or imperfectly mobile factors. Perfectly mobile factors earn the same market returns regardless of where they are employed, while sluggish factor returns in equilibrium may vary depending on the sector

(Brockmeier, 1996). Labor is a mobile factor in the model, which means that labor moves freely between regions and sectors as relative prices change. Moreover, labor is categorized into skilled and unskilled labor. Each category has its own wage rates determined by the supply and demand of labor as a factor of production. Capital in the model is mobile in the long run and can move between the sectors in one region, but not between the regions. The global bank represents global investors in the model. Savings are received from households and invested in capital goods. In the model, savings equal investments. Land and natural resources are immobile factors (Banse, 2013).

The elasticity of substitution between value-added inputs is a constant elasticity of substitution (CES) denoted by $\sigma_{VA.}$ The CES between intermediate inputs is set to $\sigma_{D.}$ The elasticity of substitution for the inputs is the same on each nest, differs, however, between the nests.

Intermediate inputs are also differentiated in the next level of the nested structure by domestic and imported intermediates. Imported inputs are differentiated by a country of origin. Imports in the model are treated via an Armington approach. A CES function is used as the elasticity of the substitution between imported intermediate inputs from different regions. The elasticity is denoted by σ_M. The elasticity of substitution between value-added and intermediate nests is $\sigma_{T,}$ which is set to zero, which implies no substitution possibilities between value-added and intermediate inputs. At the top of a nested structure, value-added and intermediate inputs are combined to produce a final output. Value-added and intermediate inputs are added in fixed proportions via the Leontief function, $\sigma = 0$. A technical change variable is available on each level of the production structure (Hertel, 1997).

3.3.3 Closure

Model closure concerns declaring exogenous and endogenous variables in the model. Endogenous variables are variables that are determined by the model. Exogenous variables are determined outside the model and are usually used as shocks.

The standard GTAP model has the following equilibrium conditions:

(1) All markets are in equilibrium.
(2) All companies earn zero profits by exhausting revenues.
(3) The regional household is on its budget constraint (Hertel, 1999).

Table 3.3 identifies standard closure and lists exogenous variable in the GTAP model.

Table 3.3 Standard GTAP closure

Exogenous variables	Description
Pop	Population
ams atm ats atd aosec aored avasec avareg afcom afsec afreg afecom afesec afereg aoall afall aleall	Technical change
to tp tm tms tx txs	Policy variables
qo (ENDW_COMM, REG)	Supply of endowment
Pfactwld	Numeraire – world price of endowment
tradslack endwslack cgdslack profitslack incomeslack psaveslack	Slack variables
au dppriv dpgov dpsave	Distribution parameters
Rest endogenous	

Source: Author's own compilation based on Brockmeier 1996 and Hertel 1997

Variables such as population, technical change, policy variables, supply of endowment (land, labor and capital), numeraire-world price of endowment, slack variables, and distribution parameters are usually exogenous in the model. The quantities of all endowment commodities, regional incomes, and prices are endogenous in the GTAP model.

Taxes and subsidies are policy variables and represent distortions within the economy. They represent linkages between various prices in the model. Taxes and subsidies are calculated by comparing the value of a transaction evaluated at agents' and market prices. If there is a difference between these values, then either a tax or a subsidy is present.

The GTAP model distinguishes between three types of prices (Table 3.4):

- Agent's price: price payable by an agent (producer, private consumer, government consumer, RoW) for the product
- Market price: the price prevailing in the market for the product. Adding output tax or a subsidy gives the value of an output at market price. Output tax (*TO*) is identified as follows:

  (9) $TO_{i,r} = VOA_{i,r} / VOM_{i,r} < 1$ *Tax*

  where $VOA_{i,r}$ = the value of non-saving commodity i, output or supplied in region r, evaluated at agents' prices; $VOM_{i,r}$ = the value of non-saving commodity i, output or supplied in region r, evaluated at market prices.

If *VOM* > *VOA* there is a tax, the reverse implies there is a subsidy.

- World price: the value of exports (fob) is derived by adding export taxes or subsidies to the value of output at a market price. Export taxes are defined as wedges between market prices of the exporter's and world prices:

  (10) $TXS_{i,r,s} = VXMD_{i,r,s} / VXWD_{i,r,s} < 1$ *Tax*

  where $VXMD_{i,r,s}$= *the* value of exports of tradable commodity I, from source r, to destination s, evaluated at (the exporter's) market prices; $VXWD_{i,r,s}$ = the value of exports of tradable commodity i, from source r, to destination s, evaluated at world (fob) prices.

  Import tax is defined as a ratio of *VIMS* over *VIWS*:

  (11) $TMS_{i,r,s} = VIMS_{i,r,s} / VIWS_{i,r,s} > 1$ *Tax*

  where $VIMS_{i,r,s}$ = value of imports of tradable commodity i, from source r, to destination s, evaluated at (the importer's) market prices; $VIWS_{i,r,s}$ = the value of imports of tradable commodity i, from source r, to destination s, evaluated at world (cif) prices.
  If *TMS > 1*, there is a tariff; if *TMS < 1*, there is a subsidy (Hertel, 1999).

Table 3.4 Distribution of sales to regional markets

Value of output at the agent's price (*VOA*)	Payment received by companies in industry i, in region r
Value of output at market price (*VOM*)	*VOA* + output tax/subsidy Domestic sales, exports, transportation
Value of exports at world prices (*VXWD*) (fob)	Value of output at market price (*VOM*) + export taxes/subsidies
Value of imports at world prices (*VIWS*) (cif)	*VXWD* + transportation margin
Value of imports at market prices (*VIMS*)	*VOA* + import tax / subsidy Imports by private households, governments, and companies

Source: Author's own compilation based on Hertel, 1999

3.3.4 GTAP model output

The GTAP model can be solved in a general algebraic modeling system (GAMS), general equilibrium modeling package (GEMPACK) or using the RunGTAP programs. The GTAP model in this study is solved and analyzed in GEMPACK economic modeling software and in the RunGTAP program. GEMPACK software was developed by the Center of Policy Studies

at Monash University, Australia. This software can solve large non-linear equation models. The use of GEMPACK allows equation-by-equation analysis and decomposition of the results of the model.

The GTAP model produces numerous outputs. The changes in endogenous variables are presented as percentages and/or volume changes. The percentage change in the GDP is divided into price GDP (*pgdp*) and quantity GDP (*qgdp*). Quantity index, *qgdp*, usually has little solution value in trade policies because it shows only shifts in the production possibility frontiers due to the allocation of fixed resources. Trade balance changes by region and sector are provided by the model. The trade balance changes are presented in millions of USD (Hertel, 1997).

Equivalent variation (EV) is one of the main indicators of policy change in the GTAP. Explaining welfare gains or losses involves analyzing the sources of change. In the GTAP model, EV measured in millions of USD is a welfare effect indicator. Regional household's equivalent variation is equal to the difference between the expenditure required to obtain a new (post-simulation) level of utility at initial prices Y_{ev} and the initial $\bar{Y}$.

(12) $EV = Y_{ev} - \bar{Y}$

for a region, [u(r)] is the welfare change variable computed by the standard GTAP model during simulations. The model also computes a money metric equivalent of this utility change and any change in population, [EV(r)]. This convenient measurement summarizes the regional welfare changes resulting from a policy shock in dollar values (millions of USD) and is frequently reported in studies employing the GTAP model (Huff and Hertel, 2000).

The GTAP model decomposes the sources of the total EV welfare effect of model scenarios, allowing the tracing of the sources of welfare contributions by commodity, factor, and tax type. The welfare decomposition in GTAP includes six sources:

1. Allocative efficiency effect, which represents the excess burden of each tax, changes in the production or consumption efficiencies due to the existence of distortions.
2. The endowment effect shows changes in quantities of factors of production that change an economy's productive capacity.
3. The technology effect includes changes in the productivity of factors and/or intermediate inputs, which change an economy's effective endowments and productive capacity.

4. The commodity terms of trade effect demonstrates changes in the economy's world (fob) prices of exported goods and services relative to its world (fob) prices of imported goods and services. The terms of trade measures the import purchasing power of a country's exports. Changes in the terms of trade have an impact on consumption possibilities. Improvement in the terms of trade means that the export price of the product increased relative to the price of importing the product.
5. Investment savings effects include changes in the price of domestically produced capital investment goods relative to the price of savings in the global bank.
6. The preference change effect shows changes in the shares of private consumption, government, and savings in national spending (Burfisher, 2011).

Other useful model output results refer to the changes in trade, GDP and sector outputs, which are briefly presented below.

Terms of trade variable:

(13) tot (r) = psw (r) – pdw (r)

where *tot* = terms of trade for region *r*; *psw (r)* = a price index received for tradable commodities produced in region r, including sales of net investment to the global bank; *pdw (r)* = the price index paid for tradable commodities used in region r, including purchases of savings from the global bank.

Trade balance variable:

*(14) DTBAL(r) = [VXWREGION(r) / 100] * vxwreg(r) - [VIWREGION(r) / 100] * viwreg(r)*

where *DTBAL(r)* = change in the trade balance of region *r*, in millions of USD; *VXWREGION(r*) = the value of exports from source r, evaluated at world (fob) prices; *vxwreg(r)* = value of merchandise exports by region; *VIWREGION (r)* = value of imports into region r, evaluated at world (cif) prices; *viwreg(r)* = value of merchandise imports by region at world prices.

In order to obtain the GDP quantity index *qgdp (r)*, first a value index *vgdp (r)*, which accounts for changes in prices and quantities, and the price index of GDP *pgdp (r)*, which accounts only for price changes, are calculated. Quantity GDP is calculated as the difference between *vgdp (r)* and *pgdp (r)* (Hertel, 1999).

(15) qgdp (r) = vgdp (r) – pgdp (r)

The GTAP model is an appropriate methodology tool that provides a comprehensive framework to analyze trade agreements and energy policies. First, it is a widely applied model that provides a common theoretical framework for a wide range of policy analysis, providing opportunity to measure welfare effect changes. The GTAP model has already proven itself as a suitable model to analyze economic policies and demonstrate macroeconomic and sectoral effects. Applying the GTAP framework allows one to simultaneously capture multiple region and sector impacts of the macroeconomic reforms. Moreover, countries of interest, especially Kazakhstan and other CIS countries, are identified separately, which allows an analysis of the effects the policies have on each region and country.

This finishes a general description of the theoretical basis and a modeling method implemented in this study. The next chapter focuses on an empirical analysis, including a literature review with special focus on the CGE and partial equilibrium studies on Kazakhstan as well as selected studies on energy subsidies.

4 Empirical Analysis

4.1 Literature overview

There have been numerous studies on the effects of various PTAs. Many of them discuss trade creation and trade diversion effects. PTAs such as NAFTA, Mercosur, EU, and ASEAN have been studied extensively using various methodologies, particularly general equilibrium modeling (WTO, 2011). Most of the empirical studies have been done using CGE models. Robinson and Thierfelder (2002), in their survey of CGE studies on regional trade agreements, found that most of the results showed that trade creation exceeded trade diversion effects, welfare improved, and further global liberalization could be observed.

Romalis (2007), using the CGE method, analyzed the Canada and USA FTA (CUSFTA) and NAFTA. The results showed trade creation effects only on trade flows involving Mexico and trade diversion by the CUSFTA and NAFTA. Trefler (2004), using the CGE model, analyzed NAFTA effects on Canada. Due to NAFTA, imports from the US to Canada increased, and imports from the rest of the world to Canada decreased. Robinson and Thierfelder (2002) surveyed empirical literature on multi-country CGE modeling of regional trade agreements. The authors point out that there are differing views among economists regarding the effects of trade liberalization and regional integration. Robinson et al. (2002) came to a different conclusion; in aggregate, trade creation surpasses trade diversion effects, and welfare measured in equivalent variation or in terms of real GDP increases for member countries. Most of the studies the authors surveyed are on NAFTA, APEC, and FTAA. The results of the impacts of various trade agreements vary and are ambiguous. Some findings point out that an RTA has a negative effect on the economy and welfare for the agreement members and hinders global liberalization (Bhagwati and Krueger 1995, Bhagwati and Panagariya 1996, Srinivasan 1998).

Literature on the topic of energy subsidies includes studies on the global state of subsidies in the energy sector and country studies on subsidies in developed and developing countries. To the author's knowledge there is limited literature on subsidies in the FSU countries.

The rest of the chapter provides an overview and presents selected empirical studies on the CU, trade and energy subsidies in Kazakhstan, and relevant studies in other countries.

4.1.1 Literature: customs union

CGE and partial equilibrium approaches are still underdeveloped in scientific and political discussions of economic analysis in Kazakhstan. There are only a few studies that analyze the economic policies in the country using a CGE or partial equilibrium approach. Existing CGE studies are largely conducted by international institutions such as the IMF or World Bank. To the author's best knowledge, there are no CGE studies on Kazakhstan published in scientific journals.

So far most of the studies that exist have focused either on trade or an energy policy analysis of Kazakhstan. To the author's knowledge, there are several studies on the effects of the CU on Kazakhstan and accession to the WTO using the CGE approach. The studies on the CU applying a CGE approach, which also consider the effects on the country, are briefly presented in Table 4.1. The studies are World Bank (2012), Vinhas de Souza (2011), and Astrov et al. (2012). The existing studies on trade policies in Kazakhstan differ by the type of CGE models and data used.

Table 4.1 Economic literature on the effects of the CU on Kazakhstan

	World Bank, 2012	**De Souza, 2011**	**Astrov et al. (2012)**
Model	57-sector small, open economy CGE model of Kazakhstan	GTAP model	Francois, van Meijl, and van Tongeren, 2005, CGE model
Data	Input-output table Kazakhstan 2009	GTAP database version 7, 2007 base year	GTAP database version 8
Scenario	Change in a CET and NTBs	Change in a CET	Creation of a CU and change in a CET
Change in GDP and welfare	Real income loss: -0.2% per year Welfare (EV % as of consumption) -0.2% Welfare (EV % of GDP) = -0.1%	Real income loss: -0.2% per year GDP changes: -0.54% Trade balance changes: -800 million USD	GDP changes: -2.6%

Source: Author's literature review

The World Bank (2012) analyzed the economic effects of the CU on Kazakhstan. The methodology used is a 57-sector small, open economy CGE model of Kazakhstan. The model includes 18 imperfectly competitive sectors and 37 competitive services and goods sectors. The rest of the world in the model is disaggregated into four regions; CU members (Belarus and Russia), the rest of the CIS (including Georgia), the EU, and the rest of the world. There are two primary factors of production in the model: labor and capital. The main data is based on the input-output table of Kazakhstan from 2009, obtained from the Statistical Agency of Kazakhstan. The World Bank conducted three scenarios: 1) CU under the tariffs of 2011 where

CET was not implemented for all tariffs in Kazakhstan; 2) Kazakhstan implements CET without any exceptions, but does not reduce NTBs or trade facilitation costs; 3) Kazakhstan fully implements CET and reduces NTBs and trade facilitation costs. The main results show that implementing the CU CET will have an overall negative impact on Kazakhstan. The real income is reduced by 0.02% of consumption due to increased tariffs. Due to the higher costs of importing from outside of the CU, Kazakhstan will trade more with CU members and less with the other regions of the world. In the second scenario, the results show negative economic impacts after full implementation of the CET in the country, where the real income is reduced by 0.3% of consumption. In the last scenario, the CET and reduction of the NTBs are shocked; the real income increases by 1.5% of consumption.

Vinhas de Souza (2011) quantitatively estimated the effects of CU creation using the GTAP model and GTAP database 7 with the base year 2004. The aggregation included 15 sectors and 10 regions. Three scenarios were simulated: scenarios depended on the degree of tariff harmonization depending on sectors, specifically energy. For all scenarios de Souza found that the CU is welfare reducing; real income losses are 0.2%, and GDP decreases by 0.54%. The trade balance in Kazakhstan deteriorates by 800 million USD.

Astrov, Havlik, and Pindyuk (2012) modeled CIS trade integration, which includes CGE modeling of the CU and the FTA between Ukraine and the EU. The authors used a CGE model based on the extended version of the Francois, van Meijl, and van Tongeren (2005) model. The model is a standard CGE model and includes short-run and long-run adjustments in labor markets. GTAP database version 8 is used in the study. The database is aggregated in 19 sectors and 14 regions. The authors ran three set of scenarios: 1) creation of the CU and Ukraine does not join the CU; 2) CU is created and Ukraine joins; 3) CU is created and Ukraine implements the FTA with the EU. The main source of updated tariffs for CGE analysis, i.e. CET is a UN TRAINS database. According to the model results, Kazakhstan experiences net output losses (negative GDP change of 2.6%) and negative welfare effects in all scenarios. Kazakhstan decreases overall imports especially in the long run. The largest decrease in imports is observed in machinery, light manufacturing, textiles, and metals.

4.1.2 Literature: energy subsidies

Numerous quantitative studies on the issue of energy and fossil fuel subsidies have been published. The literature can be categorized according to the country or regions in focus; the studies have focused largely on two categories: net importers and net exporters of energy. CGE

has been the most widespread tool to analyze energy and environmental policies (Bergman, 2005).

Table 4.2 presents a literature review of energy subsidies and energy market liberalization that largely uses the general equilibrium approach, and the main results are mentioned. Several of the studies are discussed in detail later.

Kosmo (1989) emphasizes that energy subsidies are prevalent in developing countries. The largest energy subsidies are in oil-exporting countries that subsidize oil consumption and discourage energy saving, which in the future can affect availability of the oil resources for exports and therefore oil revenues. Oil-importing countries subsidize kerosene, heavy fuel oil, and diesel oil. Electricity is highly subsidized in most developing countries, and prices are below marginal costs of production.

Burniaux and Chateau (2011) emphasize that most non-OECD countries have high consumer fossil fuel subsidies. The analysis is based on 37 non-OECD countries that have total subsidies of 557 billion USD (2008). Using the ENV-Linkage model, gradual removal of subsidies from 2013 to 2020 is simulated. The results show positive economic and environmental effects. Welfare gains range from 0.3% to more than 4% in the oil-exporting countries. Although oil-exporting countries face real income reductions, this is compensated by welfare gains achieved through subsidy reforms.

Table 4.2 Energy subsidies: selected literature overview

Article	Countries	Methodology	Scenario description	Results
Burniaux and Chateau (2011)	37 non-OECD countries (incl.Kaz)	Dynamic CGE model / IEA price gap	Gradual removal of consumer subsidies from 2013 to 2020	•welfare gains range from 0.3% to more than 4% in the oil-exporting countries •income gains through allocation efficiency effects
Saunders and Schneider, 2000	five OECD and 12 non-OECD countries (incl.Kaz)	Dynamic CGE model / price gap	Consumer subsidy removal	•% increase in some fossil fuel prices for some non-OECD countries •decrease in consumption of fossil fuel subsidies •negative impact on production of energy-intensive products •increase in aggregated changes in fossil fuel exports from non-OECD countries
Birol, Aleagha and Ferroukhi (1995)	Algeria, Iran, and Nigeria	Econometric approach	Full and partial removal of energy subsidies	•domestic demand for oil decreases •exports of oil increase between 3.3% and 11.3%
Jensen and Tarr (2002)	Iran	CGE model / price gap	Full removal of subsidies and transfers to the poor households	•gains for poorest rural household are over 200% of their income, and a 23% increase in welfare •exports increase by 76% •output of particularly energy intensive sectors declines by 25-65% •output in farming, food production, and other services increases
Siddig, Grethe, Minor, and Welmsley (2014)	Nigeria	GTAP model	Full and partial removal of consumer subsidies	•real GDP increases •change in trade balance is positive •price of fuel more than doubles •output in transportation, manufacturing, and electricity sectors to decline
Riipinen (2003)	FSU region	GTAP model / GTAP database	Full energy liberalization	•beneficial to the EU •FSU incurs welfare losses •increase in exports •regional GDP in FSU increases slightly by about 0.04%

Kerkela (2004)	Russia	GTAP model / GTAP database	Energy consumer subsidies removal	•increased GDP in Russia •trade between Russia and the rest of the world • increased welfare •decreased output for most energy products; oil output increases by 10.7% •output of energy-intensive industries, including metal (-9.9%) and chemical (-7.8%) sectors, decrease •agriculture and services sectors slightly increase their output.
IEA (1999)	Eight non-OECD countries (incl.Kaz)	CGE model / price-gap	Fossil fuel subsidies removal	•results for Kazakhstan •19% decrease in energy consumption •0.98% gains in economic efficiency (% of GDP)

Source: Author's literature review

Birol, Aleagha, and Ferroukhi (1995) analyze the impact of a subsidy phase-out and conservation policies in three oil-exporting countries, Algeria, Iran, and Nigeria, using a standard econometric approach. Two sets of scenarios are considered: an increase in domestic prices to the world level and increasing the price to half of the world price. Under both scenarios, the domestic demand for oil decreases. The savings effects compared to the production levels are between 3.3% to 11.3% for Algeria, 1.8% to 8% for Iran and 2.8% to 13.8% for Nigeria.

Jensen and Tarr (2002) studied the impact of subsidy reforms in Iran on the poor, without considering the impact on GHG emissions. The analysis is based on a general equilibrium model, incorporating 20 households (10 urban and 10 rural) differentiated by income. The model assumes that when subsidies are reduced, government revenue increases and is distributed in the same proportion to all households. In the scenario where revenues are transferred to the poor, the gains for poorest rural households are over 200 percent of their income, a 23% increase in welfare is observed, and the poorest urban households gain over 100% of their income and 11% of welfare improvements. Moreover, due to increased fossil fuel prices, demand decreases and exports increase by 76%. The output of energy-intensive sectors declines by 25-65%. On the other hand, farming, food production, and other service outputs expand.

Lin and Li (2012) simulate various policy options of removing fossil fuel subsidies in China, including a scenario where China unilaterally removes the fuel subsidies. Welfare effects are positive (0.33%) in China but also in other regions such as OECD, Brazil, and India. In sectors such as industrial goods, non-industrial goods, and overall outputs, China will experience a decrease in output. Findings show a positive impact on output in other regions.

Lin and Jiang (2011) used a price-gap approach to estimate energy subsidies in China. Their results show that energy subsidies are equivalent to 13% of GDP. Applying the CGE model, the authors simulated a reform of energy subsidies in China. The simulations show that energy demand in China will significantly fall, and macroeconomic variables will be negatively impacted.

Siddig, Grethe, Minor and Welmsley (2014) analyzed the impact of removing fuel import subsidies in Nigeria. Although Nigeria is among the major exporters of petroleum in the world, it imports, particularly from the EU, around 85% of its total oil and fuel consumption. In 2012, total subsidies on the imported fuels amounted to 20% of total public budget. Using a CGE

model, MyGTAP, the impact of fuel subsidy reduction in Nigeria was analyzed. Special focus in the analysis was placed on the effects on poor households. Combined data of the GTAP database 8 and SAM of Nigeria from 2006 was used. Two scenarios, full and partial removal of subsidies were run, whereas in the scenario with partial removal of subsidies petroleum product prices did not rise more than 10% above the baseline. Alternative policies were run, including subsidies paid to domestic petroleum producers and second option subsidies provided to rural households. In all four scenarios, real GDP increased and the overall change in trade balances was positive. Full removal of subsidies caused the price of fuel to more than double. As expected, the market price of imported fuel increased. Domestic consumption switched to locally produced petroleum, which drove the increase in the domestically produced petroleum price. Private demand for domestically produced petroleum increased, while it declined for imported. Higher petroleum prices led to a higher output of petroleum products. Increasing petroleum prices caused output in transportation, manufacturing, and electricity sectors to decline.

Riipinen (2003) simulated full energy liberalization in the FSU region using the GTAP model. The results show that energy market liberalization in the FSU was beneficial to the EU; however, the FSU incurred welfare losses and at the same time increased exports. Welfare in the FSU decreased by over two billion USD, largely due to the negative terms of trade effects. The regional GDP in the FSU increased slightly by about 0.04%.

Kerkela (2004), using the GTAP model and GTAP database, analyzed the effects of energy price liberalization in Russia. First, the tax and subsidy structure of Russia in the GTAP database was updated using the Altertax model. The main scenario included total removal of all subsidies and taxes in the energy sector in Russia. Removing taxes and subsidies would increase the GDP in Russia; on trade between Russia and the rest of the world, it would increase welfare and decrease output for most energy products except oil. Welfare decomposition shows that the main contributor to gains in welfare was improved allocative efficiency. The output of energy-intensive industries, including the metal (-9.9%) and chemical (-7.8%) sectors, decreased. Agriculture and service sectors slightly increased their output. Oil output increased by 10.7%

Orlov (2015) analyzed the effects of gas prices increasing in Russia by using a CGE model. Domestic gas prices in Russia are regulated and lower than export netback prices. The results show that an increase in domestic gas prices resulted in overall welfare gains, an increase in

government revenues, and a reduction in wages and returns to capital. Production in non-energy sectors increased. The structure of the economy shifted from energy-intensive to non-energy-intensive sectors such as agriculture, food, and services. Exports of gas from Russia increased.

The above overview shows that there are only a few studies on Kazakhstan using the CGE modeling approach. This can be largely explained by the difficulty in obtaining the most recent data such as input-output tables and primary data on the household budget survey. Studies using CGE on the effects of the CU on Kazakhstan are limited and focus on different sectors and country aggregation. The directions of economic effects as a result of the creation of the CU on Kazakhstan are negative in all studies. Studies on energy subsidies are numerous and focus on individual countries, and there are no studies of Kazakhstan. The majority of these studies apply a general equilibrium approach and price-gap approach to estimate the energy subsidies.

4.1.3 Empirical studies of Kazakhstan

The rest of this section provides an overview of the selected relevant empirical literature on trade in Kazakhstan. There are generally a limited number of empirical studies on trade in Kazakhstan, and only a few that apply the general equilibrium approach. Selected relevant studies mentioned in Table 4.3 are discussed further in detail. Other relevant literature is also briefly discussed.

Table 4.3 Selected relevant literature on trade in Kazakhstan

	Kazybayeva and Tanyeri, 2003	**Jensen and Tarr, 2007**	**Francois and Manchin, 2009**
Model	St. Calipel, J.-M. Marchat, 1999, TACIS project, CGE model	Jensen, Rutherford, and Tarr 2004, CGE model	Francois, van Meijl, and van Tongeren, 2005, CGE model
Data	SAM 1997	Input-output table 2003	GTAP database version 7
Scenario	1. Accession into the WTO and reduction of import tariffs 2. Increase in import tariffs for all sectors	1. Accession into the WTO (including a reduction of FDI barriers)	1. Full FTA between Kazakhstan, CIS, and the EU
Change in GDP and welfare	1. GDP: 0.32% Household income: 0.72% 2. GDP: -0.60% Household income: -1.31%	1. Welfare as a % of consumption: 6.7% 2. Welfare as a % of GDP: 3.7%	1. Real income effects: 2.06% GDP: 2.36% 2. Terms of trade effects: -0.53%

Source: Author's literature review

Kazybayeva and Tanyeri-Abur (2003) analyzed the effects of market liberalization and tariff protection on the economy of Kazakhstan using a CGE model developed by the TACIS. The model was based on SAM for Kazakhstan with a base year of 1997. Two sets of scenarios were run: a 50% reduction of tariffs in individual sectors and in all sectors, which represented trade liberalization and accession into the WTO, and a second scenario with a 100% tariff in individual sectors, and in all sectors protection under import substitution policy. The first scenario showed that the GDP and welfare increased and unemployment decreased in the country. However, due to the decreased import tariffs, the government revenue decreased. Under the import substitution scenario, the GDP decreased, unemployment increased, and household welfare decreased. The limitation of this study is that the analysis was based on the SAM for the year 1997.

Jensen and Tarr (2007) analyzed the impact of Kazakhstan's accession into the WTO. The authors developed a 56-sector small, open economy comparative static CGE model of Kazakhstan. The model was adopted from Jensen, Rutherford, and Tarr (2004). In the model, the authors adopted the Dixit-Stiglitz-Ethier structure for business services, which implied productivity gains in goods and services markets were endogenous. The primary factors in the model include labor, mobile capital, sector-specific capital in the energy sectors, sector-specific capital in imperfectly competitive sectors, primary inputs imported by multinational companies. The model had three sector categories: competitive goods and service sectors, goods produced subject to increasing returns to scale, and services produced under increasing returns to scale and imperfect competition. *Ad valorem* equivalents of barriers to FDI in services were estimated through surveys conducted in the country. The input-output table was based on the year 2003 and adopted from the Statistical Agency of Kazakhstan. In the first scenario, the barriers to FDI were reduced by 50%. The second scenario focused on tariff reductions, the third scenario on the barriers of entry for multinational companies, and the final scenario on local content and VAT that multinational firms must pay in the oil sector. The findings of all scenarios showed that Kazakhstan would gain 6.7% of value of consumption in the medium run from WTO accession, and 17.5% in the long run. The authors estimated that all four elements analyzed had a positive impact on the gains, but a significant effect came from liberalization of barriers for multinational service companies.

Francois and Manchin (2009), using CGE modeling, evaluated the effects of a potential FTA between the EU and CIS countries. The EU is an important import and export partner for the CIS region. The CIS exports largely oil, gas, and minerals, while EU exports to the region are

predominantly from the light and heavy manufacturing industries. The CGE model applied was a standard multi-region model with features of imperfect competition. The model was based on Francois, van Meijl, and van Tongeren (2005). Manufacturing and service sectors (16 out of 36 sectors) were modeled as imperfectly competitive in the model. The model was implemented in Gempack. The database was based on the GTAP database version 7, with a base year of 2004. The database was aggregated to 16 regions and 12 sectors.

The baseline scenario takes into account WTO accession, EU enlargement, and a phase-out of ATC (Agreement on Textile and Clothing). Three sets of scenarios were run (liberalization for manufactured sectors only, liberalization in agricultural and manufacturing sectors, and full liberalization, which includes full bilateral tariff removal in agricultural and manufacturing sectors and in services). Under the first two scenarios, the CIS region had negative net income effects (-0.53% and -0.83%); under the third scenario there was a positive effect (0.62%) for the CIS region. The EU experienced small positive net income effects in all three scenarios. Light manufacturing in the region would have had the most pronounced decrease in output, while heavy manufacturing, textiles, and apparel the largest increase in output. Small positive terms of trade effects (0.11%) are in the EU, and -0.83% in the CIS region under the full FTA scenario. A change in GDP was only positive (1.195%) for the CIS region under the full FTA scenario.

The authors also analyzed the effects on individual CIS countries. Under all three scenarios, Kazakhstan would have had a positive income effect. The largest decrease in output was in light manufacturing services (57% under the full FTA scenario), and the highest increase in output was in heavy manufacturing (20% under the full FTA scenario). Under all three scenarios, exports from the EU to Kazakhstan of light manufacturing, textiles, and apparel products increased. Under agricultural liberalization and full FTA scenarios, the share of exports of agricultural and processed food from the EU increased. Exports from Kazakhstan to the EU expanded in almost all sectors except for the light manufacturing one. Under the full FTA scenario, agricultural exports increased by around 53% and processed food by 60%. Changes in GDP under the full FTA were positive (2.36%) for Kazakhstan; under partial FTAs, GDP changes were positive as well. The terms of trade effects under full FTA are -0.53%. Generally there are asymmetric effects of the FTA on the EU and Kazakhstan, with larger effects on Kazakhstan and marginal ones in the EU.

Tumbarello (2005) analyzed sequencing of the CIS countries accession into the WTO and the Eurasian Economic Community Customs Union (EECCU). Tumbarello focused on two

questions: 1) Should CIS countries pursue multilateral liberalization through the WTO or customs union membership? 2) If CIS countries pursue a customs union prior or parallel to WTO accession, would it hinder or slow down the WTO accession? The analysis applied a simple partial equilibrium model approach with two sets of scenarios: implementation of a CET of a customs union prior to the WTO accession and second implementation of a CET of a customs union after accession into the WTO. The author argued that pursuit of a CU prior to WTO membership could delay the WTO accession, arguing that regionalism could hinder the process of liberalization. Forming a CU increased overall trade protection of customs union members compared to the protection levels before a CU. If the countries in the union are heterogeneous, the country that dominates and has higher bargaining power and higher tariff rates will dominate when determining the rates of a CET. Therefore, more liberal countries in a CU will adjust their tariffs rates upwards.

The results of the first scenario, which assumed the highest tariffs among the EECCU members as CET rates, showed that Kazakhstan, Kyrgyzstan, and Tajikistan had decreased welfare. The imports from the non-EECC members decreased in Kazakhstan, Kyrgyzstan, and Tajikistan. Russia and Belarus had welfare gains. The second scenario assumed that the CIS countries first joined the WTO and then formed an EECC with a CET implemented. Since the CIS countries except for Kyrgyzstan had no bound rates with the WTO, the scenario assumed the prevailing EECCU CET and the lowest bound rates that had not yet been bound. The results showed that Russia and Belarus had larger welfare gains. The consumer surplus losses in Kazakhstan, Kyrgyzstan, and Tajikistan would be smaller than in the first scenario. This scenario did not intend to show the gains from WTO accession, but rather to show the difference in cases when the EECC is implemented after WTO accession.

Michalopoulos and Tarr (2004), employing a partial equilibrium model, analyzed the economic effects of establishing a CU by the CIS countries. The main scenario in question depicted the effects of a higher common external tariff in comparison to the initial tariff. The initial scenario considered no FTA between the CIS countries, and the same import tariff applied for all countries. Joining a CU would have had a negative economic impact on smaller economies in the region. The authors recommended maintaining an open trade regime in order to maximize welfare. For the CIS countries, trade policies that orient trade towards the countries in the region would result in negative impacts such as lock in traditional technologies and production structures, a lack of innovation and competition, and an inefficient use of resources.

Hindley (2008) econometrically estimated the impact of accession into the WTO on Kazakhstan. He noted that Kazakhstan already had a liberalized trade regime, and the major share of exports consisted of oil and gas. Therefore, the main benefits of membership in the WTO would come from the import side. He noted that Kazakhstan already over-traded with Russia, traded too little with other parts of the world, and further regional integration with Russia would cause economic loss in the country. Hindley pointed out that the membership in the WTO would have small static effects on trade. The effects of trade liberalization would have more impact on the imports than exports. Moreover, a better institutional framework in the country would significantly improve the trade environment. The largest source of gains would be caused by a reduction in corruption and liberalization of foreign investments.

Gill, Izvorski, van Eeghen, and de Rosa (2014) analyzed using an econometric method trade policy and policies for diversification in the Eurasian region. The report emphasized that the Eurasian region, including Kazakhstan, should not pursue further regional integration. The Eurasian region should focus on trade with countries outside of it, where the gains from trade would be larger. More than 85% of the GDP in the region was produced by resource-rich countries with similar endowments. The authors noted that trade could be beneficial among the countries with similar endowments only if economies were large and costs were small. These conditions do not exist in Eurasia at the moment. These countries are advised to seek trade expansion with countries such as China, Turkey, India, and the Republic of Korea. Central Asia is expected to integrate more with China and perhaps India. Global integration will be more beneficial for Eurasian countries than regional integration. Kazakhstan's global integration can create the necessary conditions for further successful regional integration.

The study by the OECD (2014) emphasized the presence of energy subsidies, particularly consumer subsidies, in Kazakhstan. While the OECD countries tended to subsidize energy production, consumer subsidies predominated in non-OECD countries. The low domestic price of fuel, less than half of the export price, motivated producers to export more oil and petroleum products, which resulted in frequent shortages. Using a partial equilibrium model, a subsidy reform in the district heating sector was simulated; particular emphasis was on the CO_2 effects due to the subsidy, the public budget, and poor households. The model employed one elasticity: the price elasticity of demand. The supply side was not modeled and was assumed to follow the changes on the demand side. The main subsidy scheme considered in this study was implicit subsidies through regulated prices in the district heating sector. The results of the scenarios showed substantial CO_2 emission reductions in the district heating sector. The analysis showed

that richer cities such as Astana and Almaty rather than poorer regions benefitted the most from low energy tariffs.

To summarize, there is currently limited empirical literature using a partial equilibrium or CGE modeling approach on Kazakhstan. Only a few studies, mostly by the World Bank and other international organizations, undertook in-depth analysis using a CGE or partial equilibrium model. There are several studies on the effects of the CU on Kazakhstan and Kazakhstan's accession into the WTO. The results differ depending on the methodology, data use, and assumptions made in the analysis, although directions of change due to the trade policy changes are similar in all studies. Previous studies emphasized the general direction of the effects of trade policy changes such as accession to the CU as having an overall negative effect on Kazakhstan. The studies mentioned above also pointed out that Kazakhstan should rather focus on multilateral integration and first enter the WTO before further integration within the CU with Belarus and Russia.

The necessity for further analysis of alternative trade policies in Kazakhstan is evident. So far, only two policy directions have been considered: 1) accession into the WTO and 2) regional integration. However, there were no studies on other possible trade policies and integration such as the possibility of an FTA with China and other countries outside of the CIS region.

Moreover, there are few studies on energy subsidies or energy pricing in Kazakhstan using a CGE modeling approach or another empirical method. Previous research emphasized that energy subsidies are harmful to both the economy and the environment. Most of the energy subsidies are concentrated in resource-rich countries. Moreover, to the author's knowledge, this is the first study that uses the GTAP framework in analyzing energy subsidies. The GTAP model allows one to follow the impact of policy change on various sectors and regions and see how trade and general welfare changes. This study also contributes to the expanding field of CGE modeling in Kazakhstan by applying the GTAP model and database and providing suggestions for further improvement of CGE modeling on issues in Kazakhstan.

4.2 Database

In this study, the GTAP database version 8.1 and the latest version 9 are used. GTAP database version 8.1 has a reference year of 2007, and the version 9 has a reference year of 2011. The most recent database version 9 was made available in 2015. Specific regional and sector

aggregation allows one to focus on the sectors that will be impacted by policy changes and analyze the effects on other regions.

GTAP is a global database that is compiled by the Global Trade Analysis Project of Purdue University. The database includes 57 sectors, 129 regions, and five factors of production: land, skilled labor, unskilled labor, natural resources, and capital. Moreover, it provides extensive information on bilateral trade, transport, production, consumption, and intermediate use of commodities and services (Walmsley, Aguiar, and Narayanan, 2012).

The GTAP database is based on two main data sources:

- Regional input-output tables: usually nationally published input-output tables and submitted by researchers worldwide.
- Data from international organizations such as the World Bank, World Trade Organization, United Nations Conference on Trade and Development, United Nations Statistics Division, etc.
    - Macroeconomic data is taken from the World Bank Development Indicators.
    - Trade data is taken from the United Nations COMTRADE database.
    - Income and factor taxes come from the IMF government finance statistics.
    - Tariff data is compiled from the MAcMap system.
    - Energy data presented in the database is from the International Energy Agency statistics (Harslett, 2013).

Structure of the GTAP database

GTAPAgg, a data aggregation program, was used to aggregate the regions and sectors for this study. The main files included in the aggregation program that are further used in running the model are listed below.

- Sets.har contains all the sets that are necessary to run the model.
- Basedata.har of GTAP consists of flows valued at various prices, which represent the initial economy.
- Default.prm contains all elasticities used in the model, including Armington elasticities, income and substitution parameters, elasticities of substitution between value added, and others.

- Baseview.har is a data summary file obtained from Basedata.har and contains information such as value of output, GDP etc.).
- Baserate.har contains information on percentage *ad valorem* tax rates.
- Gsdvole.har includes information on volume of input purchases by firms and households and bilateral trade on six energy commodities (Narayanan, Aguiar and McDougall, 2012).

The GTAP database is structured as the arrays in the set of files. The array H1 includes a list of regions, H2 includes traded commodities, and H6 contains primary factors or endowment commodities such as land, skilled and unskilled labor, capital, and natural resources. Array H9 includes capital endowment commodity; array H3 contains non-saving commodities / endowment commodities, traded commodities, and investment goods. H4, demanded commodities, include endowment and traded commodities; H5, produced commodities, include traded and investment goods (see Table 4.4) (Narayanan et al. 2012).

Endowment commodities are categorized into perfectly mobile endowment commodities (array H8) across different industries and sluggish endowment commodities (array H7), which are immobile. In the database, capital, as well as skilled and unskilled labor are classified as perfectly mobile endowment commodities, while land and natural resources are considered sluggish. Labor is divided into skilled and unskilled based on the International Labor Organization (ILO) classification. According to this classification, managers, administrators, professionals and para-professionals are classified as skilled labor force. Tradespersons, clerks, sales personnel, plant and machine operators, laborers, farm workers, etc. are categorized as unskilled labor (Dimaranan and Narayanan, 2012).

Table 4.4 Arrays in the GTAP database sets

Name	Dimension	Description
H1	r	Regions
H2	t	Traded commodities
H3	s+m+t+1	Non-saving commodities
H4	s+m+t	Demanded commodities
H5	t+1	Produced commodities
H6	s+m	Endowment commodities
H7	s	Sluggish endowment commodities
H8	m	Mobile endowment commodities
H9	1	Capital endowment commodities
MARG	g	Margin commodities
TAR	2	Types of tariffs

DEC	5	Types of domestic support payments
PYS	5	Domestic support payments base types
AGRI	12	Agricultural commodities
DREG	38	Regions with domestic support data

g-number of margins commodities (sectors)

m-number of primary factors perfectly mobile across industries

r-number of regions

s-number of primary factors not perfectly mobile across industries
Source: Narayanan et al. (2012)

The parameter file includes the list of elasticities that are used in the database and further in the model. The parameters used in the database are described in detail in Hertel et al. (2012). Table 4.5 lists all the elasticities in the database.

Table 4.5 Elasticities in the GTAP database

Name	Dimension	Description
ESBD	t	elasticity of substitution between domestic product and imports
ESBM	t	elasticity of substitution between imports from different regions
ESBT	t	elasticity of substitution between composite intermediate inputs
ESBV	t	elasticity of substitution between primary factors in the production of value-added
ETRE	s	elasticity of transformation between industries for sluggish primary factor endowments
INCP	t*r	expansion parameter in the CDE consumer demand system
RDLT	1	binary switch mechanism of allocating investment funds
RFLX	r	flexibility of expected net rate of return on capital stock with respect to investment
SLUG	e	sluggish-mobile switch parameter
SUBP	t*r	substitution parameter in the CDE consumer demand system
PYRT	5*5*12*38	domestic support payment rates with appropriate bases in %
PAYD	5*5*12*38	domestic support payments of different types/bases in millions of USD

e-number of factor endowments
r-number of regions
s-number of primary factors not perfectly mobile between industries
t-number of tradable commodities (sectors)
Source: Narayanan et al. (2012)

The elasticities in the GTAP database implemented in the model are briefly mentioned below.

1. Source substitution elasticity

   Source substitution elasticity relates to the substitution between domestic and imported products, and the second to the substitution between the imports from various regions.

2. Factor substitution elasticity

   The CES production function used in the GTAP model is standard to many CGE models. Primary factors of production are assumed to substitute for one another, according to CES; $\sigma_{va,}$ value-added and intermediate inputs are used in fixed

proportions. The primary factor elasticity of substitution determines how the economy reacts to changes in the relative prices and endowment factors and how its output mix changes. CES for primary factors, $\sigma_{va,}$ is provided for all the sectors of the GTAP database.

3. Factor transformation elasticity

   Factor transformation elasticities in the GTAP refer to the degree of primary factor mobility between different sectors. As was already mentioned in the GTAP model description, primary factors are classified as perfectly mobile or sluggish.

4. Investment flexibility parameters refer to the degree of flexibility of regional investments.

5. Consumer demand elasticity is used in the GTAP model to describe private household demand behavior. CDE is based on the assumption of implicit additivity. The CDE implicit expenditure function is represented below

(16) $$\sum_{i \in TRAD} B\ (i,r) * UP^{\beta\ (i,r)\gamma(i,r)} * [PP\ (i,r)/E(PP(r), UP\ (r))]^{\beta\ (i,r)} = 1$$

where *E* is the minimum expenditure function necessary to obtain a pre-specified level of private household utility, *UP*; *PP* is a vector of private household prices. Using minimum expenditure, prices are normalized and raised to the power of $\beta\ (i, r)$ and further combined in additive form (Burfisher, 2011; Hertel, 1997; Narayanan et al. 2012).

Protection data in the database is expressed as implicit and explicit. The explicit data are revenues and expenditure values related to the protection measures. Implicit protection data are listed in Table 4.6, and includes such measures as import and export duties, output subsidies, intermediate subsidies, domestic and imported inputs, and factor-based payments.

Table 4.6 Implicit protection data in the GTAP database set file

Protection measures	Formula	Description
Import duties	VIMS/VIWS	power of import tax (comprehensive)
Export duties	VXMD/VXWD	power of export tax (comprehensive)
Output subsidies	VOA/VOM	power of output tax
Intermediate input subsidies		
domestic inputs	VDFA/VDFM	power of domestic intermediate input tax
imported inputs	VIFA/VIFM	power of imported intermediate input tax
Factor-based payments	EVFA (VFM+FTRV)	power of factor-based subsidies

Source: Narayanan et al. (2012)

There are several reasons for using the GTAP framework in this study. GTAP is a unique data set that allows capturing inter-linkages between different sectors and regions. It allows analyzing the effects of policy changes on CIS countries since it covers almost all countries of

the region and the countries can be aggregated individually. Therefore, the database allows disaggregating regions to include and analyze separately the impact of policy changes on Kazakhstan and other countries.

4.3 Scenario descriptions

This section describes the main scenarios that focus on trade and energy policy in Kazakhstan. Although the aggregations include several regions, the main focus of the analysis is Kazakhstan. The simulations are meant not to provide forecast, but rather analyze the direction of macroeconomic and sector changes due to the policy change.

Table 4.7 provides an overview of the policy scenarios. First, a baseline or reference scenario is run. Updated data obtained from the baseline scenario serves as a reference scenario for policy simulations in scenarios 1 and 2. Scenario 1 identifies the economic and sector effects of Kazakhstan's customs union membership with Russia and Belarus. Scenario 2 quantifies the economy-wide effects of a hypothetical FTA between China and Kazakhstan. Scenario 3 is run separately, based on the latest GTAP database version 9 and with different sector and region aggregations. It focuses on updating the database to include energy subsidies in the country, which allows simulating the effects of subsidy removal in Kazakhstan.

Table 4.7 Description of the scenarios

Scenario	Baseline scenario 2015	Scenario 1: Customs union (CU) – comparative static scenario	Scenario 2: Kazakhstan-China FTA – comparative static scenario	Scenario 3: Subsidy removal – static scenario
Description	Simulating the baseline scenario by projecting the database to the year 2015	Simulating the creation of the CU by modifying the CU CET to the level of 2012 and by removing remaining tariffs between Kazakhstan, Russia, and Belarus	Simulating bilateral full trade liberalization between China and Kazakhstan	Simulating full energy subsidy removal in Kazakhstan
Aggregation	10 sectors and seven regions	10 sectors and seven regions	10 sectors and seven regions	11 sectors and six regions
Database	GTAP database version 8.1	GTAP database version 8.1	GTAP database version 8.1	GTAP database version 9
Variables shocked	GDP (*qgpd*), population (*pop*), skilled labor (*skLab*), unskilled labor (*unskLab*), endowment commodities (*Endw_comm*)	Introduction of the Kazakhstan CET to non-CU countries in the aggregation and removal of the remaining tariffs between CU countries (*tms*)	Bilateral removal of all import tariffs between China and Kazakhstan (*tms*)	Variable output tax, export tax, import duty, consumer and firm subsidy (*tfd, tfm, tpm, tpm, tpd, to, tms*)
Modified data	Projections for all regions of the GDP, population, endowment commodities growth to the year 2015 using international data sources	Common external tariff for the year 2012 for Kazakhstan, sectors aggregated to the GTAP database aggregation using the data from World Integrated Trade Solution and UNCTAD TRAINS (United Nations Conference on Trade and Development, Trade Analysis Information System)	GTAP database 8.1	Update of the energy subsidies in Kazakhstan using national and international data (IEA and World Bank)

4.4 Trade policy scenarios

This section focuses on trade in Kazakhstan with its important trade partners. The database with 57 standard sectors was modified to focus on particular sectors of interest in this study. Table 4.8 lists seven regions and countries, and a total of ten sectors are specified in the model[11]. The regions include Kazakhstan, Russia, Belarus, FSU, EU, China, and the rest of the world. Regional aggregation puts emphasis on countries and regions with the greatest importance to Kazakhstan in terms of the share of external trade. The policy changes could have an impact on the trading partners as well on a trade between Kazakhstan and other countries; therefore, it is important to also consider these countries/regions in the policy simulations. Sector aggregation focuses on agricultural products to analyze the specific impact on the agricultural sector. Production factors specified in the model are land, skilled and unskilled labor, capital and natural resources.

Table 4.8 Model regions and sectors (Scenario 1-3)

No	Sectors	Regions	Production factors
1	Wheat	Kazakhstan	Land
2	Grains & Crops	Russia	Unskilled Labor
3	Dairy	Belarus	Skilled Labor
4	Meat & Livestock	FSU	Capital
5	Processed Food	EU	Natural Resources
6	Beverages & Tobacco	China	
7	Vegetables & Fruits	Rest of the World	
8	Energy		
9	Manufacturing & Chemicals		
10	Other Services & Transportation		

Source: Author's own compilation based on GTAP database 8.1

Baseline scenario 2015

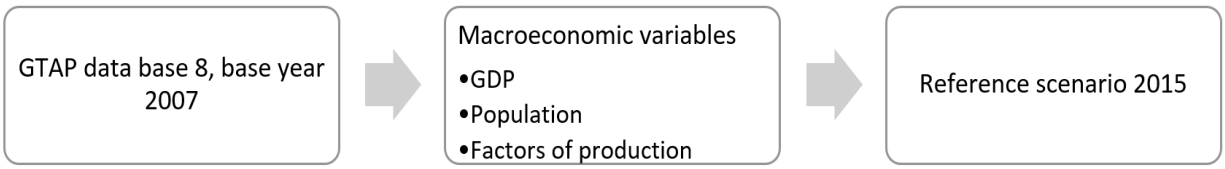
For the purpose of this study a baseline, often referred to as a reference scenario, was run in a single static simulation. It is a common practice in the general equilibrium modelling approach to establish a baseline scenario to some specific year or policy change against which the effects of policy scenarios can be compared. The scenario is implemented to analyze the impact of a policy and calculate the differences between the scenario with policy implemented and a

[11] See Appendix A.2. and A.3.for detailed sector and regional breakdown based on the GTAP database version 8

baseline scenario with no policy implemented (Chappuis and Walmsley, 2011). Furthermore, trade scenarios are analyzed in a comparative static approach.

GTAP database 8.1 includes 129 regions composed of 244 countries. Projections were collected for all the countries. For countries where data was missing, a special approach was implemented to fill in the missing data; the procedure is documented in Chappuis et al. (2011). Following the work of Hertel et al. (2000), external projections of the growth of the GDP, population, skilled and unskilled labor, and capital to the year 2015 are calculated. Assumptions about productivity growth rates are included, which allows one to predict trade flows, input usage, and other variables (Hertel et al. 2000).

Figure 4.1 illustrates a flow chart of the baseline scenario. It shows the main macroeconomic variables that have been shocked in one simultaneous static scenario. Scenario 1 and Scenario 2 are based on the updated core data obtained after running the baseline scenario.



Source: Author's own illustration

Figure 4.1 Flow chart of the baseline scenario

Data source for projections

Various sources have been included to calculate the projections. The sources for the macro projections are as follows:

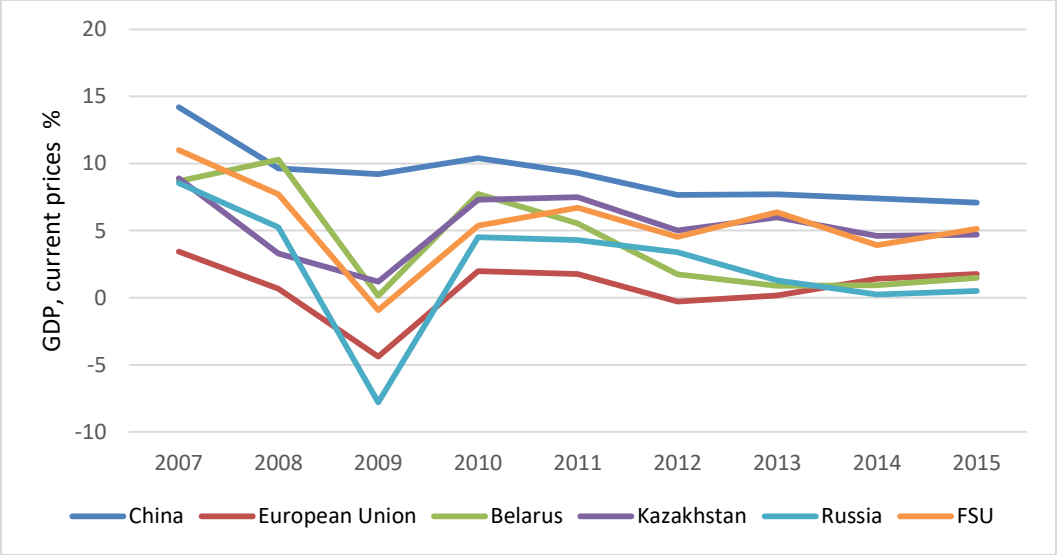
1. Forecast growth in GDP was obtained from the World Economic Outlook, IMF (2014).
2. Projections for population growth are based on the World Economic Outlook, IMF (2014) and U.S. Census Bureau (2013).
3. Skilled labor projections are based on Samir, Barakat, Goujon, Skirbekk, Sanderson, Lutz (2010), Projection of populations by level of educational attainment, age, and sex for 120 countries for 2005-2050, *Demographic Research* 22(15): 383-472.
4. Unskilled labor projections were obtained from Foure, Benassy-Quere A., and Fontagne (2010), The world economy in 2050: a tentative picture, *CEPII Working paper* 2010-27.

5. Capital projections were obtained from Foure, Benassy-Quere A., and Fontagne (2010), The world economy in 2050: a tentative picture, *CEPII Working paper* 2010-27.

   Capital projections $K_t\ (r)$ were estimated by adding projected gross domestic investments $GDI\ (r)$ to the previous years projected capital $K_{t-1}\ (r)$ less depreciation, where depreciation is 4%. Base year capital stocks were obtained from the GTAP database (Walmsley, Dimaranan, and Dougall, 2000).

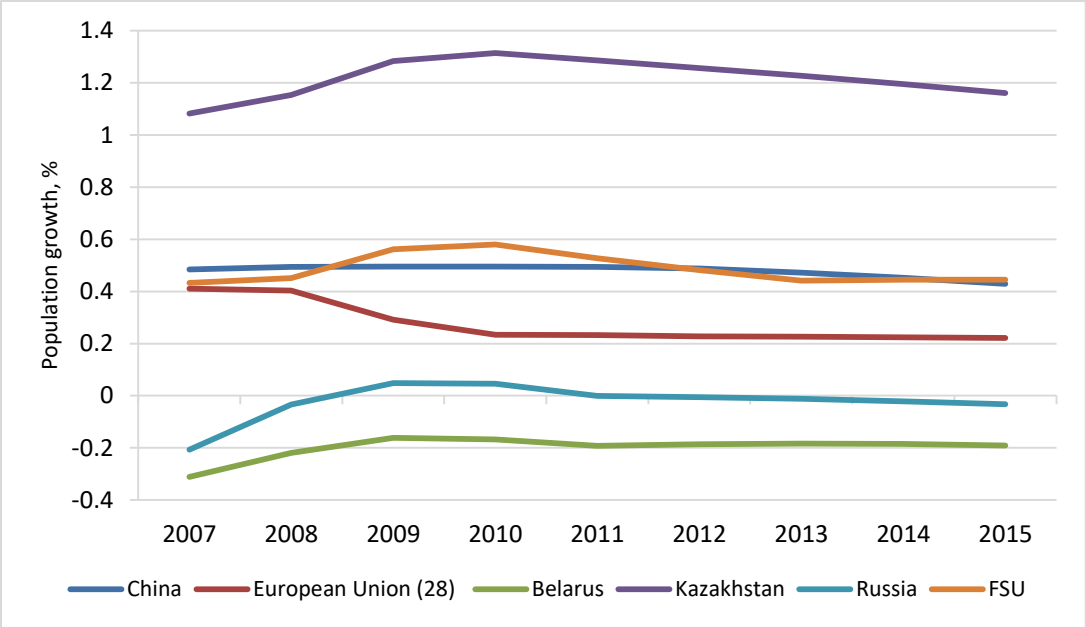
   (17) $K_t\,(r) = K_{t-1}\,(r) * (1- DEPR\,(r)) + GDI\,(r)$

Selected indicators used in the baseline projections are presented in Figures 4.2 and 4.3 below. The percentage changes of macroeconomic variables from the base year of 2007 to projection year 2015 were calculated for each region in the aggregation. The growth rates for GDP and population are shown in Figures 4.2 and Figure 4.3.



Source: Author's own illustration based on IMF, 2014

Figure 4.2 GDP growth rates for 2007-2015 (current prices, %)



Source: Author's own illustration based on U.S. Census Bureau, 2013

Figure 4.3 Population growth rates for 2007 to 2015, %

Changes were made in a main model file, gtap.tab, in order to run a baseline scenario. In a standard GTAP model, the variable GDP is usually an endogenous variable. The GDP variable was swapped with *tfp* (total factor productivity), making GDP an exogenous variable. Swapping GDP with one macro tfp growth rate leads to all sectoral tfp growth rates being equal. This is not in accordance with stylized empirical facts. Therefore, a new equation was added to allow for exogenous user-specified ratios between sectoral growth rates (Hertel et al., 2000). A new header was introduced to the GTAPPARM, a parameters file, in the GTAP model. A new header named "AOSC" is a sector-specific scalar for Hicksneutral productivity growth in the final output.

In the final step, macro projections were aggregated to match the study's specific GTAP aggregation. Shocks were calculated, and the baseline scenario was run in the Gempack software.

Trade scenarios

The next two scenarios are of a comparatively static nature. In Scenario 1, the customs union between Russia, Belarus and Kazakhstan is simulated. Creation of the CU and recent accession to the EEU is considered controversial. Many studies indicated that Kazakhstan has pursued largely regional trade integration with CIS countries since independence and that further trade and economic integration such as the creation of a CU will result in economic losses.

The agreement on the creation of the CU was signed between Belarus, Kazakhstan, and Russia in 2007, and in 2010 the common customs code, rules, and tariffs were implemented. Previous studies have shown that the CU has a negative impact on Kazakhstan, which before the CU had one of the most liberalized trade regimes and lowest effective tariffs among the FSU countries. The initial CU CET was based on Russia's original tariffs. Jandosov and Sabyrova (2011a) calculated that total trade-weighted average import tariff increased from 4.30% to 12.56% after implementing the CET. Under a different methodology estimating the applied tariff protection level, Jandosov & Sabyrova (2011b) calculated that the simple average AVE tariff rate increased from 6.78% to 12.31%, and the trade-weighted average went from 5.52% to 12.66%.

A World Bank (2012) study indicated that the average tariff increased from 6.7% to 11.1%, and the trade-weighted tariff increased from 5.3% to 9.5%. The CET caused a significant change in the import tariff structure, particularly in Kazakhstan, where around 10% of the tariff lines increased and 45% decreased. The main increases were in the following sectors: transportation, wood, refrigeration equipment, electro-mechanical equipment, footwear, and apparel. Decreased tariffs were in the agricultural sector, hides and skins, and medical equipment and appliances. In Russia and Belarus, few tariff lines changed (de Souza, 2011).

First, the creation of the CU was simulated. All remaining barriers to trade between Belarus, Kazakhstan and Russia were removed. Second, import tariffs of Kazakhstan towards all non-CU members were shocked, except for the CIS countries. Updated tariffs for 2012 used in the simulation were obtained from the World Integrated Trade Solutions (WITS, 2014) and UNCTAD Trade Analysis and Information System (TRAINS). TRAINS is a comprehensive database that includes data on tariff and non-tariff measures under the most disaggregated level of HS for 150 countries. The benefit of the TRAINS database is that it is in concordance with GTAP nomenclature. The import tariffs of Kazakhstan, Russia, and Belarus for this policy scenario were based on the year 2012, which reflected adjustments of the CET after Russia's WTO accession. Russia's reduction of tariffs due to the WTO commitments led to the reduction of the CU CET. Agricultural product tariffs were especially decreased after Russia's accession into the WTO (OECD, 2013). The changes in import tariffs are implemented only for Kazakhstan because, as noted by other studies on CU, Russia's and Belarus import tariffs were not affected or only marginally changed by the implemented CU CET.

Scenario 2 aims to describe an alternative trade policy for Kazakhstan, which simulates a hypothetical full trade liberalization between Kazakhstan and China.

China is one of the most important trade partners of Kazakhstan, both in exports and imports. Trade with China has rapidly increased since independence in 1991 and is continuously expanding. Moreover, from both countries there have been calls for deeper economic integration, including possibilities for free trade agreements. Therefore, considering that Kazakhstan until now has pursued largely regional integration, it is of specific interest to consider alternative options for trade policy in Kazakhstan. The scenario was run by simulating a complete removal of import tariffs[12] between the Kazakhstan and China.

The choice of scenarios was motivated by observing and analyzing current academic, political, and public discussions and debates on the international and national levels. The scenarios analyzed current and alternative policy scenarios for Kazakhstan in the field of trade policy and the energy sector. The next section of the chapter discusses the results of the two scenarios. The results are presented separately for each scenario. The GTAP model produced numerous output results. The main outputs of the model are presented, including the effects on GDP, welfare, trade balance, export and import changes, and sector output changes.

4.4.1 Results: scenario 1

This section of the chapter reports quantitative estimates of the likely impact of customs union on Kazakhstan's economy and sectors of the economy. The simulation analysis provides the effects on Kazakhstan's GDP; decomposed welfare effects for all countries and regions in the model; Kazakhstan's trade balance; and Kazakhstan's exports, imports, and production by sectors.

The model scenario results using the GTAP model estimate that under existing CU conditions, Kazakhstan's welfare decreased by 215 million USD (- 0. 09% of GDP), and real GDP decreased by 0.04%.

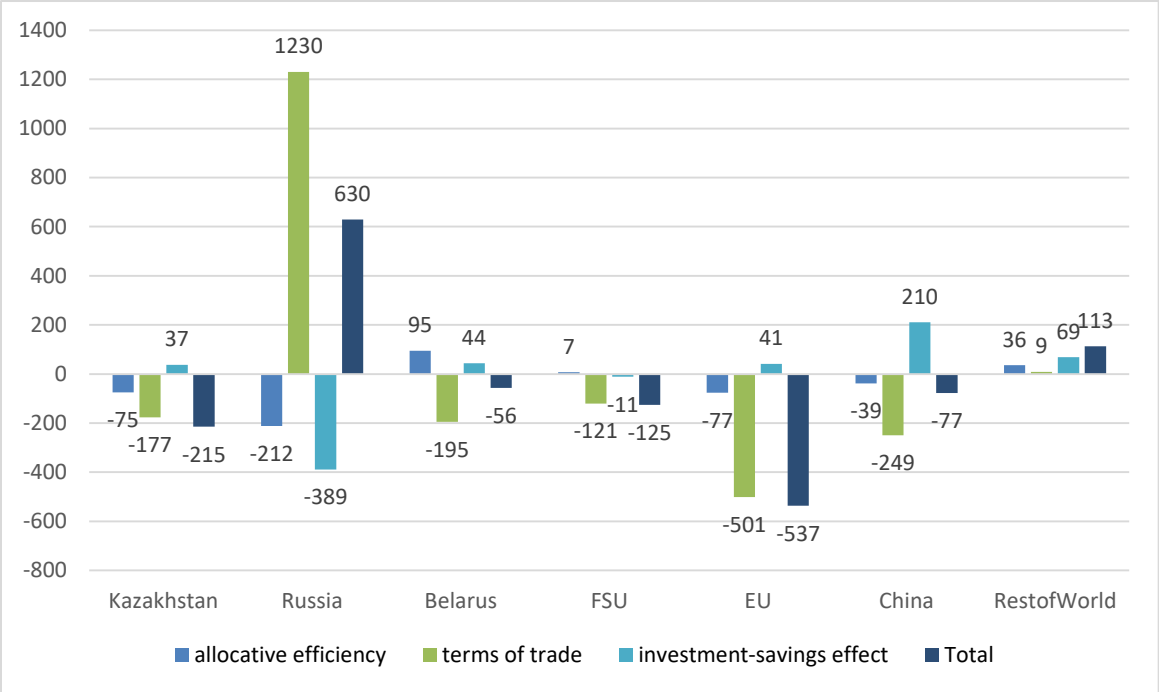
GTAP and Gempack software allow decomposing welfare results in order to analyze in detail the sources of welfare increase or decrease. Figure 4.4 depicts welfare changes by the effects of allocative efficiency, terms of trade, and investment savings for all countries and regions in the model. For Kazakhstan, the main sources of welfare loss were decreasing terms of trade and decreasing allocative efficiency effects.

[12] Import tariffs between the two countries were presented in Chapter 2, section 2.6.

Figure 4.4 indicates that Russia had the largest gains in overall welfare, largely caused by positive effects of the terms of trade. The positive effects on Russia can be explained by the fact that Kazakhstan imported more from Russia, while Russia traded with other non-CU countries. Kazakhstan on other hand experienced overall welfare deterioration by 215 million USD. The largest contributor to the decreasing welfare was deteriorating terms of trade by 177 million USD. The equation below from the GTAP model code shows that terms of trade in the model are calculated as the difference between the price index received for tradable commodities produced in region *r*, including sales of net investment to the global bank and price index paid for tradable commodities used in region r, including purchases of savings from the global bank.

(18) *Variable (orig_level=1.0)(all,r,REG)*
tot(r) # terms of trade for region r: tot(r) = psw(r) - pdw(r) #;
Equation TOTeq
 # terms of trade equation computed as difference in psw and pdw (HT 66) #
(all,r,REG)
tot(r) = psw(r) - pdw(r);

where PSW_r price index received for tradable commodities produced in region r, including sales of net investment to the global bank and PDW_r price index paid for tradable commodities used in region r, including purchases of savings from the global bank.



Source: Author's estimates

Figure 4.4 Welfare changes and welfare decomposition by region, in millions of USD

Gempack software allows for decomposing the effects of terms of trade by sector, which can reveal the sectors that experience the largest terms of trade losses or gains. Table 4.9 indicates that all sectors in the model have deteriorating terms of trade. The largest decrease can be observed in the energy (-52 million USD) and manufacturing and chemicals (-88 million USD) sectors. The total decrease in terms of trade for the agro-food sector was 23 million USD.

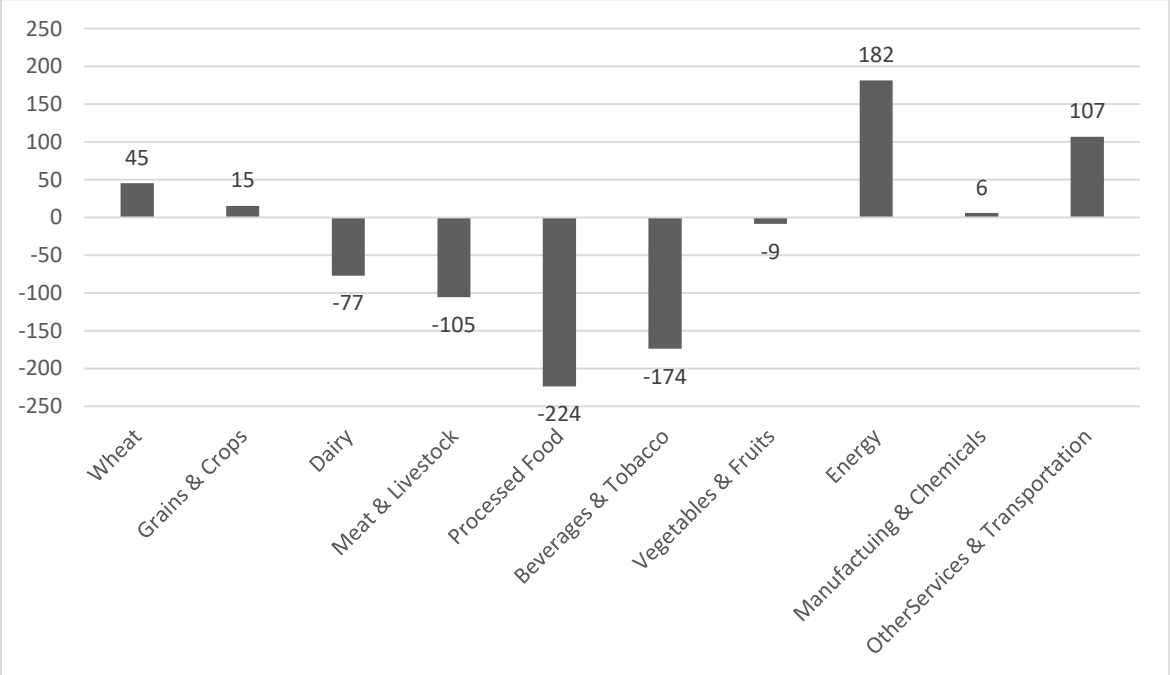
Table 4.9 Terms of trade effects in Kazakhstan, in millions of USD

Sectors	
Wheat	-7
Grains & Crops	-4
Dairy	-1
Meat & Livestock	-2
Processed Food	-6
Beverages & Tobacco	-2
Vegetables & Fruits	-1
Energy	-52
Manufacturing & Chemicals	-88
Other Services & Transportation	-14
Total	**-177**

Source: Author's estimates

The CU had a negative effect on the aggregate trade balance in Kazakhstan as indicated in Figure 4.5, which depicts changes in the trade balance by sector in the country. The trade balance in Kazakhstan deteriorated by a total of 234 million USD. As a result of the CU, the increase in imports in relation to exports could be observed in the country for almost all sectors, except for wheat, grains and crops, and energy. The positive trade balance impact was in wheat (45 million USD), grains and crops (15 million USD), energy (182 million USD), manufacturing and chemicals (6 million USD), and other services and transportation (107 million USD).The largest positive impact in the trade balance was in the energy sector (182 million USD).

The negative impact on Kazakhstan's trade balance is observed in the agricultural sectors such as dairy (-77 million USD), meat and livestock (-105 million USD) and processed food (-224 million USD).



Source: Author's estimates

Figure 4.5 Trade balance changes by sector in Kazakhstan, in millions of USD

Table 4.10 presents results of the trade balance changes in other regions. There is an overall improvement in the aggregate trade balance in Russia (433 million USD) and a decrease in the trade balance in Belarus (-478 million USD). Moreover, a positive effect on trade balances in other countries such as the FSU, EU, and the rest of the world is observed.

Table 4.10 Trade balance changes by region, in millions of USD

	Russia	Belarus	FSU	EU	China	Rest of the world
Wheat	-87	-4	9	7	2	28
Grains & Crops	-28	-5	21	10	6	-21
Dairy	51	16	-6	8	0	-6
Meat & Livestock	96	-14	-1	9	3	1
Processed Food	401	-1	-123	-45	1	-51
Beverages & Tobacco	316	-67	-66	-31	0	-6
Vegetables & Fruits	-35	-3	12	11	4	8
Energy	-2,094	187	119	248	114	1,194
Manufacturing & Chemicals	2,630	-527	-27	-682	-393	-1,235
OtherServices & Transportation	-816	-59	79	751	101	225
Total	433	-478	18	285	-162	138

Source: Author's estimates

Overall both import and export changes in Kazakhstan are positive (Table 4.11). The largest percentage increase in imports is observed in the agro-food sectors such as dairy (38.55%), meat and livestock (71.66%), processed food (15.71%), beverages and tobacco (41.05%), and vegetables and fruits (13.95%). This could be interpreted as a response to the trade policy change where domestic products are substituted by imported products. Kazakhstan's exports would increase for all sectors. The largest increases in percentage are observed in the meat and livestock (4.09%) and manufacturing and chemical sectors (3.03%).

Table 4.11 Export and import effects in Kazakhstan

	Exports (change in %)	**Imports (change in %)**
Wheat	1.98	7.35
Grains & Crops	2.43	0.51
Dairy	3.7	38.55
Meat & Livestock	4.09	71.66
Processed Food	1.75	15.71
Beverages & Tobacco	2.27	41.05
Vegetables & Fruits	2.17	13.95
Energy	1.63	11.64
Manufacturing & Chemicals	3.03	0.6
Other Services & Transportation	0.94	-0.67

Source: Author's estimates

Increasing imports specifically of agro-food products can be explained by an increasing import volume from Russia and high import taxes on agricultural products that Kazakhstan previously applied towards imports from Russia and that were subsequently removed in the policy scenario. Removing the remaining import duties Kazakhstan imposed previously on Russian

and Belarusian products increased the demand for imported products and decreased the demand for domestic products.

Tables 4.12 and 4.13 below present volume and percentage changes of exports from other regions to Kazakhstan. The results of the export changes show that Russia will export significantly more to Kazakhstan. Other regions such as the EU, China, and the rest of the world export less to Kazakhstan, which can be interpreted as a trade diversion. In volume changes, the largest decrease in imports is observed from the EU and China, the two largest sources of imports for Kazakhstan.

In volume changes as depicted in Table 4.12 the largest increase can be observed in the manufacturing and chemical sectors, and Kazakhstan imports significantly more from Russia and less from China and the EU. Significant results particularly for this sector can be explained by the fact that this sector, though in this study not disaggregated, comprises a major share of total imports to Kazakhstan.

Results in sectors such as manufacturing and chemicals can be explained by the fact that these products before the policy change were already highly traded between Russia and Kazakhstan[13]. The magnitude of the import changes in manufacturing and chemicals is explained by the fact that this sector makes up around 60% of total imports according to the database year in GTAP version 8.

Table 4.12 Volume changes[14] in imports by trade partners, in millions USD

	Russia	Belarus	FSU	EU	China	Rest of the world
Wheat	0.07	-0	-0	-0.03	-0	-0.01
Grains & Crops	8,49	0	-1,77	-0.93	0.98	-6,16
Dairy	75,97	19,1	-18,57	-3,36	-0.26	-0.72
Meat & Livestock	141,3	0.93	-10,85	-8,69	-0.57	-18,28
Processed Food	331,96	16,01	-80,37	-29,47	-13,93	-19,25
Beverages & Tobacco	206,05	-0.07	-26,77	-21,17	-0.11	-3,15
Vegetables & Fruits	12,5	-0	-0.58	-0.82	1.20	-2,35
Energy	327,24	1,81	-67,54	-32,08	-21,71	-14,54
Manufacturing & Chemicals	3,357.77	102,55	-118,87	-1,417.01	-1,154.66	-692,32
Other Services & Transportation	-7,32	-0.19	-0.10	-40,77	-2	-35,04
Total	4,454.04	140.13	-325.43	-1,554.34	-1,191.06	-791.83

Source: Author's estimates

[13] Appendices A.4. and A.5. include the import and export structure of Kazakhstan in the GTAP database version 8.1

[14] Change in volumes i.e. quantity concept measured in million USD, at base year prices, i.e. keeping prices constant

Analyzing percentage changes, the largest import change increases can be observed with imports from Russia. The meat and livestock sector has the largest increase in imports in percent terms from Russia and Belarus. Other agricultural sectors such as dairy, processed food and beverages, and tobacco also experience significantly expanded imports from Russia. In percentage change, imports from other regions decrease (Table 4.13).

Table 4.13 Change in exports of other regions to Kazakhstan (change in %)

	Russia	Belarus	FSU	EU	China	Rest of the world
Wheat	28	-9	-13	-43	-14	-14
Grains & Crops	27	10	-4	-4	33	-12
Dairy	85	93	-31	-34	-20	-18
Meat &Livestock	168	213	-56	-63	-52	-60
Processed Food	51	136	-26	-27	-21	-25
Beverages & Tobacco	88	-20	-45	-28	-12	-24
Vegetables & Fruits	46	-23	-21	-21	7	-11
Energy	22	28	-22	-35	-19	-30
Manufacturing & Chemicals	45	55	-5	-23	-15	-21
Other Services & Transportation	-2	-4	0	-1	-1	-1

Source: Author's estimates

Furthermore, output effects by sector are discussed. Table 4.14 reports sector output percent and volume changes. The trade policy changes adversely affect the output of almost all sectors. The results show that output slightly expands in several sectors such as energy (0.53%), manufacturing and chemicals (0.54%), wheat (1.23%), and grains and crops (0.67%). On the other hand, in percent terms the following sectors shrink: beverages and tobacco (9.72%) and processed food (4.02%).

Table 4.14 Sector output changes in Kazakhstan

	Sector output (change in %)	Sector output (change in million USD)
Wheat	1.23	57
Grains & Crops	0.67	17
Dairy	-1.02	-92
Meat & Livestock	-1.02	-123
Processed Food	-4.02	-198
Beverages & Tobacco	-9.72	-166
Vegetables & Fruits	-0.33	-12
Energy	0.53	284
Manufacturing & Chemicals	0.54	242
Other Services & Transportation	-0.05	-83

Source: Author's estimates

Private household and government demand for domestic products in Kazakhstan decreases. On the other side, private household and government demand for imports decrease. A significant increase in imports can be observed for agricultural products.

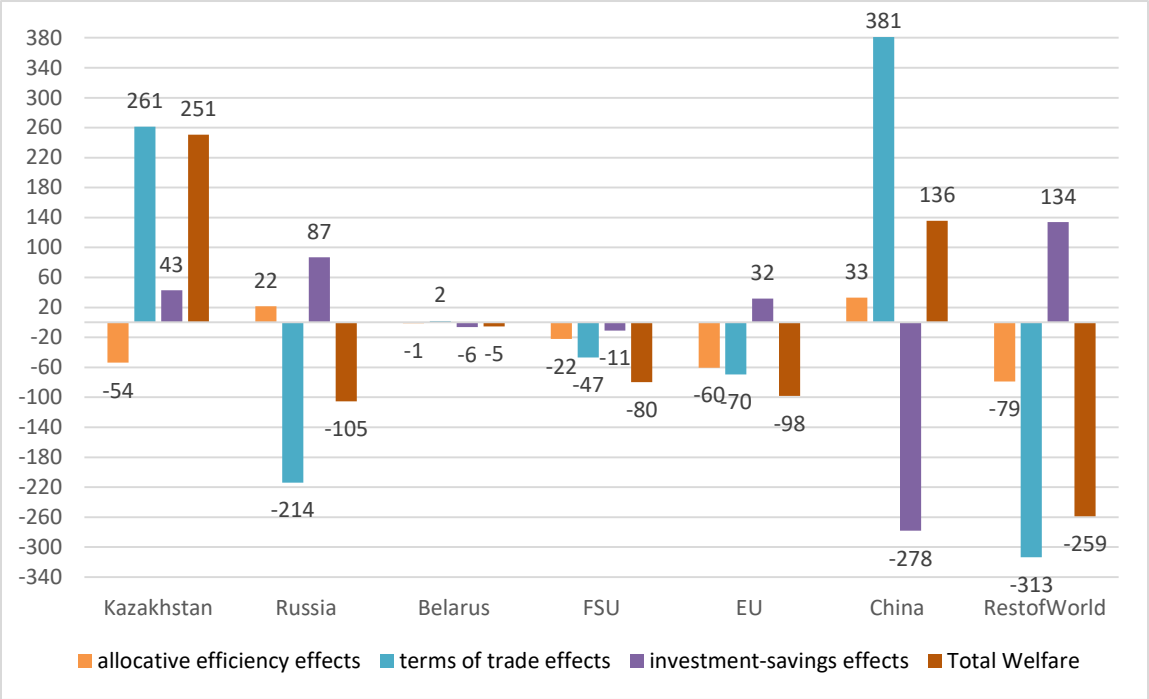
Kazakhstan's membership in the CU also has an impact on other regions. In this scenario, the country most profiting from the policy change is Russia. Russia experiences a welfare gain of 629 million USD. The largest contributing factor to the welfare gain in Russia is the improvements to the terms of trade. Kazakhstan's demand for Russian products increase; as a result Russian prices increase, and Russia realizes larger terms of trade gains. The increasing welfare gain in Russia can be also explained by looking at the trade balance changes. Russia's trade balance improves by approximately 433 Million USD. Due to the policy change, Russia starts to export more to Kazakhstan. After analyzing other regions in the model, FSU, Belarus, China, and the EU all experience a slight decrease in welfare, and considering the size of the economies and other factors such as trade with Kazakhstan, the proportions of welfare reduction are different.

4.4.2 Results: scenario 2

The results of the scenario simulating a hypothetical FTA between China and Kazakhstan obtained using the static version of the GTAP model are presented in the following part of the chapter. The simulation analysis provides results of the welfare effects degraded by individual components, changes in trade balance, Kazakhstan's exports and imports, and production changes.

Changes in welfare and welfare decomposition in all regions are presented in Figure 4.6. As a result of full trade liberalization between Kazakhstan and China, both countries will experience overall welfare improvement. The overall welfare in Kazakhstan will improve by 251 million USD. Terms of trade effects increase by 261 million USD in Kazakhstan contributing the most to the overall welfare improvement in the country. A small decrease in real GDP by 0.030% and in regional household by 0.3% can be observed. As a result of the policy change, real exchange rate slightly appreciates by 0.128%.

Considering the economic effects of a possible FTA between China and Kazakhstan on other regions and countries, in all other regions except China and Kazakhstan, welfare deteriorates. The largest welfare decrease is in Russia (-214 million USD) and the rest of the world (-313 million USD). Other FSU countries experience welfare decrease of -47 million USD.



Source: Author's estimates

Figure 4.6 Welfare changes and welfare decomposition, in millions of USD

As previously mentioned, the effects of terms of trade have the largest impact on the improvement of overall welfare in Kazakhstan. Terms of trade improve significantly for manufacturing and chemicals (253 million USD) and energy (17,7 million USD) sectors in Kazakhstan (Table 4.15). Almost all agricultural sectors experience decreasing terms of trade. The beverages and tobacco sector have a marginal increase in terms of trade.

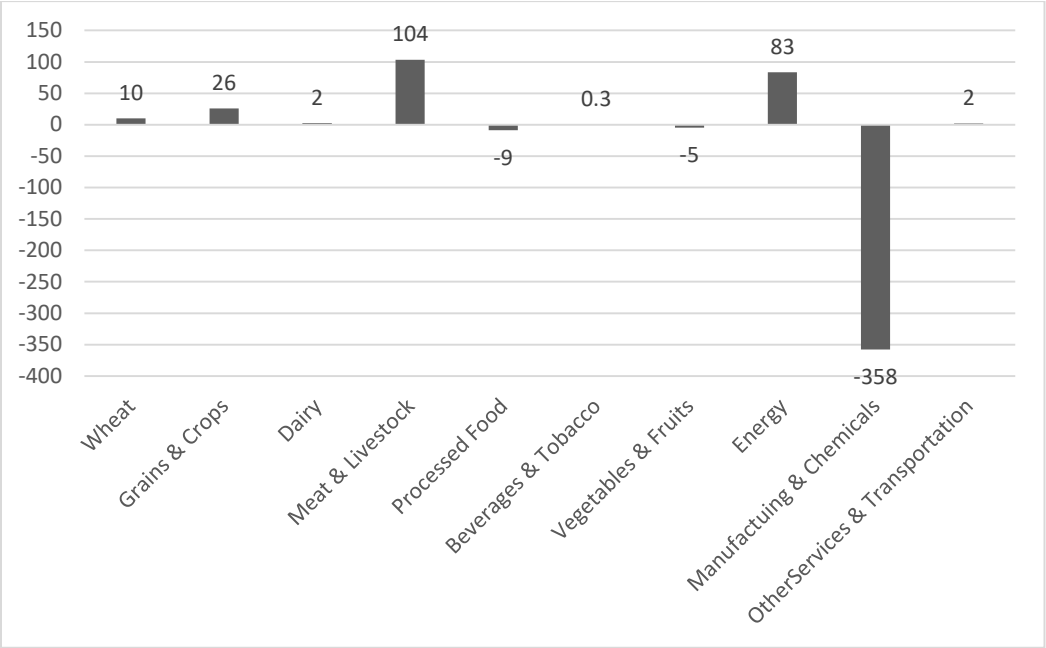
Table 4.15 Terms of trade effects in Kazakhstan by sector, in millions of USD

Sectors	
Wheat	-2
Grains & Crops	-2,1
Dairy	-0.2
Meat & Livestock	-0.2
Processed Food	-1,7
Beverages & Tobacco	0.1
Vegetables & Fruits	-0.5
Energy	17,7
Manufacturing & Chemicals	253,3
Other Services & Transportation	-2,3
Total	**262**

Source: Author's estimates

The effect of an FTA on Kazakhstan's aggregate trade balance is negative (-144 million USD) and positive in China (206 million USD) relative to the baseline. Sectors with positive changes in trade balance are wheat (10 million USD), grains and crops (26 million USD), dairy (2 million USD), meat and livestock (104 million USD), energy (83 million USD), and other

services and transportation (2 million USD). Manufacturing and chemicals has the most significant trade balance impact (358 million USD) (Figure 4.7).



Source: Author's estimates

Figure 4.7 Change in trade balance by sector in Kazakhstan, in million USD

The estimated import and export percentage effects for different sectors in Kazakhstan are shown in Table 4.16. Kazakhstan would export more meat and livestock (54.35%), grains and crops (3.5%), and manufacturing and chemicals (7.05%). A slight percentage increase in imports can be observed. Table 4.16 shows that the largest increase in imports in terms of percentage would be vegetables and fruits (7.7%) and manufacturing and chemicals (5.27%).

Table 4.16 Estimated effects on aggregate exports and imports Kazakhstan (change in %)

	Exports	Imports
Wheat	0.48	-0.02
Grains & Crops	3.5	0.01
Dairy	1.91	-0.13
Meat & Livestock	54.35	0.22
Processed Food	1.64	1.32
Beverages & Tobacco	0.41	0.02
Vegetables & Fruits	1.08	7.7
Energy	0.57	4.75
Manufacturing & Chemicals	7.05	5.27
OtherServices & Transportation	0.2	0.03

Author's estimates

An overview of the results reported below is meant to provide an understanding of the range of sector results. Table 4.17 reports percentage changes in sector output that can be observed in Kazakhstan and China. Analyzing the effects of trade liberalization, almost all sectors in Kazakhstan slightly expand production. The only contracting sector in Kazakhstan is manufacturing and chemicals (-0.95%). The results can be explained through general equilibrium effects of the model; as some sectors shrink their production, the resources move to other sectors of the economy. Results obtained from the policy simulation show that the impact on sector output in China is marginal.

Table 4.17 Sector output changes in Kazakhstan and China (change in %)

Sectors	Kazakhstan	China
Wheat	0.33	-0.03
Grains & Crops	1.23	-0.03
Dairy	0.13	-0.01
Meat & Livestock	1.03	-0.02
Processed Food	0.12	-0.01
Beverages & Tobacco	0.12	0
Vegetables & Fruits	0.01	0
Energy	0.1	0.01
Manufacturing & Chemicals	-0.95	0.01
Other Services & Transportation	0.09	0

Source: Author's estimates

One of the outcomes of the model simulation is the negative effects on other regions such as Russia, the EU, and FSU. The three regions experience decreasing aggregate welfare, and Russia and the EU also experience a deterioration in trade balance. On other hand, a slight improvement in the trade balance of the FSU region can be observed.

4.5 Energy policy scenario

Specific aggregation for the energy scenario based on the latest standard version 9 of the GTAP database includes 140 regions across 57 sectors. For the purpose of this policy scenario, the database was modified to focus on particular sectors of interest: farming, coal, oil, gas, processed food (procfood), petroleum products (p_c), the chemical sector (chem), the rest of the economy (RestOfEconom), gas manufacturing and distribution (GasMnfDstr), electricity, and other services (OthServices). Table 4.18 shows countries and regions specified in the

model[15]. Regions include Kazakhstan, Russia, FSU, EU27, China, and the rest of the world. The production factors are the standard five factors, including land, unskilled and skilled labor, capital, and natural resources.

Table 4.18 Model regions and sectors

	Sectors	Regions	Production factors
1	Farming	Kazakhstan	Land
2	Coal	Russia	Unskilled labor
3	Oil	FSU	Skilled labor
4	Gas	EU_27	Capital
5	ProcFood (processed food)	China	Natural resources
6	P_C (petroleum and coal products)	RestofWorld	
7	Chem (chemicals sectors)		
8	RestOfEconom (rest of the economy)		
9	GasMnfDstr (gas, manufacturing, and distribution)		
10	Electricity		
11	OthServices (other services)		

Source: Author's compilation based on GTAP database 9

To proceed with a running simulation on subsidies and taxes in the energy sector in Kazakhstan, several steps have to be taken. (1) Improved information on subsidies in the energy sector has to be implemented in the database using the Altertax procedure. (2) Shocks to remove all subsidies and taxes are calculated using the shocks procedure (shocks.tab and shocks.cmf). (3) Finally, using updated subsidies and tax data, the main static scenario is run.

In order to improve the representation of energy subsidies in the GTAP framework, the GTAP database is supplemented with additional data through the Altertax model. Data from international organizations is used in modifying tax and subsidy data on Kazakhstan. The subsidies used in updating the core database are averaged across producers and consumers, as well as time and regions within a country, but they are different across energy inputs. It should be noted that the "overall" energy subsidy rate is different from consumer to consumer depending on the mix of energy inputs they use and the share in overall costs.

The Altertax model was specifically developed in order to adjust tax rates in the GTAP database. This procedure allows maintaining internal consistency of the database and at the same time minimizing the impact of tax changes on the value flows in the database. The

[15] See Appendix A.6. and A.7. for detailed sector and region breakdown.

parameter settings include the Cobb-Douglas production and consumption functions, Cobb-Douglas inter-intermediate input substitution, universal factor mobility, and fixed trade balance. In contrast to the standard model, the Altertax model structure and parameters are meant to minimize disturbances in the database (Malcolm, 1998).

In the second step, using the model data file (shocks.tab) and shocks file (shocks.cmf), the shocks necessary to remove all taxes and subsidies in the energy sector were calculated.

In the final step, employing a modified database and model, the removal of taxes and subsidies is simulated in the energy sector in Kazakhstan. The scenario is of a static nature. All these variables have been shocked to the target rate equal to zero. The following variables have been shocked: 1) tax on domestic and imported energy products purchased by companies (*tfm* and *tfd*), 2) tax on domestic and imported energy products purchased by households (*tpm* and *tpd*), 3) output tax on energy products (*to*), and 4) import duties on energy products (tms).

The scenario does not capture all the existing subsidies and market distortions in the energy sector in Kazakhstan but is rather based on the available stable data provided by the international organizations, which also implied making assumptions by the researcher. The results represent the lower bound of the impact of distortions in the energy market in the country.

Results

Removing energy subsidies in Kazakhstan has a significant impact on macroeconomic indicators. Selected macroeconomic results are presented in Table 4.19. The welfare impact of full elimination of energy subsidies measured in terms of EV are large and overall positive, improving by 4,906 billion USD, which is equivalent to around 2.6% of GDP. Positive welfare effects come largely from changes in the allocative efficiency effects. Terms of trade effects in Kazakhstan are negative. Changes in the prices of capital goods (*cgd*) have a positive impact on welfare.

The equation below from the GTAP model code shows the contribution to regional equivalent variation (EV) in the price of cgds:

(19) *CNTcgdsr(r) # contribution to regional EV of changes in the price of cgds #;*
Equation CNT_EV_cgdsr
(all,r,REG)

*CNTcgdsr(r)= [0.01 * EVSCALFACT, (r)] * [NETINV(r) * [pcgds, (r) - pxwwld] - SAVE(r) * [psave(r) - pxwwld]];*

where *EVSCALFACT (r)* = equivalent variation scaling factor; *NETINV(r)*= net investment in region *r*; *pcgds (r)* = price of investment good in region *r*; *pxwwld* = price index of world trade; *SAVE(r)* = value of (net) savings in region *r*; *psave(r)*= price of savings in region *r*.

In the simulation, the results for Kazakhstan: psave = -9.815, pcgds = -9.830 and pxwwld = 0.035. To obtain a positive value for *CNTcgdsr* for Kazakhstan, it must be the case that NETINV < SAVE in initial equilibrium.

The energy sector is generally a capital-intensive sector. The rate of return to capital declines, investments decline, and savings decline as well. The macroeconomic accounting equation in the GTAP model presented below helps explain the results of the model. The equation states that national savings minus investments are equal to current account surplus or deficit (trade balance) (Hertel, 1997):

(20) $S-I=X-M$

where S = saving; I = investments; X =exports; M = imports.

The difference between exports and imports is the trade balance. In this accounting equation, the real exchange rate is an equilibrating factor. The GTAP model does not include the explicit nominal exchange rate but rather the variable *pfactor (r)*, which reflects changes in the real exchange rate. The *pfactor* describes percentage changes in an index of a country's factor prices relative to the world average market price (Burfisher, 2011). The results demonstrate that the real exchange rate in Kazakhstan depreciates by 21.24%, and therefore overall exports increase, and overall imports decrease.

The quantity GDP (*qgdp*) index, which is a change in real GDP, measures efficiency gains and reflects shifts in the economy production possibilities frontier due to the changes in the production and improved allocation of a fixed resource base (Hertel, 1997). The GDP quantity index increases by 2% in Kazakhstan as a result of a policy change. Energy subsidies are a burden to the government and economy, and removing subsidies leads to potential economic growth and gains.

Regional household income *(y (r))* declines because factor prices according to the model calculations decline.

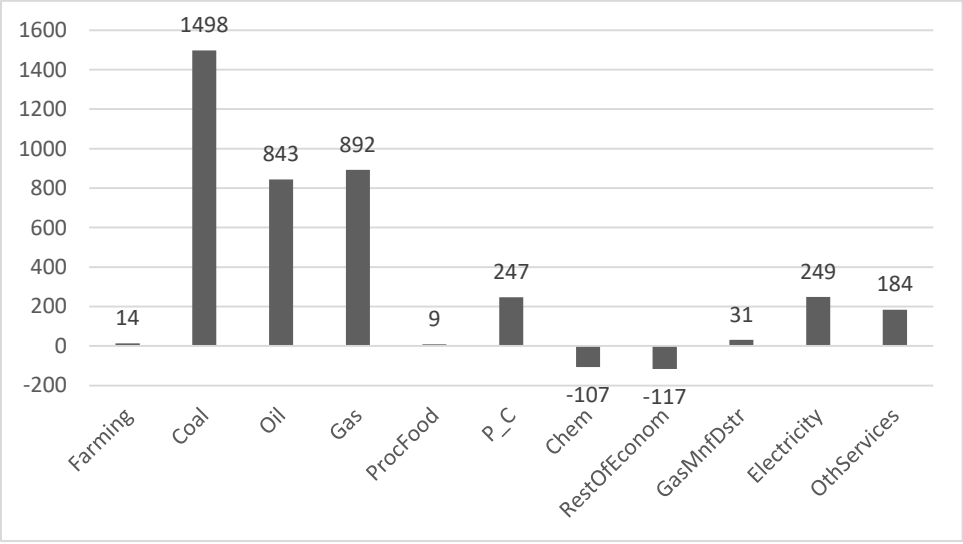
Table 4.19 Selected macroeconomic results

	Kazakhstan
Welfare changes (in millions of USD)	4,906
Allocative efficiency effects	3,743
Terms of trade changes	-873
Change in the price of capital goods	2,036
QGDP (quantity GDP) (change in %)	2
Y (regional household income (change in %)	-6
Real exchange rate (change in %)	-21.24
Total exports (change in %)	5.6
Total imports (change in %)	-2.7
Trade balance (change in millions of USD)	3,786

Source: Author's estimates

Other regions are also impacted by policy changes in the country. Russia, FSU, and the EU experience overall welfare improvement. In this case, the major contributor to welfare changes in the EU are the positive shifts in terms of trade. This could be explained by the fact that Kazakhstan is a net exporter of energy largely to the EU, and changes in the energy policy would have an impact on the main trading partners. Therefore, it can be foreseen that changes in the energy policy would have an impact on the EU.

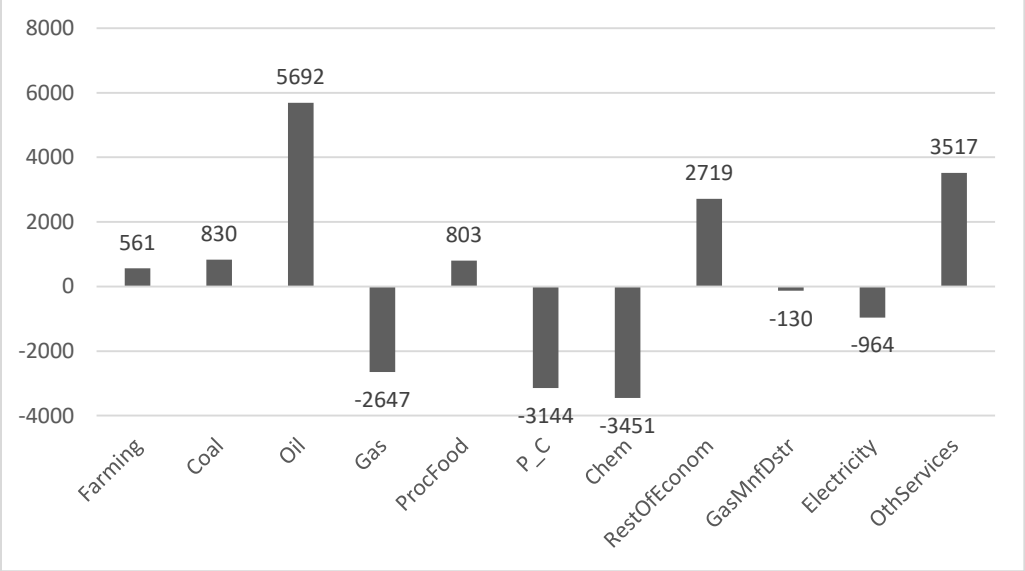
Figure 4.8 depicts allocative efficiency effects in Kazakhstan by sector. Almost all energy sectors in this scenario have improvement in allocative efficiency; the largest improvement is observed in the coal sector. Only two sectors, chemicals and the rest of the economy have negative allocative efficiencies.



Source: Author's estimates

Figure 4.8 Allocative efficiency effects by sector, Kazakhstan, in millions of USD

Figure 4.9 presents trade balance changes by sector. Removing subsidies in the energy sector would have an overall positive effect on the trade balance. Trade balance changes are positive for oil, the rest of the economy, farming, and processed food. Petroleum and chemicals have deteriorating trade balance effects.



Source: Author's estimates

Figure 4.9 Trade balance changes in Kazakhstan, n millions of USD

The findings on changes in the current net rate of return on capital stock and the output of the capital goods sector are reported in Table 4.20. Removing energy subsidies impacts investments as well. In this case, both capital rentals and investments decline. Standard GTAP set-up assumes that economy-wide investments (*qcgds (r)*) are allowed to change and that the sector employment of existing capital is allowed to change. The net rate of return on capital stock and the output of the capital goods sector decreases in Kazakhstan.

Table 4.20 Capital goods and net rate of return on capital stock in Kazakhstan (change in %)

Current net rate of return on capital stock	-15
Output of the capital goods sector	-9

Source: Author's estimates

Removing energy subsidies leads to an increase in production costs in energy intensive sectors, which causes a decline of output in many sectors (Table 4.21). Energy products are an important intermediate input in most of the sectors[16].

[16] Appendix A.8 provides data on the cost structure of companies in Kazakhstan, including expenditures on energy products

The most significant decreases in output in percentage terms are in the gas, petroleum (p_c), gas manufacturing and distribution (GasMnfDstr), and electricity sectors. Farming, processed food (ProcFood), oil, the rest of the economy, and other services expand. These sectors profit from decreased labor, capital, and natural resource demand in contracting sectors. Moreover, although all other energy sectors' production declines, the oil sector expands by 4% when subsidies are applied to domestic consumption and not exports. The oil sector accounts for a large share of Kazakhstan's production and exports.

Table 4.21 Industry output (% and volume change in millions of USD)

	%change	pre-simulation	post-simulation	volume change
Farming	4	29,405	30,592	1,187
Coal	-12	16,422	14,521	-1,901
Oil	4	46,048	47,831	1,783
Gas	-62	18,449	7,081	-11,367
ProcFood	7	26,360	28,092	1,733
P_C	-37	11,733	7,429	-4,305
Chem	-12	51,060	44,926	-6,135
RestOfEconom	17	20,116	23,542	3,426
GasMnfDstr	-36	865	556	-309
Electricity	-23	9,847	7,623	-2,224
OthServices	2	217,146	221,323	4,178
CGDS	-9	39,961	36,328	-3,633

Source: Author's estimates

Table 4.22 presents percentage changes and Table 4.23 volume changes in domestic sales, exports, and imports in Kazakhstan. Domestic sales decrease substantially for most sectors. Domestic consumption decreases for all energy products.

Exports of crude oil, which account for large share of Kazakhstan's GDP, benefit from energy reform. After removing energy subsidies, net exports of energy products such as coal and oil increase. This can be explained by the savings effect through decreased domestic demand for energy products. Moreover, farming, processed food, and the rest of the economy increase exports.

Imports into the country, as a result of a policy change, decrease for most sectors. For sectors such as gas, petroleum, gas manufacturing and distribution, and electricity, imports increase. Overall, Kazakhstan sells less domestically and exports more farming, processed food, and energy products.

Table 4.22 Domestic sales, exports, and imports in Kazakhstan by sector (change in %)

	Domestic sales	Imports	Exports
Farming	2	-17	51
Coal	-21	-54	110
Oil	-34	-39	19
Gas	-60	57	-94
ProcFood	4	-23	69
P_C	-24	92	-78
Chem	-8	7	-22
RestOfEconom	16	-13	78
GasMnfDstr	-25	138	-89
Electricity	-22	253	-95
OthServices	1	-23	41

Source: Author's estimates

Table 4.23 reports the volume of domestic sales, exports, and imports changes in Kazakhstan by sector. In terms of volume, the largest decrease in domestic sales is observed in the gas sector, followed by oil, coal, and chemicals. The volume of exports of coal and oil increases significantly.

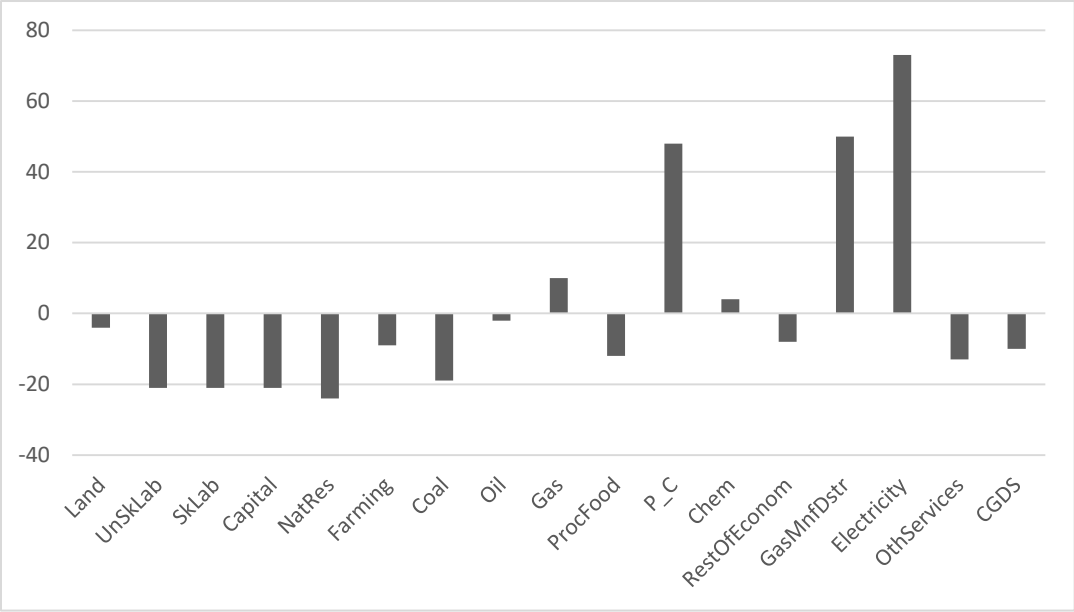
Table 4.23 Domestic sales, exports, and imports in Kazakhstan (volume change in millions of USD)

	Domestic sales			Imports			Exports		
	Pre	Post	Change	Pre	Post	Change	Pre	Post	Change
Farming	28,375	29,040	666	1,077	897	-181	1,030	1,552	521
Coal	15,272	12,110	-3,162	50	23	-27	1,150	2,410	1,261
Oil	13,003	8,617	-4,385	848	520	-328	33,045	39,213	6,169
Gas	17,636	7,031	-10,604	3,158	4,966	1,809	813	50	-763
ProcFood	25,372	26,426	1,054	1,563	1,203	-360	988	1,666	678
P_C	8,959	6,829	-2,131	1,444	2,767	1,322	2,774	600	-2,174
Chem	35,007	32,332	-2,675	7,659	8,225	566	16,054	12,594	-3,459
RestOfEconom	19,636	22,687	3,050	20,041	17,432	-2,610	480	855	375
GasMnfDstr	726	541	-185	9	22	13	139	15	-124
Electricity	9,788	7,620	-2,168	359	1,268	908	58	3	-56
OthServices	212,610	214,912	2,302	10,591	8,121	-2,470	4,535	6,411	1,876

Pre: pre-simulation; post: post-simulation

Source: Author's estimates

Figure 4.10 shows the percentage change in the market price of products. The market price of many products and all factors of production decrease. The highest increase in market price is observed in oil, electricity, gas, and petroleum products.



Source: Author's estimates

Figure 4.10 Market price of commodities and factors of production in Kazakhstan (change in %)

All primary factors experience decline in rents. Demand for endowment commodities, in this case unskilled and skilled labor, capital, and natural resources, by industries decreases significantly for energy sectors; however, the oil sector slightly increases the demand for endowment commodities. The processed food and farming sectors expand demand for skilled and unskilled labor and for capital (Table 4.24).

Table 4.24 . Demand for endowment commodities in Kazakhstan (change in %)

	Land	UnSkLab	SkLab	Capital	NatRes
Farming	0	6	6	6	0
Coal	-18	-18	-18	-18	0
Oil	3	8	8	8	0
Gas	-64	-70	-70	-70	-1
ProcFood	-7	7	6	7	0
P_C	-27	-37	-37	-37	0
Chem	-16	-13	-13	-13	0
RestOfEconom	-4	17	16	17	0
GasMnfDstr	-27	-36	-36	-36	0
Electricity	-20	-22	-23	-22	0
OthServices	-10	2	1	2	0
CGDS	-14	-9	-10	-9	0

Source: Author's estimates

The percentage changes in the domestic demand for goods by industries are shown in Table 4.25. Companies' demand for energy products largely decreases for most sectors. Interestingly,

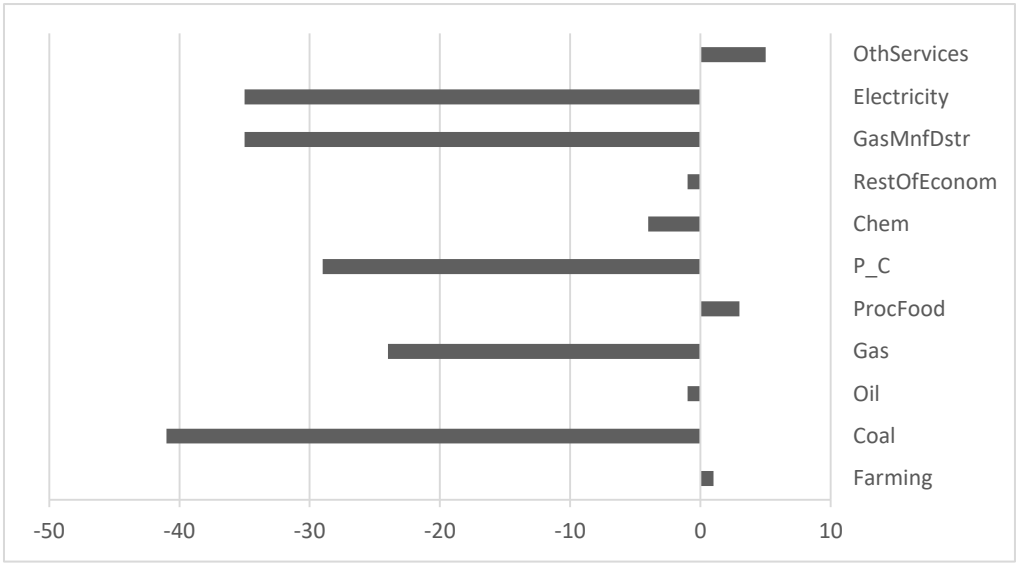
sectors such as farming and processed food slightly increase the demand for domestic energy products.

Table 4.25 Domestic demand for goods by industries in Kazakhstan (change in %)

	Farming	Coal	Oil	Gas	ProcFood	P_C	Chem	RestOfEconom	GasMnfDstr	Electricity	OthServices	CGDS
Farming	6	-10	9	-61	8	-36	-10	18	-35	-21	3	-9
Coal	4	-11	4	-62	7	-37	-12	17	-36	-22	2	-9
Oil	4	-11	4	-62	7	-36	-12	17	-36	-23	3	-9
Gas	-39	-35	-26	-73	-29	-51	-36	-16	-61	-51	-22	-30
ProcFood	6	-10	6	-61	7	-36	-10	25	-35	-21	4	-8
P_C	-10	-25	-13	-66	-9	-45	-24	-1	-45	-34	-13	-16
Chem	-1	-15	1	-63	2	-40	-13	14	-38	-26	-1	-11
RestOfEconom	25	7	30	-53	22	-20	6	31	-28	-13	13	1
GasMnfDstr	2	-13	0	-62	5	-38	-14	15	-37	-24	0	-10
Electricity	-4	-19	-5	-65	-2	-42	-19	7	-41	-29	-6	-10
OthServices	7	-11	6	-61	7	-36	-11	19	-34	-20	3	-8

Source: Author's estimates

Domestic demand by households in Kazakhstan decreases for all energy products as well. Private household demand for farming and processed food increases slightly by 1-3% (Figure 4.11).



Source: Author's estimates

Figure 4.11 Private household demand for domestic products, Kazakhstan (change in %)

This chapter concludes the empirical analysis discussion. This chapter pointed out that empirical studies of Kazakhstan using a CGE approach are scarce. The CU was studied, and previous studies conclude that it has an overall negative economic impact on Kazakhstan and a

positive economic impact on Russia. Previous studies emphasize that trade liberalization in Kazakhstan would have a positive economy-wide effect.

Topics such as energy subsidies in Kazakhstan have been studied to a lesser extent, largely due to the lack of reliable and extensive data. The GTAP database is unique in that allowed one to focus on a specific country such as Kazakhstan. Due to the limited data, a social accounting matrix for Kazakhstan with more updated data is not available. Therefore, using a CGE approach and the GTAP database was considered the most appropriate methodology. The next chapter discusses the results and provides implications for further research.

5 Conclusion and Implications

5.1 Conclusion and discussion

This chapter discusses the results obtained through policy scenarios simulated using the GTAP framework. The findings are also analyzed in the context of the theory discussed in Chapter 3 and previous research and related to the policies considered. Both similarities and differences of the obtained results to the theory and previous research are discussed. First, the results of trade scenarios are discussed followed by the results of the energy scenario. Moreover, taking into consideration the results obtained from this study allows one to make several policy implications and suggestions. In conclusion, certain limitations of this study and the methodology applied are listed, and suggestions for further research are briefly discussed.

The results obtained by conducting simulations of a comparatively static nature are compared to the current research. It is important to emphasize that there are generally a limited number of studies on Kazakhstan using the general equilibrium approach or using other empirical approaches. Moreover, a comparison of the obtained results across the existing studies is difficult due to the differences in the model designs and settings, data sets used including different base years, and varied regional and sector aggregation and parameter values, which can lead to different results.

The economic impact of an FTA is generally perceived as welfare enhancing and trade creating. The effects of a CU usually consist of creating and diverting trade, and the effects of a CU largely depend on the level of tariffs in the country before and after its creation. Removing internal tariffs and decreasing external tariffs could lead to welfare improvement and gives consumers the choice to purchase from producers that are more efficient, which results in trade creation effects. A customs union, however, can also result not in trade creation but in trade diversion. Due to a CU, union member countries start to trade more between each other and less with non-union member countries, which causes trade diversion from more cost-efficient trade partners. In cases where trade-diversion effects dominate trade-creating effects, a CU reduces welfare.

Trade creation and trade diversion effects due to CU membership largely depend on the degree of change in the CET towards non-members. If the country joining a CU implements a CET lower than pre-CU tariffs, the potential for trade diversion is lower. The higher a CU CET is to pre-CU tariffs, the higher the trade diversion effects are expected (IFBRD and World Bank, 2012). Kazakhstan, due to membership in the CU with Belarus and Russia, on average increased

its tariffs towards non-member countries, which could be one of the reasons for trade diversion in some sectors, particularly in manufacturing. The CU CET was largely adapted to Russia's tariff levels, and Kazakhstan on average had to increase its tariffs. In the manufacturing sector, trade diversion could be observed, where Kazakhstan decreased imports from China and the EU and imports from Russia increased.

In general, CU membership under current conditions had a negative economic effect on Kazakhstan. The results of the CGE simulations show that Kazakhstan experienced an overall decrease in welfare, which results largely from the decreasing terms of trade effects. As this study suggests, trade diversion effects are dominating the trade creation effects. Kazakhstan will import more from Russia, and the imports from other regions, especially from the EU and China, will decrease. The country that gains the most from the creation the CU is Russia. Russia's overall welfare and trade balance substantially increase.

The impact on industry output, import, and export changes in different sectors in Kazakhstan can be explained by several factors: 1) different original tariff protection levels 2) and whether the specific sector was import or export oriented before the policy change. After analyzing the results, it can be observed that the sectors that were mostly import oriented before the policy change have a deteriorated trade balance, decreased sector output, and increased imports. On the other hand, export-oriented sectors such as wheat and energy due to the CU improve the trade balance and increase in output.

The results of the scenario on the economy-wide effects of the CU on Kazakhstan are largely consistent with the findings of previous studies on this topic. Previous studies on Kazakhstan's membership in the CU, including by the World Bank (2012), Asrov et al. (2012), and de Souza (2011) indicate overall welfare-decreasing effects and a decreasing GDP in Kazakhstan. The direction and negative effects on the economy of Kazakhstan are found in all previous studies. The magnitude of the effects of the CU on Kazakhstan varies from the findings of previous research and this current study. Due to different sector and regional approaches, as well the data and base year undertaken in other studies, the magnitude of the effects varies from the results obtained in this study.

The analysis and findings of the following study provide important policy implications. The findings show that Kazakhstan would have negative economy-wide effects due to the CU. Kazakhstan at this stage should consider pursuing first multiregional integration and multiregional trade liberalization. At this stage in economic development, Kazakhstan should

look into possibilities of trade integration outside the CIS region with countries such as China, and at the same time maintaining economic and trade ties with its partners in the CIS region. Moreover, in order to achieve further economic diversification and decrease dependence on the export of fuel products, Kazakhstan should diversify its trade partners by initiating trade agreements.

The effects of trade liberalization between Kazakhstan and China are mutually positive and welfare enhancing. In this scenario, the tariffs between China and Kazakhstan, presented in Chapter 2 and based on the database used, were completely removed, but Kazakhstan's import tariff structure towards other countries stayed the same. Overall the welfare effects are positive both in China and Kazakhstan. Increasing the terms of trade effects in both countries contribute largely to the positive welfare effects. In the case of Kazakhstan, the terms of trade effects increase the most for the manufacturing and chemical sectors. Aggregate exports and imports increase for almost all sectors in Kazakhstan. A slight increase in output can be observed in almost all sectors.

According to trade theory, removing trade distortions is widely beneficial. It helps the country improve its comparative advantage, achieve better allocation of production factors, and increase its welfare. Looking at the theory of trade diversion and trade creation we can observe similarities.

To the author's best knowledge there are no previous empirical studies on the topic of trade liberalization between Kazakhstan and China or Southeast Asian countries. Francois et al. (2009) analyzed a hypothetical FTA between the EU and Kazakhstan. The authors emphasize that trade liberalization between Kazakhstan and the EU would have positive income and GDP effects on Kazakhstan. The results from Scenario 2 can also be discussed in the light of several studies on trade liberalization in Kazakhstan and accession to the WTO. Empirical analyses by Kazybayeva et al. (2003), Jensen et al. (2007), and Timbarello (2005) emphasized that trade liberalization would have an overall positive impact on the economy of Kazakhstan. Kazybayeva et al. (2003) found that market liberalization and decreased tariff protection will increase GDP, increase overall welfare, and decrease unemployment.

Positive economic effects obtained in the simulation of a hypothetical FTA between China and Kazakhstan and other studies on the FTA between the EU and Kazakhstan indicate that Kazakhstan would benefit, and policy discussion should also focus on expanding trade and trade policy to countries of the EU, China, and other emerging economies.

In general, several implications can be derived from the findings of the energy subsidy removal scenario. First, macroeconomic variables experience positive changes as a result of energy subsidy removal. Increases in the GDP and welfare are observed. Second, removing energy subsidies decreases domestic demand for energy products. One of the effects is that an increased availability of oil leads to an increase in oil exports. Third, energy subsidy reform in Kazakhstan influences the output structure; output composition shifts from energy-intensive industries to less energy-dependent sectors such as farming and processed food in the case of this scenario.

In general, the findings from the energy subsidy scenario are in line with the theory and with previous research findings. Since to the author's best knowledge there are no studies of energy subsidies in Kazakhstan, the results are compared to the previous literature most comparable to Kazakhstan with an emphasis on energy-exporting countries. Almost all studies applied the CGE framework in analyzing distortions in the energy markets. The CGE models ranged from static to dynamic ones.

Consistent with the finding of Kerkela (2004) and Orlov (2015), both studies on distortions in the energy sector in Russia, the GDP in Kazakhstan increased. Moreover, Siddig et al. (2014) in his analysis of oil subsidy removal in Nigeria and Riipen (2003) of energy liberalization in FSU also found an increase in GDP in the countries studied. Removing energy subsidies led to overall welfare gain in Kazakhstan. There is a terms of trade loss, but it was significantly offset by improvements in the allocative efficiency of the resources. The results are comparable to the findings of Kerkela (2004), where an increase in welfare in Russia was observed, and the main contributor to the improvement of welfare was allocative efficiency effects. Welfare gains were also found by Riipen (2003). The impact on trade in Kazakhstan was largely positive. Removing subsidies and taxes had a positive effect on the overall trade balance, which improved by 3,786 million USD. The results are consistent with the findings of Siddig et al. (2014) and Kerkela (2004).

Domestic prices of energy products increased, which caused the domestic demand for energy products to decline, and consequent saving effects enabled the country to increase exports. Abolition of taxes and subsidies resulted in structural changes in Kazakhstan. Kazakhstan exports more coal and oil products and imports and consumes fewer domestically. Similar results were found by Birol et al. (1995), Jensen et al. (2002), Riipen (2003), Kerkela (2004) and Orlov (2015).

Energy is an important intermediate input in many sectors. Higher energy costs resulting from the removal of subsidies will usually adversely affect the production of energy intensive products. In this scenario the most vulnerable to energy policy changes is the chemical sector, which is a particularly energy-intensive sector. However, there are some sectors that are positively affected. The agricultural sectors (farming and processed food) increase output, improve their trade balance, and increase exports. This can be explained by the fact that the agricultural sector in Kazakhstan is less energy intensive and more intensive in the use of non-energy factors. Moreover, a general equilibrium effect can be observed; particularly, a part of the economy shrinks, while the other, the agricultural sector, absorbs these resources and expands, which can be seen in this simulation. Agriculture is labor and capital intensive. By analyzing results, it can be observed that endowment commodities such as skilled labor, unskilled labor, and capital have increased demand from the farming and processed food sectors. Decreased factor prices enable the agricultural sector to become more competitive, allowing more production and exports. The results are consistent with the findings of Jensen et al. (2002), Siddig et al. (2014), Kerkela (2004), and Orlov (2015). These authors found that the output of energy-intensive sectors decreased while non-energy intensive sectors such as agriculture, farming, and services profited and were able to increase their output.

Energy products are also used as intermediate inputs for the final energy products. By analyzing the cost structure of the companies (Appendix A.9) it could be seen that the oil sector had a significant share of gas in its cost structure; the petroleum sector had a significant share of oil use in its cost structure. The electricity sector had a significant share of coal and gas use as an intermediate input. This could explain why some energy products increase or decrease output, exports, and imports.

In summary, energy subsidy reforms have a significant impact on other sectors in the country. Some structural changes in the economy of Kazakhstan can be observed. In reaction to energy subsidy removal, the economy moves from more energy-intensive sectors towards less energy-intensive sectors such as farming and processed food.

Moreover, energy subsidy reforms also have an impact on other regions, especially on those with which Kazakhstan trades actively. There are positive effects on the EU, mostly through improved terms of trade. On the other hand, an adverse impact is observed on Russia and other FSU countries. Comparable results were found by Kerkela (2004) and Riipen (2003).

Considering the volatility of energy prices and the dependence of Kazakhstan on energy exports and revenues, Kazakhstan will need to consider phasing out energy subsidies and price controls in the energy sector and further liberalizing its energy market.

5.2 Implications for further research

Empirical studies and the application of quantitative models always provide room for improvements, which largely refer to the data or the methodology implemented. In this section, an overview of the suggestions related to the methodological approach and policy questions for further research is provided.

Using a global database such as GTAP means making a compromise regarding the level of sector and region disaggregation. The level of sector and region disaggregation can have an influence on the results of the study. In this analysis, the agricultural and energy sectors were largely disaggregated, while other sectors such as manufacturing were more aggregated. This could be one of the explanations for why some sectors in the model have a higher magnitude of results. For further studies, a detailed sector disaggregation, especially of manufacturing and chemicals, would provide additional insights on sector dynamics.

GTAP database version 8.1 and version 9 used in this study have reference years of 2008 and 2011. GTAP is continuing to expand and update the input-output tables and SAM of the CIS countries. Future studies can focus on research using updated input-output tables and a SAM of Kazakhstan with enhanced data on non-tariff trade barriers, subsidies, taxes, and environmental data. The GTAP database includes one representative household, and due to the difficulty of obtaining access to the household budget survey in Kazakhstan, further disaggregation of different households such as urban and rural or income levels was not possible. Depending on future data availability, disaggregating households based on income or other factors would provide significant insights into the impact of policy changes on households of different income levels.

Future studies on trade policy issues in Kazakhstan should consider incorporating and analyzing NTBs. NTBs have not been quantitatively modeled in this study. This was partly due to the data limitations in Kazakhstan and other CIS countries. However, when good quality data on NTBs for the CIS countries is available, it could provide valuable insights into the impact of trade policy issues.

A static type of the CGE model, the GTAP model, was applied to the policy scenarios in this thesis. Running policy scenarios using a dynamic model can provide enhanced results and understanding of policy issues that are usually omitted by a static model.

Future policy analyses of Kazakhstan can take an advantage of such countrywide CGE models as GTAP. However, this area of macroeconomic analysis is still underdeveloped in Kazakhstan due to many reasons such as the lack of appropriate data, knowledge, and training. The Kazakh government should provide opportunities and encourage further development of this field. Policy studies based on the GTAP model can be enhanced with a single-country CGE model incorporating specific economic features of the country.

With regard to further policy analysis, the CU is expected to expand to other CIS countries, which deserves further research. Moreover, Kazakhstan is negotiating FTAs with other countries. Further expansion and new FTAs could possibly improve current losses that Kazakhstan has experienced through its membership in the CU. Therefore, further research should assess continuous CU expansion, FTA agreements with non-CIS countries, and Kazakhstan's accession into the WTO.

The analysis of energy subsidies focused on the economy-wide effects of energy subsidy abolition. However, such energy reforms are expected to have an impact on the reduction of CO_2 emissions. This is an important factor when arguing in favor of energy reforms and should be taken into consideration in future research.

Reforms in the energy market and particularly the removal of subsidies or increases in prices usually have a significant impact on households. Further research should include analyses of various households based on their incomes. Moreover, simultaneous removal of energy subsidies and transferring the revenues to the lowest income households could reduce the negative impact of an energy price increase on poor households. This option should be further studied as well.

In this study, energy subsidies were eliminated at once. This is usually a not realistic energy policy reform especially in the context of a developing country. Gradually phasing out the subsidies and subsequent reforms are usually advised in the developing and transition countries such as Kazakhstan. Therefore, further studies using dynamic models can analyze economy-wide, environmental effects of gradually phasing out subsidies with different sequencing depending on the energy products.

6 Executive Summary

Following a difficult period of transformation to a market-based economy, Kazakhstan achieved impressive economic growth and moved in status from a lower middle-income to an upper middle-income country. This was largely due to expanding oil production and favorable commodity prices. However, this created a high dependence for the macroeconomic and financial stability of the country on the extraction of natural resources. The country's current economic, geopolitical, and trade features make it specifically vulnerable to external shocks such as volatility in commodity prices and economic slowdown in China and Russia. Though the government implemented numerous measures such as strategies of economic diversification and industrial development, the country faces numerous constraints. Considering this background and the current national and international policy discussion, this research analyzes trade and energy policies in Kazakhstan.

The main methodology is based on the GTAP framework, which includes a global database and CGE model. GTAP is a standard multi-regional, multi-sectoral CGE model based on neoclassical assumptions. It assumes one model for all countries, and applications of this model are widespread and include international and national agriculture, climate change, energy, economic integration, and trade issues. Such a model allows one to take into account and analyze linkages between sectors and different regions. The study and model scenarios are based on the global database versions 8.1 and 9. The database includes 57 sectors and 140 regions, and it includes data on bilateral trade, transport, and protection linkages. Underlying the database are national input-output tables and data on trade, macroeconomy, and protection obtained from national and international sources. The last few versions of the database include more and more SAM of the CIS countries, including countries in the Central Asian region. This allows one to create aggregation with a focus on Kazakhstan and its main trade partners.

Since independence Kazakhstan has pursued deeper regional trade integration and the most recent example is the creation of the customs union with Belarus and Russia, which was further integrated into the Eurasian Economic Union by signing in 2014 the Treaty on the Eurasian Economic Union establishment. Kazakhstan's concentration of trade policies in the CIS region is publicly and economically a highly debated issue. Considering this background and the current debates, this study, using a computable general equilibrium approach, examined and quantified economywide effects of Kazakhstan's customs union membership. The results show that Kazakhstan will have negative economic effects, including decreasing welfare (-215

million USD) and GDP (-0.04%), due to the introduction of the common external tariff largely adjusted to Russia's higher import tariffs. The findings show that the country experiences negative trade balance effects and imports more from Russia, especially in the manufacturing and chemicals sector, and imports less from other countries and regions such as China and the EU. In percentage terms, Kazakhstan imports more agricultural products from Russia and fewer from other regions.

To examine alternative trade policies for the country, and considering the fact that the possibility of free trade between China and Kazakhstan has already been expressed by policy makers, a scenario with a potential free trade agreement between China and Kazakhstan is investigated. The results show that Kazakhstan experiences positive welfare (251 million USD) effects. Trade balance of the country deteriorates by 144 million USD and significantly for the sector manufacturing and chemicals. Almost all of the agricultural and food sectors slightly improve trade balance.

An abundance of natural resources, the Soviet legacy of control of energy price, and high energy intensity of the economy is still a present constraint, considering that the country significantly subsidizes energy prices through price controls. This leads, among others, to an already outdated energy infrastructure and a lack of investments in the energy and renewable energy sector, inefficient and wasteful consumption, and decreased availability of energy exports. The findings of the scenario where energy subsidies are removed, conducted using the CGE model and a modified GTAP database, show that the welfare (4,906 million USD) and GDP (2%) effects in Kazakhstan are positive. The largest contributor to the welfare effects are allocative efficiency effects. A decrease in output in more energy-intensive sectors and a slight increase in output in less energy-intensive sectors such as farming and processed food are observed.

This research has its limitations and assumptions, which are largely related to the applied data and model. The main restriction in this work is the limited availability of the necessary data. Collection and restrictive access to the national data on subsidies and protection measures proved to be problematic in this study. Therefore, certain asumptions and restrictions in the data set and scenarios had to be made. Necessary future improvements, particularly data availability and reliability, need to be considered by policy makers and researchers, especially at the national level.

Based on the findings of the model scenarios and the associated discussion, several policy recommendations can be concluded:

- First, the government should analyze and reconsider its current trade policy that places emphasis on regional trade integration with the countries of the CIS region. The government needs to estimate the dynamic macroeconomic effects of the current trade policy.
- Second, the government of Kazakhstan should consider alternative trade agreements including ones with China and other emerging economies.
- Third, dismantling energy subsidies in the country is necessary. Energy subsidy reform, particulary the elimination of subsidies, is usually implemented through stepwise reductions. This allows for a greater public acceptance of such reforms and at the same time gives consumers and markets opportunity to adjust. Moreover, the state would also profit from subsidy removal. Such a policy reform could also contribute to the sustainable development of the energy sector, improvements towards economic diversification, and the general economy in the country.

7 Zusammenfassung

Nach einer schwierigen Periode des Wandels hin zu einer marktbasierten Wirtschaft hat Kasachstan ein beeindruckendes ökonomisches Wachstum erreicht und sich von einem Land mit niedrigem mittleren Einkommen zu einem Land mit oberem mittleren Einkommen entwickelt. Das liegt hauptsächlich an der expandierenden Ölproduktion und den vorteilhaften Rohstoffpreisen. Dadurch hat sich eine große Abhängigkeit der makroökonomischen und finanziellen Stabilität des Landes vom Abbau natürlicher Ressourcen ergeben. Die gegenwärtigen ökonomischen und geopolitischen Rahmenbedingungen sowie Handelspolitiken führen dazu, dass das Land gegenüber externen Schocks, wie die Volatilität von Rohstoffpreisen und die Wirtschaftsabschwächung Chinas und Russlands, besonders verletzlich ist. Obwohl die Regierung mit der Strategie der ökonomischen Diversifizierung und industrieller Entwicklung eine Vielzahl von Maßnahmen implementiert hat, steht das Land zahlreichen Hemmnissen gegenüber. Unter Berücksichtigung dieser Hintergründe und der derzeitigen nationalen und internationalen Politikdiskussion analysiert diese Untersuchung die Handels- und Energiepolitik in Kasachstan.

Die Hauptmethode basiert auf dem GTAP-System, das eine globale Datenbank und das berechenbare allgemeine Gleichgewichtsmodell (CGE-Modell) beinhaltet. GTAP ist ein standardisiertes multiregionales und multisektorales CGE-Modell, welches auf neoklassischen Annahmen basiert. Es schätzt ein Modell für alle Länder und hat mehrere Bestandteile. Die Bestandteile beinhalten internationale und nationale Landwirtschaft, Klimawandel, Energie, ökonomische Integration und Handelsaspekte. Solch ein Modell ermöglicht es Verbindungen zwischen Sektoren und verschiedenen Regionen zu analysieren. Die Studie und die Modellszenarien basieren auf der globalen Datenbank Version 8.1 und Version 9. Die Datenbank umfasst 57 Sektoren sowie 140 Regionen und sie enthält Daten zum bilateralen Handel, Transport und Protektion. Der Datenbank liegen nationale input-output-Tabellen, Daten über Handel, Mikroökonomie und Protektion aus nationalen und internationalen Quellen zugrunde. Die letzten Versionen der Datenbank beinhalten mehr und mehr Social Accounting Matrizen (SAM) der Commonwealth of Independent States-Länder (CIS), unter anderem auch von zentralasiatischen Ländern. Dies ermöglicht eine Aggregation mit dem Fokus auf Kasachstan und seine Haupthandelspartner.

Seit der Unabhängigkeit verfolgte Kasachstan eine stärkere internationale Handelsintegration. Das aktuellste Beispiel ist die Schaffung der Zollunion mit Weißrussland und Russland, die

wiederum durch die Unterzeichnung des Vertrages über die Eurasische Wirtschaftsunion im Jahr 2014 weiter in die Eurasische Wirtschaftsunion integriert wurde. Kasachstans Fokus der Handelspolitik auf die CIS-Region ist ein öffentlich und wirtschaftlich diskutierter Streitpunkt. Vor diesem Hintergrund und den aktuellen Debatten untersucht und quantifiziert diese Studie mithilfe des CGE-Ansatzes gesamtwirtschaftlich die Auswirkungen Kasachstans Mitgliedschaft in der Zollunion. Die Ergebnisse zeigen, dass Kasachstan durch die Einführung des gemeinsamen Außenzolltarifs, der großteils an die höheren russischen Importzölle angepasst wurde, negative ökonomische Effekte wie abnehmende Wohlfahrt (-215 Millionen USD) und ein abnehmendes Bruttoinlandsprodukt (-0,04%) erwarten. Die Ergebnisse verdeutlichen, dass das Land negative Handelsbilanzeffekte und vermehrt Importe aus Russland, insbesondere aus der verarbeitenden Industrie und dem Chemiesektor, und weniger Importe aus anderen Ländern und Regionen sowie China und der EU erfährt. Prozentual importiert Kasachstan mehr landwirtschaftliche Produkte aus Russland und weniger aus anderen Regionen.

Um alternative Handelspolitiken für das Land zu prüfen und unter Berücksichtigung der Tatsache, dass die Möglichkeit eines freien Handels zwischen China und Kasachstan bereits von Politikern diskutiert worden ist, wird ein Szenario eines potentiellen Freihandelsabkommens zwischen China und Kasachstan untersucht. Die Ergebnisse zeigen, dass Kasachstan positive Wohlfahrteffekte erfährt (251 Millionen USD). Die Handelsbilanz des Landes verschlechtert sich um 144 Millionen USD und signifikant für die verarbeitende Industrie und den Chemiesektor. Fast alle Sektoren der Landwirtschaft und des Lebensmittelsektors verbessern die Handelsbilanz leicht.

Die Fülle an Rohstoffen, das sowjetische Erbe der Energiepreiskontrolle und die hohe Energieintensität der Wirtschaft sind noch immer Hemmnisse wenn man bedenkt, dass das Land die Energiepreise durch Preiskontrollen erheblich subventioniert. Das führt neben anderen Dingen zu einer veralteten Energieinfrastruktur und einem Mangel an Investitionen in den Energie- und erneuerbare Energiesektor, zu ineffizientem und verschwenderischem Verbrauch und verringerten Energieexporten. Die Ergebnisse des Szenarios mit abgeschafften Energiesubventionen, das mithilfe des CGE-Modells und der modifizierten GTAP-Datenbank durchgeführt wurde, zeigen, dass die Wohlfahrtseffekte für Kasachstan (4906 Millionen USD) und der Effekt auf das Bruttoinlandsprodukt (2%) positiv sind. Die wichtigste Ursache für die Wohlfahrtseffekte sind Allokationseffizienzeffekte. Es ist ein Rückgang des Outputs bei

energieintensiveren Sektoren zu verzeichnen und ein leichter Anstieg des Outputs bei weniger energieintensiven Sektoren wie Landwirtschaft und Lebensmittelverarbeitung.

Diese Untersuchung hat ihre Beschränkungen und Annahmen, die größtenteils auf die verwendeten Daten und das Modell zurückzuführen sind. Die hauptsächliche Herausforderung in dieser Arbeit ist die begrenzte Verfügbarkeit von relevanten Daten. Die Datensammlung sowie der restriktive Zugang zu den nationalen Daten über Subventions- und Protektionsmaßnahmen haben sich in dieser Studie als problematisch erwiesen. Deshalb mussten gewisse Annahmen und Beschränkungen im Datensatz und in den Szenarien gemacht werden. Notwendige zukünftige Verbesserungen, insbesondere Datenverfügbarkeit und Datenverlässlichkeit, sollten besonders auf der nationalen Ebene von Politikentscheidern und Wissenschaftlern berücksichtigt werden.

Auf Grundlage der Ergebnisse der Modellszenarien und der dazugehörigen Diskussion können einige Politikempfehlungen abgeleitet werden.

- Erstens, die Regierung sollte ihre gegenwärtige Handelspolitik, die sich auf regionale Handelsintegration mit Ländern der CIS-Region konzentriert, analysieren und überdenken.
- Zweitens, die kasachische Regierung sollte alternative Handelsabkommen mit China und anderen Schwellenmärkten in Betracht ziehen.
- Drittens, der Abbau von Energiesubventionen in dem Land ist notwendig. Eine Reform der Energiesubventionen, insbesondere die Abschaffung von Subventionen, wird normalerweise in schrittweisen Verringerungen durchgeführt. Das führt zu einer größeren öffentlichen Akzeptanz solcher Reformen und gibt den Konsumenten und den Märkten gleichzeitig die Möglichkeit zur Anpassung. Darüber hinaus würde auch der Staat von einer Beseitigung der Subventionen profitieren. Solch eine Politikreform könnte zu einer nachhaltigen Entwicklung des Energiesektors, zu Verbesserungen im Hinblick einer ökonomischen Diversifizierung und zur Verbesserung der Gesamtwirtschaft des Landes beitragen.

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Appendixes

A.1. Selected macroeconomic indicators Kazakhstan, 2008-2014

Indicator	2008	2009	2010	2011	2012	2013	2014
Current account balance (BoP, current US$)	6,250,108,639	-4,120,774,908	1,385,714,548	10,198,631,340	1,057,671,550	926,616,978	4,643,461,797
Current account balance (% of GDP)	4.68	-3.57	0.94	5.09	0.49	0.38	2.04
Net financial account (BoP, current US$)	3,845,718,344	-1,450,697,130	15,338,174,954	9,831,533,108	12,764,782	-2,718,148,107	-3,442,350,398
Foreign direct investment, net inflows (% of GDP)	12.6	12.4	5.1	6.9	6.3	4.1	3.3
External balance on goods and services (% of GDP)	20	8	14	19	14	11	14
Trade (% of GDP)	94	76	74	70	71	63	63
Inflation, GDP deflator (annual %)	21	45	20	26	5	9	6
GDP (current US$)	133,441,612,247	115,308,661,143	148,047,348,241	200,379,345,223	215,902,443,457	243,775,211,465	227,437,054,841
GDP growth (annual %)	3.3	1.2	7.3	7.2	4.6	5.8	4.1
GDP per capita (current US$)	8,514	7,165	9,071	12,103	12,858	14,310	13,155
GDP per capita growth (annual %)	2.1	-1,4	5.8	5.7	3.1	4.3	2.6
GINI index (World Bank estimate)	29.1	28.8	28.6	27.4	27.4	26.4	
Population, total	15,674,000	16,092,701	16,321,581	16,556,600	16,791,425	17,035,275	17,289,224

Source: World Bank n.d.

A.2. Mapping of the sector aggregation (GTAP database 8.1): scenario 1-3

No	Sectors	GTAP Code	Description
1	Wheat	wht	wheat: wheat and meslin
2	Grains and Crops	pdr , gro, osd, c_b, pfb, ocr, pcr	paddy rice, other grains (maize, barley, rye, oats, other cereals), oil seeds, cane & beet, plant fibres, other crops, processed rice
3	Dairy Products	rmk, mil	raw milk, milk (dairy products)
4	Livestock and Meat Products	ctl, oap, wol, cmt, omt	cattle (cattle, sheep, goats, horses, asses, mules, and hinnies; and semen thereof), other animal products (swine, poultry and other live animals; eggs etc.), wool, cattle meat, other meat (pig meat and offal.preserves and preparations of meat etc.)
5	Processed Food	vol, sgr, ofd	vegetable oils, sugar, other food (prepared and preserved fish or vegetables, fruit juices and vegetable juices etc.)
6	Beverages and Tobacco	b_t	beverages and tobacco products
7	Vegetables and Fruits	v_f	veg. & fruit
8	Energy Products	coa, oil, gas, ely, gdt, p_c	coal, oil, gas, electricity, gas distribution, petroleum
9	Chem,Heavy&Light Mnfc,Textiles	frs, fsh, omn, tex, wap, lea, lum, ppp, crp, nmm, i_s, nfm, fmp, mvh, otn, ele, ome, omf	forestry, fishing, other mining, textiles, wearing apparel, leather, lumber, paper & paper products, chemical rubber products, non-metalic minerals, iron & steel, non-ferrous metals, fabricated metal products, motor vehicles and parts, other transport equipment, electronic equipment, other machinery & equipment, other manufacturing
10	Other Services and Transport	wtr, cns, trd, otp, wtp, atp, cmn, ofi, isr, obs, ros, osg, dwe	water, construction, trade, other transport, water transport, air transport, communications, other financial intermediation, insurance, other business services, recreation & other services, other services, dwellings

Source: GTAP database version 8.1

A.3. Mapping of the regional aggregation (GTAP database 8.1): scenario 1-3

No.	Aggregation	Description
1	China	China
2	Russia	Russian Federation
3	Kazakhstan	Kazakhstan
4	Belarus	Belarus
5	EU_27	Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom, Bulgaria, Romania
6	FSU	Ukraine, Rest of Eastern Europe, Kyrgyzstan, Rest of Former Soviet Union, Armenia, Azerbaijan, Georgia
6	RestofWorld	Australia, New Zealand, Rest of Oceania, Hong Kong, Japan, Korea, Republic of Mongolia, Taiwan, Rest of East Asia, Brunei, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Philippines, Singapore, Thailand, Viet Nam, Rest of Southeast Asia, Bangladesh, India, Nepal, Pakistan, Sri Lanka, Rest of South Asia, Canada, United States of America, Mexico, Rest of North America, Argentina, Bolivia, Republic of, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela, Rest of South America, Costa Rica, Guatemala, Honduras, Nicaragua, Panama, El Salvador, Rest of Central America, Dominican Republic, Jamaica, Puerto Rico, Trinidad and Tobago, Caribbean, Switzerland, Norway, Rest of EFTA, Albania, Croatia, Rest of Europe, Bahrain, Iran Islamic Republic of, Israel, Jordan, Kuwait, Oman, Qatar, Saudi Arabia, Turkey, United Arab Emirates, Rest of Western Asia, Egypt, Morocco, Tunisia, Rest of North Africa, Benin, Cameroon, Cote d'Ivoire, Ghana, Guinea, Nigeria, Senegal, Togo, Rest of Western Africa, Central Africa, South Central Africa, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Tanzania, United Republic of Uganda, Zambia, Zimbabwe, Rest of Eastern Africa, Botswana, Namibia, South Africa, Rest of South African customs union, Rest of the World, Burkina Faso

Source: GTAP database version 8.1

A.4. Composition of Kazakhstan's exports by sector and destination, (in millions of USD and % total shares)

	Russia	Belarus	FSU	EU	China	RestofWorld	Total	Total %
Wheat	69,1	31,9	406	113	0,149	462	1,083	2.39%
Grains and Crops	61,2	13,7	14,8	105	2,7	125	322	0.71%
Dairy Products	2,55	0,014	3,01	8,09	0,667	8,82	23,1	0.05%
Livestock and Meat Products	1,95	0,046	3,76	13,3	23,8	18,7	61,6	0.14%
Processed Food	42,7	0,202	315	58,5	3,75	112	532	1.17%
Beverages and Tobacco	0,368	0,003	47	1,91	0,139	14,8	64,2	0.14%
Vegetables and Fruits	148	0,012	0,482	3,74	0,447	4,06	157	0.35%
Energy Products	2,519	1,93	2296	13,065	3,970	7,392	29,244	64.41%
Manufacturing & Chemicals	2,634	56,5	894	2,556	2,977	2661	11,778	25.94%
Other Services and Transport	42,6	1,78	17,8	874	44,2	1160	2,141	4.72%
Total	5,522	106	3,997	16,799	7,023	11,959	45,405	100%
Total %	12%	0,2%	9%	37%	15%	26%	100%	

Source: own calculations based on GTAP database version 8

A.5. Composition of imports to Kazakhstan by sector and source, (in millions of USD and % total shares)

	Russia	Belarus	FSU	EU	China	Restof World	Total	Total %
Wheat	0,586	0	0,018	0,132	0,002	0,167	0,905	0%
Grains and Crops	56	0,023	62,3	38,6	5,57	81,8	244	0.55%
Dairy Products	172	31,3	97,9	18,8	0,793	9,88	330	0,.5%
Livestock and Meat Products	79,2	0,444	20	29,5	2,62	62	194	0.44%
Processed Food	730	12,1	240	169	54,2	111	1,315	2.97%
Beverages and Tobacco	364	0,459	69,8	92,3	0,957	16,4	544	1.23%
Vegetables and Fruits	39,3	0,008	3,54	4,59	43,3	28,5	119	0.27%
Energy Products	2,103	9,45	844	108	134	75,1	3,273	7.4%
Manufacturing & Chemicals	8,028	369	1,870	7,987	5,428	4,092	27,773	62.82%
Other Services and Transport	259	7,1	39,6	5,070	398	4,642	10,416	23.56%
Total	11,829	430	3,246	13,517	6,068	9,119	44,210	100%
Total %	27%	1%	7%	31%	14%	21%	100%	

Source: own calculations based on the GTAP Database 8

A.6. Mapping of the sector aggregation (GTAP bata base 9): scenario 3

No	Sectors	GTAP code	Description
1	Farming	pdr, wht, gro, v_f, osd, c_b, pfb, ocr, ctl, oap, rmk wol	paddy rice, wheat, cereal grains nec., vegetables, fruit, nuts, oil seeds, sugar cane, sugar beet, plant-based fibers, crops nec, other animal products nec, raw milk, wool, silk-worm cocoons
2	ProcFood	fsh, cmt, omt, vol, mil, pcr, sgr, ofd, b_t,	fishing, bovine meat products, meat products nec, vegetable oils and fats, dariy products, processed rice,sugar, food products nec, beverages and tobacco products
3	Chem	omn, crp, nmm, i_s, nfm, fmp	minerals ne;c chemical, rubber, plastic products, mineral products nec., ferrous metals, metals nec, metal products
4	RestofEconom	frs, tex, wap, lea, lum, ppp, mvh, otn, ele, ome, omf	forestry, textiles, wearing apparel, leather products, wood products, paper products, publishing, motor vehicles and parts, transport equipment, electronic equipment, manufactures nec, machinery and equipment
5	OthServices	wtr, cns, trd, otp, wtp, atp, cmn, ofi, isr, obs, ros, osg, dwe	water, construction, trade, transport nec, water transport, air transport, communication, financial services nec, insurance, business services nec, recreational and other services, public administration, defense, education, health, dwellings
6	Coal	coa	coal
7	Gas	Gas	gas
8	GasmnfDstr	gdt	gas manufacturing and distribution
9	Oil	oil	oil
10	P_C	P_C	petroleum products
11	Electricity	ely	electricity

Source: GTAP database version 9

A.7. Mapping of the regional aggregation (GTAP bata base 9): scenario 3

No.	Aggregation	Description
1	China	China
2	Russia	Russian Federation
3	Kazakhstan	Kazakhstan
5	EU_27	Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom, Bulgaria, Romania
6	FSU	Belarus, Ukraine, Rest of Eastern Europe, Kyrgyzstan, Rest of Former Soviet Union, Armenia, Azerbaijan, Georgia
6	RestofWorld	Australia, New Zealand, Rest of Oceania, Hong Kong, Japan, Korea, Republic of Mongolia, Taiwan, Rest of East Asia, Brunei, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Philippines, Singapore, Thailand, Viet Nam, Rest of Southeast Asia, Bangladesh, India, Nepal, Pakistan, Sri Lanka, Rest of South Asia, Canada, United States of America, Mexico, Rest of North America, Argentina, Bolivia, Plurinational Republic of, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, Venezuela, Rest of South America, Costa Rica, Guatemala, Honduras, Nicaragua, Panama, El Salvador, Rest of Central America, Dominican Republic, Jamaica, Puerto Rico, Trinidad and Tobago, Caribbean, Switzerland, Norway, Rest of EFTA, Albania, Croatia, Rest of Europe, Bahrain, Iran Islamic Republic of, Israel, Jordan, Kuwait, Oman, Qatar, Saudi Arabia, Turkey, United Arab Emirates, Rest of Western Asia, Egypt, Morocco, Tunisia, Rest of North Africa, Benin, Cameroon, Cote d'Ivoire, Ghana, Guinea, Nigeria, Senegal, Togo, Rest of Western Africa, Central Africa, South Central Africa, Ethiopia, Kenya, Madagascar, Malawi, Mauritius, Mozambique, Rwanda, Tanzania, United Republic ofUganda, Zambia, Zimbabwe, Rest of Eastern Africa, Botswana, Namibia, South Africa, Rest of South African customs union, Rest of the World, Burkina Faso

Source: GTAP database version 9

A.8. Cost structure of firms in Kazakhstan, in millions of USD

	Farming	Coal	Oil	Gas	ProcFood	P_C	Chem	RestOfEconom	GasMnfDstr	Electricity	OthServices	CGDS(capita goods)
UnSkLab	6418	475	2220	183	2842	148	8940	5026	20	797	32674	0
SkLab	11	50	235	19	180	9	658	303	15	630	31480	0
Capital	1286	115	6500	496	4633	308	6720	2549	22	920	39993	0
NatRes	0	584	8282	1115	307	0	826	47	0	0	0	0
Farming	8348	0	0	0	1708	0	8	206	0	0	841	2430
Coal	11	15	0	0	16	135	395	63	0	848	70	0
Oil	0	0	195	53	23	6376	492	87	6	11	59	0
Gas	1	0	2537	3533	13	300	264	1	464	435	36	0
ProcFood	279	1	1	0	3277	0	75	109	0	0	2109	1563
P_C	262	53	69	17	44	888	1166	83	9	151	3343	1
Chem	1892	226	434	28	2065	83	19160	2096	1	38	9927	1852
RestOfEconom	4300	250	190	14	2221	298	1225	7517	3	141	6618	8565
GasMnfDstr	2	0	16	21	13	2	73	4	6	5	103	0
Electricity	125	31	267	77	101	4	2247	250	23	981	1456	0
OthServices	6420	991	18909	1688	11083	92	7850	2219	45	1824	80552	29947

Source: own calculations based on GTAP database version 9