Accession of Black Sea Region Wheat Producers to the WTO: Implications for World Wheat Trade

A Thesis Submitted to the College of

Graduate Studies and Research in Partial Fulfillment of the Requirements

for the Degree of Masters of Science

in the Department of Bioresource Policy,

Business and Economics, University of Saskatchewan

Saskatoon

by

Saule Burkitbayeva

Abstract

Wheat trade accounts for one third of world grain trade and is expected to double by 2050.The KRU (Kazakhstan, Russia and Ukraine) countries account for approximately a quarter of the world wheat exports and are collectively considered one of the key wheat exporting regions. Ukraine became a member of the WTO only in 2008. Russia became an official member of the WTO in 2012. Kazakhstan is expected to follow Russia and reach an accession deal with WTO members shortly. As a result of WTO accession, all three countries will be entitled to "most favoured nation" (MNF tariffs), and hence, gain improved access to a number of important markets that have been largely inaccessible due to very high tariffs that could be charged on imports from non-member countries. World wheat trade liberalization, reflecting the move to the MFN tariff as a result of accession, was simulated using the global simulation model (GSIM). The KRU region's increased market accessibility as a result of successful accession to the WTO has the potential to foster important re-alignments in world wheat trade flows, prices and changes in welfare among major wheat trading countries. Simulation results suggest that increased access to markets leads to more trade between KRU countries and previously restricted markets. KRU countries trade more with now freer markets such as Turkey, the EU and China. Major traditional wheat exporters such as Australia, Canada, the EU, and the US do not seem to be negatively impacted to any important degree. Their relative market access conditions, however, erode in Turkish, Middle Eastern, and African markets with their trade flows being diverted and broadly distributed among other countries and regions at reduced prices. Trade liberalization is not uniform across regions and therefore leads to different net welfare changes across countries. However, those welfare changes appear to be modest.

ACKNOWLEDGEMENTS

My deepest appreciation goes to professor William Kerr. I would like to thank Bill for his exquisite humor that kept me uplifted throughout the whole Masters program. I thank Bill for his superior wisdom, guidance and occasional “file attachment” dementia.

I also would like to thank all of my committee members Bill Brown and Peter Philips for their time, advice and support throughout the preparation and review of this work.

I would like to dedicate this work to my best friend - my grandmother. This is for her who will forever inspire me to never rush, stay calm, be kind, seek knowledge and live life consciously.

TABLE OF CONTENTS

LIST OF TABLES

Appendix B

LIST OF FIGURES

Chapter 1: Introduction

1.1 Introduction

Wheat is one of the first cereals to be domesticated in the world. It is and will likely continue be an important part of the global food basket. World population is expected to increase by 32 percent reaching 9 nine billion by 2050 (US Census Bureau n.d.). In 2010 the world utilized 660 million metric tons (MMT) of wheat and traded 125 MMT. Ceteris paribus, in 2050 the world's 9 billion people will consume over 880 MMT of wheat (Weigand 2011). International trade will have a crucial role in fulfilling this increase in demand. Developing countries will account for the majority of the predicted population growth. Population growth is the strongest in tropical and subtropical regions where little wheat is grown.

The Food and Agriculture Organization of the United Nations (FAO 2003) projects that developing countries will experience a significant growth in consumption. Based on forecasts of population, wheat production and consumption, North Africa, the Middle East, Sub-Saharan Africa, Indonesia, the Philippines, Brazil, Mexico, and India will remain the largest importing areas. Domestic production in these countries is projected to increase by 23 percent whereas total consumption is expected to increase by 49 percent (Weigand 2011). According to the FAO (2003), the domestic production of developing countries will only cover approximately 86 percent of their own total need, making them increasingly dependent on imports. The task of supplying wheat to the rest of the world will be spread among the world's top wheat exporters; United States, Canada, Australia, the Black Sea region (Russia, Ukraine and Kazakhstan), the European Union and Argentina. These exporters will experience minimal or even negative population growth towards 2050 (Weigand 2011).

Currently, wheat trade accounts for one third of world grain trade. Weigand (2011) concluded that even with little import demand from China, world wheat trade is likely to double by 2050 reaching a minimum of 240 MMT.

The Black Sea region accounts for approximately one quarter of the world's wheat exports and is considered one of the key wheat exporting areas. The first decade of the 21st century has been characterized by an increasing role of the Black Sea region in the global trade in wheat. Although highly variable, the Black Sea region's average share of world wheat exports rose from three percent in 1992 to 12% in 2010. In comparison, over the same period the average share of world wheat exports declined by ten percent and six percent for United States and Canada respectively (USDA n.d.).

1.2 Problem Statement

The Black Sea Region's accession to the WTO creates favourable conditions for its wheat export potential. Ukraine became a member of the WTO only in 2008. Russia was accepted to the WTO in 2012. China's record of 12 years of accession negotiations was exceeded by Russia's experience. It took almost 19 years of negotiations for Russia to become a member of the WTO. Kazakhstan is expected to follow Russia and seal a deal with the WTO members in the near future. Kazakhstan's negotiations have been ongoing for 16 years. The WTO accession Working Party for Kazakhstan was established in 1996.

As a result of WTO accession, all three countries will be entitled to "most favoured nation" (MFN tariffs), and, hence, gain improved access to potential markets previously largely inaccessible due to very high tariffs and/or other trade barriers that can be applied on imports from non members. For example, in 2010 China's import duties for wheat for non-members of the WTO were equal to 180 percent, whereas MFN tariffs were equal to 65 percent. The potential

decrease in tariffs is substantial. The Black Sea region's increased market accessibility as a result of successful accession to the WTO has the potential to bring about a major re-alignment of world wheat trade flows, prices and changes in welfare among major wheat trading countries.

1.3 Objective of the Study

In the light of the increasing importance of world wheat trade, examining the growing role of the Black Sea region on the international stage accompanied by trade policy changes is not only important but also timely. Therefore, the objective of this thesis is to simulate the changes arising in world wheat trade due to the KRU's accession to the WTO and to estimate the changes in trade flows, prices, tariff revenues, exporter surplus and importer surplus.

1.4 Organization of the Study

The thesis is organized as follows: Chapter 2 presents background information on the wheat industry in KRU. Chapter 3 provides an overview of the international wheat trade. Chapter 4 touches upon the accession process to the WTO in general and the accession histories of the KRU countries. Chapter 5 formally develops a Global Simulation Model (GSIM) for the world wheat industry. Quantitative results are reported in Chapter 6. Chapter 7 provides the important findings and implications. Chapter 8 concludes the thesis.

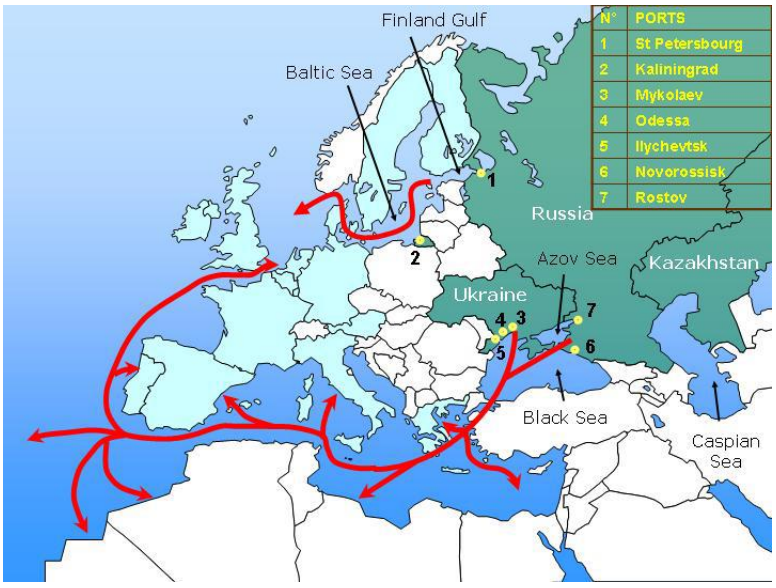
Chapter 2: The Wheat Industry in KRU

2.1 The Wheat Industry in KRU

The three major wheat-producing countries of the former Soviet Union − Russia, Ukraine and Kazakhstan are becoming increasingly prominent in the global wheat trade. After the demise of the Soviet economic system, KRU has evolved from being net wheat importing region in the 1980's into a major wheat-exporting area and by 2005 it supplied almost a quarter of world wheat exports. The following section will describe KRU's transition from 1980s to the present day and identify the possible reasons behind KRU's emergence as an important wheat producing and exporting region.

In wheat trade statistics, Russia, Ukraine and Kazakhstan are often referred to as Black Sea region exporters, RUK or KRU and reported in aggregate. The following is the map of Black Sea wheat exporters:

Figure 1. Map of Black Sea wheat exporters

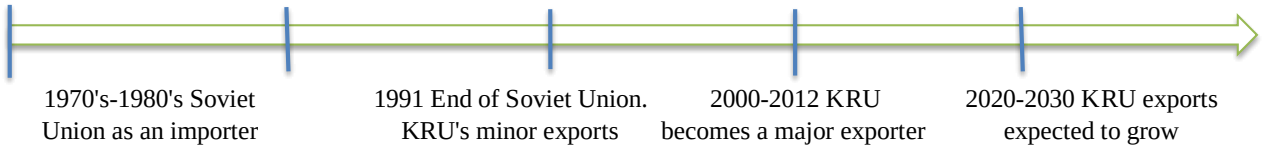


Source: Dumans and Nivet, 2003

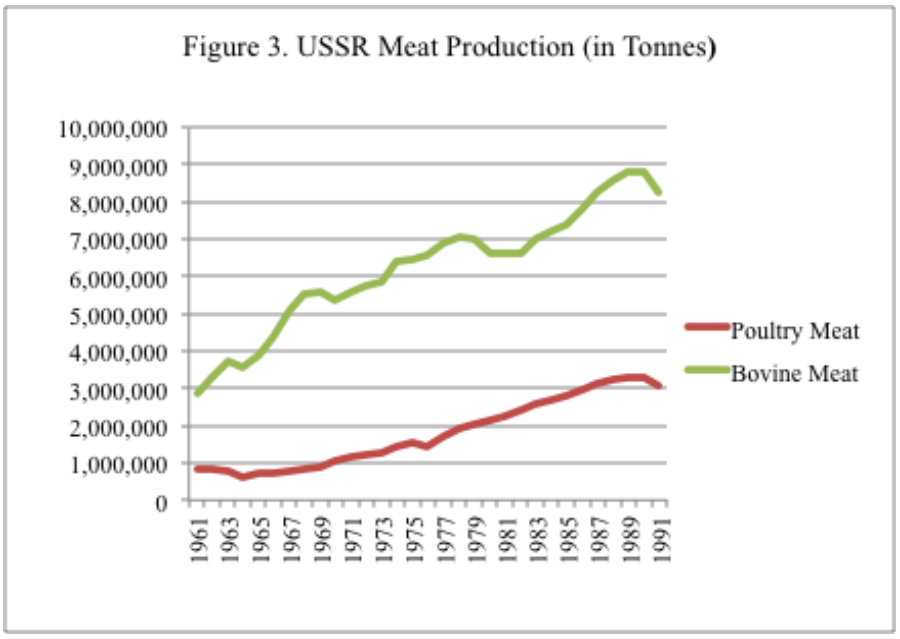
The Black Sea is the main avenue for accessing world markets for all three countries. Figure 1 shows the seaports on the Black Sea used by grain exporters and important export destinations. Russia and Ukraine have the advantage of having several seaports. Ilychevtsk, Odessa and Mykolaev are Ukraine's main seaports located in the Black Sea. Russia possesses both Baltic Sea and Black Sea exits to the world grain markets; Rostov and Novorossisk in the Black Sea, Kaliningrad and St. Petersbourg in Baltic Sea (see Figure 1). Kazakhstan, on the other hand, has no direct access to the Black Sea due to the landlocked nature of its territory. A more detailed discussion on transportation and logistics will be presented in the transition problems and constraints section below.

The following is a brief timetable showing KRU's transition from being a major wheat importer as part of the USSR to becoming a major exporter in the 2000s (see Figure 2)

Figure 2. KRU's transition from importer to exporter



The last decade of the USSR's existence can be characterized by an intensification of the agricultural production. The major focus was given to cereal production, particularly winter wheat, and meat production. The Soviet government intended to increase consumers' standard of living through increased consumption of meat and dairy products (Liefert et al. 2013).



From: (FAOSTAT n.d.)

Figure 3 illustrates the increase in the USSR's meat production, particularly from 1970 up until 1990. Domestic grain production could not satisfy the need to feed the ever increasing numbers of livestocks; therefore the Soviet Union had to import grain (Liefert et al. 2013)

The transition from central planning to a free market-based economy has been difficult for all three economies. As in the case with the broader economy, agricultural production plummeted with the collapse of central planning. The 1990s were characterized by a contraction in agricultural production, particularly livestock production. KRU's animal numbers shrank by more than half. Liefert et al. (2013) argue that the decline of livestock production during the economic transition has been the major reason for KRU countries moving from being grain importers to grain exporters. The Table 1 illustrates the decrease in livestock inventory in KRU. There was a dramatic decrease in livestock inventory over the period from 1990 to 2011. For example, the number of cattle in Ukraine declined from 25.2 million head in 1990 to 4.5

million head in 2011. The number of sheep and goats shrank from 9 million head in 1990 to just 1.7 million head in 2011.

Table 1. KRU's Livestock Inventory (in million head)

	Russia			Ukraine			Kazakhstan		
	Large horned livestock	**Sheep and goats**	**Pigs**	**Large horned livestock**	**Sheep and goats**	**Pigs**	**Large horned livestock**	**Sheep and goats**	**Pigs**
1990	n.d	n.d	n.d	25.2	9.0	19.9	9.8	35.7	3.2
1991	n.d	n.d	n.d	24.6	8.4	19.4	9.6	34.6	3.0
1992	52.2	51.4	31.5	23.7	7.8	17.8	9.6	34.4	2.6
1995	39.7	28	22.6	19.6	5.6	13.9	6.9	19.6	1.6
2000	27.5	15	15.8	10.6	1.9	10.1	4.1	10.0	1.1
2005	21.6	18.6	13.8	6.9	1.8	6.5	5.5	14.3	1.3
2007	21.5	21.5	16.3	6.2	1.6	8.1	5.8	16.1	1.4
2008	21	21.8	16.2	5.5	1.7	7.0	6.0	16.8	1.3
2009	20.7	22	17.2	5.1	1.7	6.5	6.1	17.4	1.3
2010	20	21.8	17.2	4.8	1.8	7.6	6.2	18.0	1.3
2011	20.1	22.9	17.3	4.5	1.7	8.0	5.7	18.1	1.2

Note: Russian statistics does not report some years. Therefore those years were removed from the table.
From: Statistics Agency of Kazakhstan n.d. RF Federal State Statistics Service n.d , State statistics services of Ukraine n.d

The number of pigs declined from 19.9 million head in 1990 to 8 million head in 2011. Similar trends in livestock inventory can be observed in Kazakhstan and Russia.

The second reason behind KRU's increased exports is the rise of grain production in the 2000s after a decline in early years of transition. The increase in grain production is due to increased yields rather than an expansion of the land being cropped. The KRU utilized less area for grain production in 2011 than in the 1980's. This could be partially due to the fact that during the Virgin Lands[1] campaign, the massive increase in cropland fostered by the policy expanded into areas not really suitable for grain production[2].

[1] Virgin Lands campaign is the Soviet government's (namely Nikita Khrushev's) plan to boost the agricultural production. The campaign was implemented during 1950's and early 1960's.
[2] USSR's eastern part of the grain belt (Kazakhstan, West Siberia) was particularly unsuitable for grain production due to climatic conditions (Felix,1981).

The Table 2 reports the changes in the area of grain production in the KRU over the period between 1987 and 2010.

Table 2. KRU grain area (in mln ha)

	Russia	Ukraine	Kazakhstan	KRU in total
1987-91	59.4	13.3	23.3	96
1992-95	54.7	12.2	20.8	87.4
1996-2000	47.4	11.9	13.3	72.6
2000-2005	42.7	13	13.9	69.6
2006-2010	42.7	13.9	15.9	72.5

Note: Figures are average annual values during the period.
From: FAS Production, Supply and Distribution Online (USDA 2013)

The area used for grain production fell during the early transition period in all three KRU countries. In 2010, the KRU countries were still using less land for grain production than they were in 1987. According to Prikhodko (2009), approximately 13 million ha of land can be returned into grain production in the KRU countries at no major environmental costs. However, returning idle lands back to production incurs additional costs for clearing and preparing the land for cultivation.

The decrease in wheat yields in the KRU during the 1990s, followed by a small increase in the 2000s can be seen in Table 3.

Table 3. KRU grain yeild (in tons per ha)

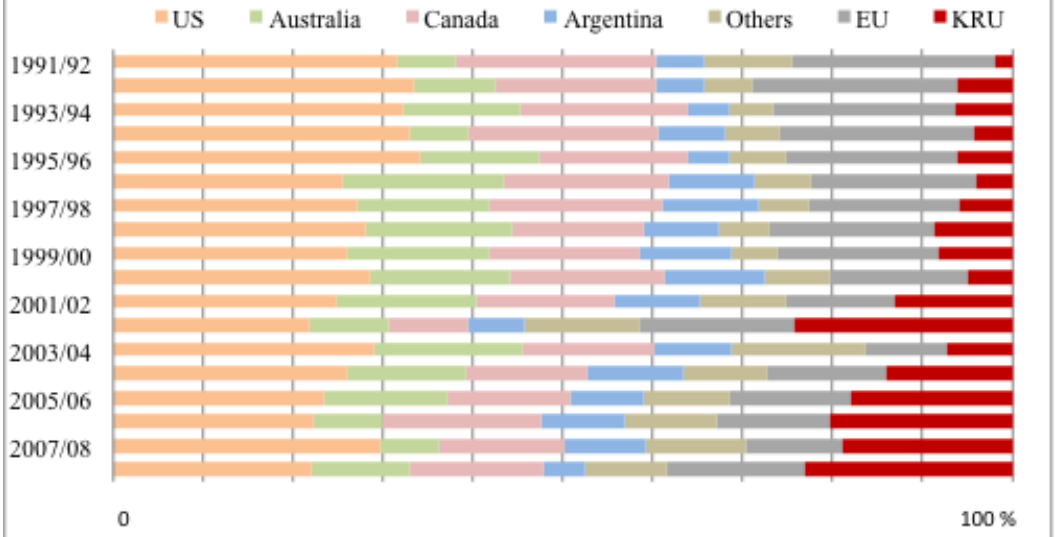
	Russia	Ukraine	Kazakhstan
1987-91	1.61	3.27	0.89
1992-95	1.53	2.91	0.9
1996-2000	1.33	2.18	0.84
2000-2005	1.79	2.62	1.04
2006-2010	1.92	2.81	1.06

Note: Figures are average annual values during the period.
From: FAS Production, Supply and Distribution Online (USDA 2013)

Yields in Russia and Kazakhstan have increase only marginally from 1987 to 2010, while the average grain yield in Ukraine decreased. Liefert et al.'s (2013) analysis indicates that the small increase in yields can be attributed to a rise in input productivity and favorable weather condition during the 2000s. However, yields in the KRU countries are still far below those in Canada, the USA or the EU[3].

In the 2000s, KRU countries become major exporters and were responsible for almost a quarter of the world wheat exports by 2008. Figure 4 clearly demonstrates the growing importance of the KRU countries in international trade.

Figure 4. Market Share of major wheat exporters



From: USDA, Foreign Agricultural Services, Production, Supply and Distribution (PS&D) Database (USDA n.d.)

KRU's export share increased from only 2 percent in 1991 to 23 percent in 2008. Future projections are positive for KRU's exports. By 2021, KRU is expected to account for 30 percent

[3] In comparison, the average yield for the 2006-2010 periods is equal to 2.9, 5.25 and 2.67 tones per hectare in US, EU and Canada respectively (FAOSTATa n.d.)

of world wheat exports (USDAa n.d.). Ultimately however that will depend on the KRU countries' ability to overcome some major transition problems and constraints.

2.2 Transition Problems and Constraints

Russia, Ukraine and Kazakhstan hold significant potential to expand their wheat exports. However, transportation and logistics problems as well as outdated agricultural equipment and practices continue to be major issues for KRU countries. Hence, it is worth keeping in mind that the major findings of the present research are subject to careful interpretation. For example, changes in future projected wheat trade between Kazakhstan and EU might not be achieved due to Kazakhstan's transportation constraints. All of the KRU countries are still countries in transition and, hence, do not exhibit the same levels of efficiency as can be achieved in modern market economies. Further, their ability to respond to incentives may be inhibited.

The KRU countries possess several exit routes to world wheat markets. They are Black Sea ports, Baltic Sea ports, Far Eastern ports, shallow water ports[4] and, the Azov Sea and rail routes. A map of the KRU's exit routes is provided in the Appendix A. All three countries are interested in increasing their grain handling capacities.

There is a lack of official information on the exact capacities of ports and grain terminals. Therefore the information presented in this section is sourced primarily from various reports and newsletters. Numerical data on ports and terminal capacities are from estimates provided by market analysts. According to Vassilieva and Flake (2011), Russia's overall port capacity is estimated at 25 million metric tones of wheat a year. Ukraine's export capacity (Black Sea and Azov Sea) is estimated at more than 26 million metric tones a year (Prikhodko 2009). Information on Kazakhstan's exact export capacity is non-existent.

[4] Shallow water ports are ports along rivers.

The Black Sea ports are for the most part utilized by Ukraine and Russia. The ports of Novorosiisk, Tuapse and Taman are the larger ones utilized by Russia. Ukraine is in the most advantageous position in terms of reaching the Black Sea. It has Ilychevtsk, Odessa and Mykolaev and other smaller ports.

Ukraine and Russia also possess shallow water ports such as those at Rostov-on-Don, Azov, Temruk, Kavkaz, Taganrog, and terminals on the Volga-Don (Vassilieva and Flake 2011). Most of these terminals are low capacity terminals that operate seasonally due to the rivers icing up.

Kazakh wheat has to travel at least 3500 kilometers to reach the Black Sea and faces competition from the other two countries. Therefore, the use of Black Sea ports' by Kazakhstan is limited. Kazakhstan has an access to world markets in the Caspian Sea and transports grain to the Black Sea and Baltic Sea by rail. Rail is also heavily used for exports to the neighboring central Asian countries. Table 4 shows KRU's actual wheat export quantities by the mode of transportation/access route.

Table 4. KRU's Wheat Export Flow in 2011 by access route (in MMT)

	Black Sea deep water ports	Black Sea shallow water ports	Baltic ports	Trains to export	Total Export
Russia	12	6	1		19
Ukraine	7.5	1	0		8.5
Kazakhstan	2	1	2	2.5	7.5

Adapted from Boersch (2013).

As can bee seen from the Table 4, Black Sea deep-water ports are primarily used by Russia and Ukraine, Baltic Sea ports are utilized by Russia and Kazakhstan. Wheat exports from Kazakhstan to the neighboring countries, including China, are shipped by rail.

According to Prikhodko (2009), Russia will increase its port capacity to handle 28 MMT of grain a year by 2015. Asian pacific markets are becoming more attractive to Russian wheat producers. Therefore, the Russian government is interested in developing grain terminals and increasing port capacity in Vladivostok on the Pacific (Baltinfo n.d.). The major concern is the cost of transportation from Siberian and Ural regions to Vladivostok.

Inadequate grain handling capacities, logistics problems and aging rail infrastructure remain the main constraints faced by wheat producers in Russia. Seventy seven percent of the grain handling railway wagon fleet is expected to be written-off by 2015 (Baltinfo n.d.).

Ukraine is the most fortunate of the KRU countries in terms of transportation costs. This is due to the short distances to the Black Sea. Ukraine's transportation constraints are largely related to low rural railway loading capacities and poor administration of the rail system (Boersch 2013).

Kazakhstan is also making efforts to increase its grain-handling infrastructure. Government officials expressed willingness to increase access to Middle Eastern markets by developing a rail line south from Kazakhstan through Turkmenistan to Iran (Prikhodko 2009). Kazakhstan is also planning to build terminals in Belorussia for grain shipment from the Baltic Sea. The recently developed Dostik-Alashankou rail route provides access for Kazakh grain to China and is now fully operational. Overall, the main obstacles faced by Kazakh wheat exports to the world markets are high transportation costs, restricted access to terminals and elevators in Black Sea ports and the risks associated with domestic policies[5].

It is difficult to talk about the farm level constraints across KRU countries in generalized terms. Nevertheless, it is evident that agro-holdings, also referred to as New Agricultural

[5] Example: an export ban.

Operators, play a significant role in grain production in all KRU countries. There presence, however, varies in the three countries (Fellmann and Nekhay 2012). In Kazakhstan, twenty big companies account for approximately 80 percent of the grain output. Two hundred companies account for about 25 percent of the grain output in Russia. The importance of agro-holdings in the Ukraine is less prominent but they rapidly increased their operation in the second half of the 2000s. The average size of the agro-holding is 100 000 ha (Prikhodko 2009).

Agro-holdings are vertically integrated entities that include agricultural production and processing facilities as well as grain elevators situated on the transport systems. They hold various advantages compared to smaller farms in terms of attracting investments, input purchases etc. The expansion of such integrated enterprises has been achieved through the acquisition of indebted former collective farms and elevators. Bank loans for large acquisitions are usually secured by the major downstream enterprises or holding companies (Wandel 2008). Apart from their own retained earnings, agro-holdings have access to bank loans for financing new technologies and western machinery. An agro-holding is controlled by a headquarters that is responsible for all financial, marketing and remote management activities of the enterprise. They enjoy economies of scale in terms of bulk input purchases and expert staff. Vertical integration allows for a better control over production methods, the quality of inputs and supply of outputs including exports of wheat. Agro-holdings maintain close relations with local authorities as well as with policy makers. These relationships allow them to garner state support when needed.

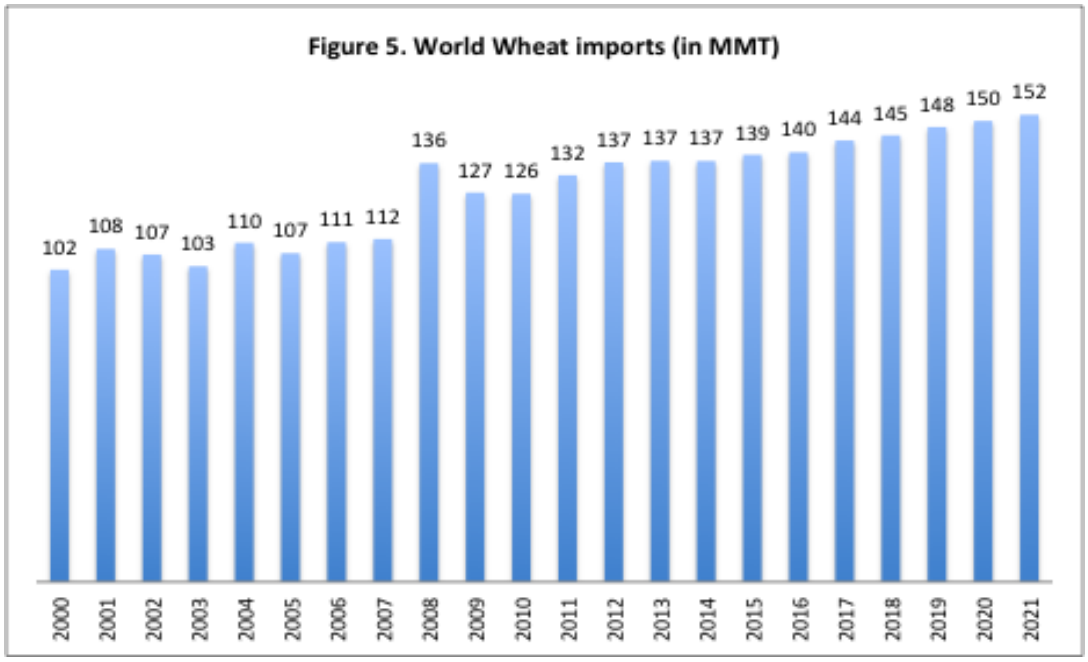
Overcoming the major constraining factors faced by KRU is a matter of time and resources. Therefore, any significant changes in trade flows projected by the model are most likely achievable in the long run only.

2.3 Summary

The KRU countries have become increasingly important in the world wheat trade. From being grain importers as part of the USSR, these three countries evolved into major wheat exporters. The transition from centrally planned command economies to the ones governed by market mechanisms has been difficult and is still continuing. Agriculture went through a major decline after the collapse of the Soviet Union. A drastic decline in livestock numbers, a marginal increase in yields and favorable weather conditions are considered to be the major factors that contributed to the increase in the KRU countries' wheat exports. In 2008, the KRU region accounted for almost a quarter of the world wheat export market share and is expected by some to play an increasingly important role on the international stage in the future. However, transition problems and constraints remain. Significant investments in infrastructure are required to remove many of the constraints faced by KRU countries. Poor infrastructure, antiquated logistics and bottlenecks may yet hinder the KRU's potential capacity to increase grain exports.

Chapter 3: International Wheat Trade

Wheat trade is and will likely be an increasingly important component of world trade in agrifood products and a contributor to global food security. Wheat accounts for one third of the world's trade in cereals. In 2010, the world utilized 666 MMT and traded 126 MMT of wheat (FAO n.d.). Figure 5 shows the increasing importance of world wheat trade currently and in the future.



From (OECD-FAO 2012)

Most of the demand for wheat imports arises from the developing countries. In 2012, developing countries accounted for eighty percent of global wheat imports and are expected to account for approximately eighty percent of the demand for wheat imports in the future (see Table 5) (OECD-FAO 2012).

Table 5. Share of Developing countries in World Wheat imports (in MMT)

Year	World Total imports	Developing countries	Developing countries in % from total world imports
2012	137	110	80
2013	137	111	81
2014	137	111	81
2015	139	113	81
2016	140	115	82
2017	144	118	82
2018	145	120	83
2019	148	123	83
2020	150	125	83
2021	152	127	83

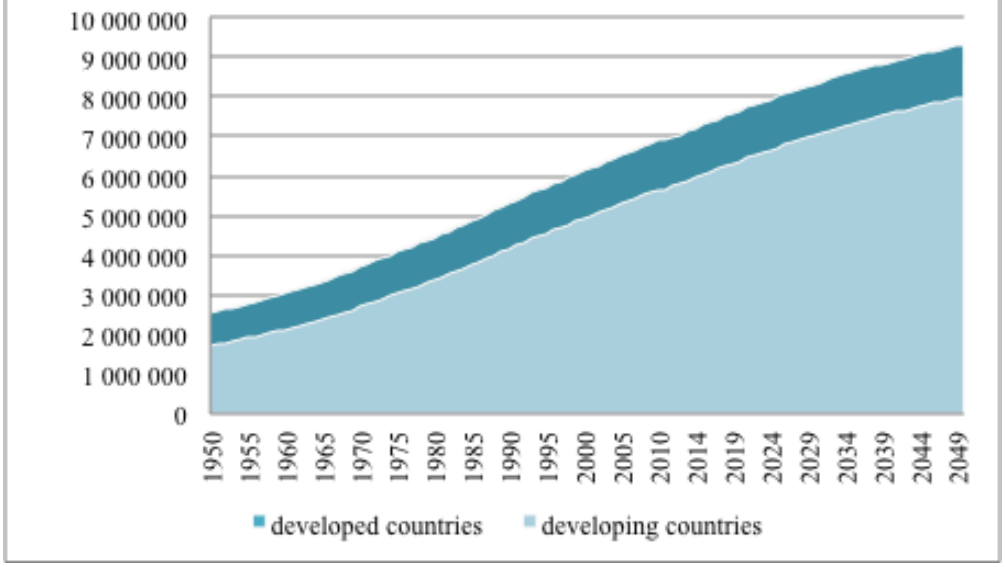
From: OECD-FAO (2012)

Increase in wheat consumption is often associated with the increase in population because these two mirror each other. According to US Census Bureau, the world population will reach 9 billion people by 2050 (US Census Bureau n.d.). Figure 6 shows the expected increase in world population. Developing countries will account for the majority of the predicted population growth. Population growth is the strongest in tropical and subtropical regions where little wheat is grown.

As reported above, in 2010 the world utilized 666 MMT of wheat and traded 126 MMT of wheat. Ceteris paribus, in 2050 the world's 9 billion people will consume over 880 MMT of wheat (Weigand 2011). Based on population growth, wheat production and consumption projections, Weigand (2011) concluded that even with little import demand from China, world wheat trade is likely to double by 2050 reaching a minimum of 240 MMT. International trade will have a crucial role in fulfilling this increase in demand.

Various agricultural outlooks and market analysis reports identify several geographical regions where wheat is an important factor in future wheat production and/or consumption: North America, South America, Central America, EU, rest of the Europe, Middle East, North Africa, Sub Saharan Africa, East Asia, South Asia, South East Asia, the Former Soviet Union and Others. Market analysis discussion by FAO, UNDP, etc. usually provide statistics and forecast for the aggregated regions listed above.

Figure 6. World population towards 2050



From: UN Department of Economic and Social Affairs, Population Division (2011)

The FAO (2003) projects that developing countries will experience a significant growth in consumption. Based on forecasts of population, wheat production and consumption, North Africa, the Middle East, Sub-Saharan Africa, Indonesia, the Philippines, Brazil, Mexico, and India will remain the largest importing areas. Domestic production of these countries is projected to increase by 23 percent whereas total consumption is expected to increase by 49 percent (Weigand 2011). According to the FAO, domestic cereal production of developing countries will only cover approximately 86 percent of their own total need, making them increasingly

dependent on imports (FAO 2003). The task of supplying wheat to the rest of the world will be spread among the world's top wheat exporters; the United States, Canada, Australia, the Black Sea region, EU and Argentina. These exporters will experience minimal or even negative population growth towards 2050.

Table 6 provides the list of the top ten wheat importers in the world in 2012.

Table 6. Top 10 Net Wheat Importers in 2012

Rank	Country	Quantity (in Million tons)
1	Egypt	9.3
2	Indonesia	6.3
3	Brazil	6.0
4	Japan	5.6
5	Algeria	5.2
6	Morocco	4.4
7	South Korea	4.3
8	Iraq	3.7
9	Iran	3.6
10	Mexico	3.4
	Total Imports	139.4

From: USDA, Foreign Agricultural Services, Production, Supply and Distribution (PS&D) Database (USDA n.d.)

As can be seen from the Table 6, the top wheat importers are all countries of North Africa, Middle East, Asia and South America. Table 7 provides a list of top ten wheat exporters. Russia, Ukraine and Kazakhstan are all included in the top ten list of exporters. They are reported separately in Table 7, however combined KRU exports are slightly less than US exports and exceed those of Canada.

Table 7. Top 10 Net Wheat Exporters in 2012

Rank	Country	Quantity (in Million tons)
1	United States	25.0
2	Canada	18.1
3	Australia	16.4
4	European Union	12.0
5	Russia	9.0
6	Kazakhstan	7.0
7	India	6.5
8	Ukraine	6.1
9	Argentina	5.0
10	Uruguay	1.0
	Total Exports	132.0

From: USDA, Foreign Agricultural Services, Production, Supply and Distribution (PS&D) Database (USDA n.d.)

In short, the importance of world trade in wheat is expected to grow. Developing countries of North Africa, the Sub-Saharan region, the Middle East, South America and Asia will experience the greatest increase in population and are expected to generate most of the increase in demand for wheat in the future. On the other hand, traditional wheat exporting countries will experience no dramatic increase in population or changes in consumption and therefore have the opportunity to fill in the gap in the increasing demand for wheat.

Trade barriers however, constrain trade in wheat and alter its distribution among countries. A major change in trade constraints, such as those arising from accession to the WTO, can have a major impact on the international trade in wheat. The affect of WTO accession on trade barriers is provided in Chapter 4.

Chapter 4: The WTO Accession Process

4.1 The WTO Accession process

One of the oldest forms of international relations is international trade. Accelerating the international division of labour, foreign trade was and remains a basis of the international economic relations that connects all countries to the global economy. Foreign trade can play a vital role in a country's economic growth and development. As with any international relations, there is a need for rules of conduct. This is particularly true in the case of international trade. Firms that wish to make investments in international trading activities need to know that their investments are not at risk from governments acting in ways that make what were initially profitable investments, unprofitable. For example, governments can put a profitable investment at risk by putting in place trade barriers. The World Trade Organization is the most important multilateral trade institution that administers an agreed set of rules for international trade – rules that have been agreed, to date, by 159 countries. Formed in 1995, as a successor to the General Agreement on Tariffs and Trade, the WTO administers the agreed rules of international trade. The WTO rules govern approximately 97 percent of global trade.

Making trade flow smoothly and in predictable ways is at the core of the existence of the WTO trading system. The WTO lists numerous benefits [6] arising from its existence that collectively promote international development, cooperation and confidence. Confidence in being treated equally and fairly is important for countries, and their firms that wish to invest in international trade activities. Being a member of the system of agreed rules means that a firm is

[6] The ten benefits of joining the WTO: 1. The system helps promote peace. 2. Disputes are handled constructively. 3. Rules make life easier for all. 4. Freer trade cuts the costs of living. 5. It provides more choice of products and qualities. 6. Trade raises incomes. 7. Trade stimulates economic growth. 8. The basic principles make life more efficient. 9. Governments are shielded from lobbying. 10. The system encourages good government (WTO n.d.)

better shielded from unfair treatment, sudden protectionist measures or other political matters. Membership means being not discriminated against and being entitled to receive the same trading conditions as every other member of the WTO. Of course, trade disputes will remain, however the WTO trading system with a set of rules and conditions reached by consensus allows the handling trade disputes in a transparent and structured manner. The equality provided by the WTO membership manifests itself through the import tariffs that firms face in foreign markets. There is a considerable difference between tariffs applied to members and non-members of the WTO. Countries are not entitled to MFN tariffs unless they are members of the WTO.

Before enjoying the security provided by WTO membership, each country wishing to join the WTO has to go through a five-stage accession process. First, after gaining observer status, the country has to submit a memorandum outlining how its trade and economic policies align, or not, with the WTO's agreed rules. The memorandum is examined by a Working Party that includes all interested member countries. After a Working Party has made sufficient progress on ensuring the applicant country's policies align with the rules, countries start bilateral negotiations. Although each interested country negotiates on tariff reductions and other trade inhibiting policies that determine export opportunities for its exporting firms, commitments made in bilateral negotiation will apply equally to all other members following the WTO principle of non-discrimination. The number of bilateral negotiations depends on the number of countries that comprise the Working Party. The third step starts when the applicant's trade regime is re-examined for compliance with the rules and bilateral talks are complete. The final accession terms are reflected in a formal protocol of accession and tariff schedules. The fifth and final step is the submission of a final package that consists of the protocol and schedules. The final package is presented to the WTO General Council or a Ministerial Conference. The observer is then free

to join the organization if two-thirds of the WTO members vote in the affirmative (WTO Information and External Relations Devision 2011)

4.2 The History of Accession for KRU countries

Accession to the WTO promotes the further integration of a country into modern economic trade relations. The duration of the process of accession to the WTO differs from one case to another depending on the number of bilateral negotiation that have to be completed to achieve consensus. Political matters can also slow the accession process down. For comparison, it took nineteen years of negotiations for Russia to become a member of the WTO but, for example less than three years for Kyrgyzstan.

After the demise of the Soviet Union and the achievement of independent country status, Russia, Ukraine and Kazakhstan applied for membership in the World Trade Organization. Russia was first to express its willingness to join the WTO (GATT[7] at the time). In June 1993, Russia submitted the official application to the Secretariat of the GATT. The Working Party chaired by Mr. W. Rossier[8] (Switzerland) was established the same year and consisted of 58 members. Subsequently, the Working Party was chaired by two other ambassadors − Kare Bryn (Norway) from 2000 to 2003 and Stefán Jóhannesson (Iceland) from 2003 to 2011. A memorandum on Russia's Foreign Trade regime was circulated by the Secretariat in 1994. The process proceeded with questions and feedback to Russian authorities. The Working Party meetings commenced in 1995. There were, in total, 31 formal Working Party meetings as well as numerous informal ones. The most difficult bilateral negotiations were those with the EU, China,

[7] GATT-General Agreement on Tariffs and Trade was replaced by WTO on January 1, 1995 under the Marrakesh Agreement

[8] Different country representatives at the United Nations and other international organizations in Geneva usually chair the WTO working parties.

the US and during most recent years Georgia[9] (Babkin et al. 2012). After 2000, the negotiations covered all aspects of Russia's accession to the WTO including it's commitments concerning the tariff schedule, market access to goods and services and agriculture. Finally, nineteen years of difficult negotiations yielded results. Russia's accession package, the biggest accession package in the history of the WTO, was approved by the Eighth Ministerial Conference in 2011. On August 22, 2012 Russia notified the WTO Secretariat of the ratification of the package and officially became a member of the WTO.

Among KRU countries, Ukraine was the first to accede the WTO. Ukraine submitted its application to the WTO after Russia, in November 1993. The Working party was established the same year in December. The memorandum on Ukraine's trade regime was circulated in 1994. Throughout the accession process, Ukraine's Working party was chaired by three ambassadors; Mr. A. Stoler (US), Mr. S. Marchi (Canada) and Mr. M. Matus (Chile). The process of Ukraine's accession can essentially be divided in to three periods. The first period, 1993-1997, was dedicated to the analysis and monitoring of the economy to determine if it reflected GATT/WTO norms and regulations. The second period, 1998-2003, entailed the process of enforcing laws deemed a priority for accession in order to adjust regulations in accordance with the WTO norms. The final, stage, 2003-2008, can be described as a process of identifying Ukraine's commitments regarding its membership to the WTO. The 2005-2007 period produces a breakthrough in the negotiation process. During that period Ukraine was able to reach agreement with 52 member states of the WTO and ratify 55 laws in accordance with the WTO norms (Pugachev 2012). In 2008, after 15 years of negotiation, Ukraine was officially welcomed into the WTO.

The negotiation process for Kazakhstan's accession to the World Trade Organization started on the 29th of January in 1996, with the submission of the official application to

[9] An armed conflict between Georgia and Russia took place in August 2008.

Secretariat of the WTO. In February of the same year, Kazakhstan was assigned status as an "observer" country to the WTO. On April 16, in 1996, the General Council of the WTO established a Working Party to examine the application and provide recommendations, including comments on a draft of the Protocol of Admission. Any interested member country could join the Working Party. Members of the Working Party were then encouraged to submit questions on Kazakhstan's Memorandum on its Foreign Trade regime that was circulated by the Secretariat, on 11 November, 1996. The feedback and questions were then transmitted to the Kazakhstan's authorities for further examination and comment. The Memorandum reflected on Kazakhstan's economy, economic policies and foreign trade regimes at that time. Government officials acknowledged that Kazakhstan's key trade legislation met the most important WTO principles and committed Kazakhstan to bringing them in to full compliance with the WTO's agreed rules. All the ministries of the Kazakhstan Government were urged to ensure full compliance of their legislation with the WTO standards (WTO 1996). To date, Kazakhstan's Working Party consists of 43 members and is chaired by H.E. Mr. Hannu Himanen. The Working Party members include the EU and its members as one. Each bilateral negotiation has to finish with a bilateral agreement. Members of the Working Party consist of all the main trading partners of Kazakhstan that belong to the WTO which have expressed a desire to discuss conditions for, and obligations of, the country's accession to WTO. Kazakh government officials have been releasing statements which anticipated accession each year since 2010. Hence, it is difficult to determine whether Kazakhstan will finally accede to the WTO by the end of 2013, as is planed.

4.3 Summary

KRU countries have gone through a long accessing journey. Russia and Ukraine have successfully joined the WTO, while Kazakhstan is expected to join them shortly. To date, the WTO governs the trade between 159 countries. Becoming a member of the WTO trading system

is an important step towards integration into the world economy for every country. Most of all, membership in the WTO provides confidence. In other words, membership provides equal access to markets and a common trade dispute resolution mechanism. Before enjoying the confidence offered by the WTO, each country has to go through a five-stage accession process. First, the potential accessing country submits its Memorandum on foreign trade. The second stage involves revision of the memorandum by the Working party. The third stage begins with the re-examination of the trade regime according to the WTO rules and bilateral negotiations. Accession terms are then reflected in a formal protocol and presented to the WTO General Council or a Ministerial Conference as a final package. Once the final package is voted in affirmative by the two-thirds of the WTO members, the observer country if welcomed to join the WTO.

Given that the KRU countries accession to the WTO will result in those countries being eligible to have MFN tariff applied on their wheat, important changes in the world trade in wheat can be anticipated. In Chapter 5, those expected changes are formally modeled.

Chapter 5: Modeling Global Wheat Trade

5.1 Literature review

Considerable effort has been devoted to developing models that can be applied to trade policies for agricultural products. Building an applied trade model is a costly, rigorous process that requires time and effort to be spent on assembling a database, the formulation of the theoretical underpinnings, obtaining estimates of parameters and shocking the model in simulations (Tongeren et al. 2001). None of the existing modeling approach is flawless. In each particular case one model is more applicable than the other. A detailed and comprehensive review and assessment of the existing global models applied to agriculture and trade policies is provided by Tonegeren et al. (2001). They discuss a number of partial equilibrium and general equilibrium models developed in the 1990s. Their review provides a comparative assessment of alternative modeling approaches by highlighting common features, differences and areas of applicability[10]. Of course, no model is appropriate for all purposes. Researchers have to use their own judgment and choose a model that is capable of providing answers to the question of interest given the information available and constraints on research resources.

In general terms, modeling approaches differ based on scope, specifications, assumptions, etc. Trade models are often multiregional. Multiregional trade models can differ with respect to the regional coverage. Some models focus on a certain set of trading partners, whereas others attempt to account for worldwide trade. A set of countries are often aggregated as one block such as the previous 15 members of the European Union (EU-15)[11], the former Soviet Union (FSU) or the Rest of the World ROW (ROW). Models differ in terms of being dynamic or static, partial or

[10] For a detailed discussion and list of agricultural policy models see F. von Tongeren et al. (2001)
[11] EU-15 countries are: Austria, Belgium, Denmark, Finland, France, German, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and United Kingdom.

economy-wide models. Dynamic models allow for time and adjustment paths. Static models observe differences between equilibriums resulting from the shocks in variables (for example, policy changes or crop failures).

A choice between a partial-equilibrium (PE) and a general-equilibrium (GE) modeling approaches is one of the key decisions faced by the analyst. This choice involves a trade-off. This trade off is best demonstrated in the following Table 8. (see Table 8).

Table 8. Partial vs. general equilibrium models

	PE	GE
Capturing economy wide linkages		x
Consistency with the budget constraints		x
Capturing disaggregated effects	x	
Capturing complicated policy mechanisms	x	
Use of timely data	x	
Capturing short and med. term effects	x	
Capturing long term effects		x

Source: Bacchetta et al, 2012

General-equilibrium models are able to capture economy-wide linkages and long term effects of the shocks. Partial equilibrium (PE) models, on the other hand, can be as disaggregated as one wishes. Partial equilibrium models are generally easy to use and straightforward to interpret as a relatively limited number of equations are used to calculate changes in demand and supply. As only one sector is modeled, PE models typically require less data than GE models: usually trade flows, trade policy data and elasticities (Bacchetta et al. 2012). PE models' simplicity and ease, however, is partially offset by a number of limitations. One of the major limitations is that PE models do not include constraints on factors of production. Second, PE model results are sensitive to the chosen values of elasticities. Effects on other markets are also lost.

Despite these limitations, PE models are widely applied to research on an industry level. Partial equilibrium models of trade in agriculture are often focused on primary commodities.

Partial equilibrium models treat agricultural trade as being isolated from the rest of the economy. Economy-wide GE models, on the other hand, account for inter-industry relations, thus allowing the implications of international trade on the economy as a whole to be observed. Economy-wide models are, of course, much more data intensive than the partial equilibrium models. Parameter estimates such as price and income elasticities, and/or substitution elasticities are also crucial for GE modeling approach. These key parameters determine the extent of response shocks including policy changes. They must be consistent with the available data and economic theory (Tongeren et al. 2001). Key parameters can be determined via two different approaches, either econometrically or by calibration. Econometric estimation of parameters is resource intensive and should be performed by simultaneous equation estimation methods that take into account the overall model structure (Tongeren et. al. 2001). Calibration, also known as the "synthetic approach", is a more popular because it is much less resource intensive. Using estimates of elasticities from existing sources, the calibration approach generates parameters consistent with the pre-shock benchmark data and the theory underlying the model.

Due to their simplicity and transparency, partial equilibrium models have been widely used in the policy assessment and economic welfare literature. Partial equilibrium models range from simple single market representations to more complicated, multi region global models. Recent partial equilibrium agricultural trade models include the USDA's Statistical World Policy Simulation (SWOPSIM) developed by Roningen et al. (1991), World Bank and UNCTAD Software for modeling Market Analysis and Restrictions on Trade (SMART), the Agricultural Trade Policy Simulation Model (ATPSM) developed by United Nations Conference on Trade and Development (Vanzetti and Peters 2004, Bacchetta et al. 2012) and the Global Simulation model (GSIM) developed by Francois and Hall (2003).

Economy-wide models have been developed by the Global Trade Analysis Project (GTAP) by Hertel (1997), the US Applied General Equilibrium model developed by the International Trade Commission (USITC 2004), MEGABARE and GTEM developed by the Australian Bureau of Agriculture and Resource Economics (ABARE 1996). The list of modeling approaches mentioned in this review is by no means exhaustive. This review is focused mainly on the models utilized specifically in agricultural trade policy and welfare research.

Most of the research related to modeling world wheat markets dates back to 1970s. Early studies accounted for the Soviet Union as a single market. In the 1990s, Russia, Kazakhstan and Ukraine were not yet considered as important exporting countries and, therefore, were often ignored in the model design. Further, command economy era data was not considered reliable and these economies exhibited considerable disequilibrium in the early years of transition. The latter meant that the data was unreliable for modeling purposes because the adjustments processes required to reach equilibrium were not well understood. The following is a short description of a number of models used specifically to examine the international market for wheat.

Large and complicated models applied to trade in wheat were developed by Devadoss et al. (1990) and Roningen et al. (1991). The Food and Agriculture Policy Research Institute (FAPRI) model produced by Devadoss et al. (1990) incorporates a set of models that can determine the effects of alternative farm policies and program proposals on agricultural commodity markets as well as the agricultural sector of the US. In general, models are solved iteratively to arrive at a simultaneous solution. A solution is obtained whenever the demand is equal to supply in each market, and the same vector of prices and other endogenous variables is obtained for all component models (Devadoss et al. 1990). One of the set of FAPRI models is focused specifically on trade in wheat. It is a non-spatial, partial equilibrium model. Non-spatial

means it does not identify trade flows between specific countries (Devadoss et al. 1990). The model consists of domestic supply and demand functions for major wheat trading and producing countries and regions. Equilibrium prices, quantities and net trade are determined by equating import and export functions of different regions and linking regional prices to world prices. Being fairly detailed, this trade model has been used to analyse the impacts of exogenous shocks such as technological change, yield changes, income growth, inflation, or changes in exchange rates, etc. FAPRI is often used in United States Department of Agriculture (USDA) and Agriculture Policy related institutions' publications. Although primarily focused on the US, the FAPRI model has been used to produce global agricultural commodity outlooks. One of the major features of the FAPRI model is its ever expansion. The model is always kept updated and is being enhanced in order to address novel policy questions. The benefits from an expanded model, however, carry certain costs. Although a larger model is suited to a broader range of questions, less focus can be given to any one specific part of the model (Meyers et al. 2010).

The Static World Policy Simulation (SWOPSIM) model developed by Roningen et al.(1991) has also been used extensively in USDA research. It is a static, partial equilibrium model that simulates the effects of changes in agricultural support on production, consumption and trade. Most of the research utilizing the SWOPSIM model dates back to the 1980s. According to Tongeren et al.(2001), the model is no longer in use.

Both FAPRI and SWOPSIM assume homogeneity of wheat across countries. Benirschka and Koo (1995) have relaxed the assumption of homogeneity. They developed a dynamic multi-commodity model that includes eleven wheat classes. The World Wheat Policy Simulation model is a hybrid between an econometric model and a synthetic model, meaning that some of the behavioural equations are estimated while others are based on synthetic parameters (Benirschka and Koo, 1995). A different approach was taken to modeling the exporting and

importing sub models that account for acreage harvested, yield, production, domestic consumption, and carryout stocks. The import side country sub models were estimated based on Armington's[12] approach to demand. This approach reduces the number of parameters that have to be estimated and allows for product differentiation.

Another method that has been used in wheat trade research is that of Spatial Equilibrium modeling (SEM). Gomez-Plana and Devadoss (2004) provide an evaluation of trade policy impacts in world wheat markets using SEM. They argue that the wheat markets' price decline in the early 2000's can be attributed to a surge in supply combined with restrictive trade barriers. The study provides a simulation of the elimination of all import tariffs and subsidies. The effects of trade liberalization are reported in terms of changes in price, supply, demand, imports, exports and welfare changes in each region/ country. A spatial equilibrium model popularized by Takayama and Judge (1971) was adapted for the wheat market. Thirty two countries were included in the modeling exercise. They are separated by distance and are assumed to trade homogeneous wheat competitively. SEM employs a non-linear optimization to maximize the net social monetary gain function, subject to a set of constraints (Gomez-Plana and Devadoss 2004). Elasticity parameters were adopted from secondary literature. Gomez-Plana and Devadoss (2004) arrived at the following main conclusions: wheat trade liberalization leads to an increase (decrease) in prices in the exporting (importing) country; production and exports increase in the exporting countries, consumption and imports increase in importing countries. As a result, there is an overall increase in trade. Most of the countries gain as a result of more trade; hence, there is an overall world welfare increase.

[12] Armington (1969) proposed a general theory of demand that distinguishes products according to their place of production. The Armington assumption states that products traded internationally are differentiated by the country of origin. The source of differentiation can be different bilaterally applied tariffs between countries

A spatial model refers to a mathematical programming model that focuses on transportation costs (Benirschka and Koo 1995). Accounting for transportation costs in a global scale trade modeling exercise is problematic. Choosing proxies for transportation costs in world wheat trade for each country is cumbersome. Obtaining reliable transport cost data is one of the main difficulties in analysing transportation (Inmaculada and Celestino 2005). There are, however, official sources that provide fairly detailed information on transportation costs. The US Census Bureau's "US Imports of merchandise" is one of the most extensive. It provides custom information including freight rates along with loading and unloading costs. Unfortunately, this is rather an exception. No similar information is found for other countries (Inmaculada and Celestino 2005). Therefore, utilizing a spatial model in the context of this thesis is not feasible.

Another popular approach to the analysis of trade policy is gravity modeling[13]. The gravity model is used to explain the impact of trade policies on trade between different geographical entities. The gravity model takes an ex-post approach to policy analysis. It means that gravity models are used to measure the effects on trade flows of a past trade policy (Ivus and Strong 2007). Unlike partial or general equilibrium models, a gravity model is not capable of measuring direct estimates of welfare costs. Gravity modeling is not regarded as suitable in the context of this research.

As the subject of interest is the effect of tariff reduction on world wheat trade and the resulting welfare changes, the GSIM model of Francois and Hall (2003) was chosen as the most suitable. The GSIM is capable of addressing the issue of trade liberalization on a single industry level and has resource requirements that are manageable. It is a static, multi-regional, partial equilibrium, Armington–type product differentiation model that solves for equilibrium prices by satisfying global market clearing conditions; that is, global imports must equal exports.

[13] For a more detailed discussion on gravity models and their basic specifications refer to Ivus and Strong (2007).

Armington type product differentiation means that the products originating from different countries are imperfect substitutes. The heterogeneity of the products among countries comes from the different bilaterally imposed tariffs (for example, the US and Russia faced different tariffs imposed by China before Russia's accession to the WTO). These tariffs determine the relative price of goods. Therefore change in tariffs translates into import changes by source.

The GSIM requires a bilateral trade matrix at world prices, an initial and final matrix of bilateral import tariffs, export supply elasticities, aggregate import demand elasticities and elasticities of substitution. Trade liberalization effects are reflected in terms of bilateral trade changes, welfare effects (producer surplus, consumer surplus and change in tariff revenues), price and change in output. The GSIM is flexible, transparent, user friendly and suitable tool to conduct the analysis required for this particular research. It captures the effects of bilateral tariff changes on international commodity trade using minimum data requirements and presents the results in an accessible format.

Although fairly recently developed, the GSIM model has found application in several recent studies of trade liberalization. Using the GSIM model, Leudjou (2012) simulates multilateral tariff reduction scenarios for the Cameroon dairy sector. The objective was to assess the impact of trade liberalization on food security in the Cameroon dairy sector, specifically domestic prices and consumer welfare effects. The dairy sector remains one of the most protected agricultural industries in the world. Leudjou (2012) discusses the importance of the dairy industry in Cameroon, tariff protection levels both in Cameroon and major dairy producers in the world, and proposed tariff reduction measures proposed in the Doha round[14]. The empirical work was carried out using GSIM model with a total of 23 countries including the major exporters and importers of dairy products along with Cameroon. Bilateral trade and tariff data was sourced

[14] The Doha Round is the latest round of trade negotiations among WTO members. It started in 2001

from WITS (n.d) and MacMap (n.d). Elasticity values were adopted from Nicita and Ollareaga (2006) and Kee, Nicita and Ollareaga (2004). Leudjou undertook three trade liberalization scenarios.

Holzner and Peci (2012) studied Kosovo's potential integration into the European Union (EU) and the resulting trade liberalization effects on Kosovo's major industries. The estimations were performed for 27 industries at the ISIC 2-digit levels[15]. The authors simulated a full trade liberalization scenario between Kosovo and the EU, meaning zero tariff rates were assumed for Kosovo's imports from the EU. Holzner and Peci (2012) also provide a brief rationale behind their chosen elasticity values. Export supply elasticity of 1.5, aggregate import demand elasticity of -1.25 and an elasticity of substitution equal to 5 were adopted from Francois and Hall (2003). An infinite export supply elasticity (9999999) was adopted for the EU and the rest of the world (ROW) to flatten out the supply curve and mimic a small versus large country assumption. Although assumptions regarding the elasticities were simplified, given the available data, identifying "true elasticities" is nearly impossible (Holzner and Peci 2012). The authors also refer to other research to determine alternative values for the elasticities. The trade liberalization simulation revealed a net negative welfare effect for Kosovo. Welfare loses were due, for the most part, to losses in tariff revenue. Holzner and Peci (2012) concluded that trade liberalization between Kosovo and the EU will not substantially diversify Kosovo's export profile. Increased competitiveness could be reached through an improved investment climate as well as better institutional and physical infrastructure.

A number of trade liberalization case studies based on GSIM measurements were performed by Holzner. Holzner (2008) measures the effects of a potential accession of the

[15] ISIC-The International Standard of Industrial Classification of All Economic Activities developed by UN as a standard way of classifying economic activities. For example: 01-Agriculture, 02-Forestry...17-Textiles, etc.

Balkan countries and Turkey to the EU on agricultural trade. The author concluded that agricultural trade liberalization will primarily benefit the accessing countries, while EU members will be affected only to a minor degree. Holzner (2008) also calls for great caution when interpreting the results of the GSIM model. The author refers to the GSIM's partial equilibrium nature and warns of its inability to capture second round effects or resource reallocation effects in the economy at large. Nevertheless, if model limitations are kept in mind, important implications of trade liberalization can be drawn from the model's results. The GSIM's limitations as well as the limitations of this study will be reported separately in Chapter 8.

Using GSIM, Mutambatsere (2006) attempted to evaluate the implications of freer trade policies on cereal markets in the southern African region. The model included 13 countries of sub–Sahara Africa. Intra-regional trade is simulated with the inclusion of extra regional trade in form of ROW. In accordance with the Armington assumption, commodities are not homogeneous across borders. Imports originating from different countries are considered imperfect substitutes of each other. Data was obtained from World Integrated Trade Solutions (WITS) database, the US International Trade Commission (USITC), the Food and Agriculture Organization (FAO) dataset FAOSTAT, the Trade Analysis Information System (TRAINS) and national statistical agencies. Elasticity coefficients were sourced from secondary literature. A sensitivity analysis was performed to ensure the robustness of the results and to determine the lower and upper bounds of the expected welfare changes. Mutambatsere (2006) attempted to answer whether trade openness increases aggregate supply of cereals available at lower prices to consumers; if increased trade improves regional wealth through higher grain producer surplus and increased buying power of consumers. The analysis suggests that, all else being constant, freer intra-regional trade results in a minimal increase of the aggregate supply of cereals and a slight drop in average prices. An increased intra-regional trade and decreased trade with the rest

of the world is suggestive of a diversion of trade from the world to the region. No conclusive result was obtained with respect to an increase in vulnerability to the external shocks. Mutambatsere (2006) concludes that intra-regional tariff elimination does not induce greater regional supply of cereals.

Vanzetti et al. (2005) employed the GSIM model in an analysis of policy changes in the EU banana market. They assessed the impact of a removal of banana import quotas and the shift of the EU regime to a tariff only system. The model includes twenty regions including the main banana producers and exporters. Again, assumptions on elasticity values were obtained from secondary sources. Three alternative trade liberalization scenarios were assessed. The first scenario assumed the removal of both tariff and quotas by the EU, while the other two scenarios assumed the presence of two different tariffs on non African Caribbean and Pacific (ACP) country imports. Vanzetti et al. (2005) concluded that the abolition of banana imports quotas can potentially result in the transfer of quota rents to EU consumers. Total EU banana market liberalization results in a thirty percent decrease in prices and, hence, increased consumption of bananas. There is also a considerable increase in EU consumer surplus. An increased demand for bananas is expected to be satisfied by non-ACP countries (Venzetti et al., 2005).

Serletis and Fetzer (2008) assessed the impact of the 2004 US tobacco quota buyout in US and foreign markets using GSIM. The GSIM model results are usually perceived to be either over or under estimates because of its partial equilibrium nature. They compared the model output with the actual post-buyout changes in trade flows of US produced tobacco. The simulation results and actual changes were of the same magnitude and, therefore, appeared to be realistic (Serletis and Fetzer 2008).

Worz et al (2007) undertook an analysis of Russia's WTO accession and its implication for the Russian economy using GSIM. Partial equilibrium modeling was applied to different sectors of the economy separately: agriculture and food, chemicals, metals, textiles and clothing and machinery and vehicles. They concluded that losses associated with greater trade liberalization are rather insignificant for Russia (Worz, et al. 2008).

Choosing the appropriate modeling approach in trade policy analysis involves a trade off. In general terms modeling approaches differ based on scope, specifications, assumptions, etc. Building an applied model is a costly, rigorous process that requires time and effort to be spent on assembling a database, the formulation of the theoretical underpinnings, the estimation of parameters and shocking the model in simulations. The choice of between partial and general equilibrium model appears to be crucial for researcher. As the present research is focused on a single industry related policy reform, the analysis is carried out on a partial equilibrium basis. A GSIM model developed by Francois and Hall (2003) appears to be capable of answering the questions posed by the research question in this thesis. The GSIM has been applied in a wide variety of research projects related to international trade liberalization. Tariff reform studies were carried out using GSIM in various specific industries such as milk, wheat, and bananas as well as more aggregated sectors of the economy.

Given the scope and depth of the research possible, GSIM is chosen to be the most suitable tool for analysis. Firstly, GSIM is flexible. It allows for a disaggregated sector specific analysis while maintaining global scope. Its partial equilibrium nature implies that the analysis can focus on a specific tariff line level trade between countries of interest and aggregated regions. Secondly, the GSIM framework offers transparency. The model captures the welfare effects of trade policy changes (tariff reduction) in a disaggregated fashion. It means that the GSIM makes a clear distinction between producer, consumer, national effects and sources of economic

adjustments (production increase etc.) (Francois and Hall 2003). Thirdly, GSIM offers the analytical capacity required for the purpose of this particular research. The model allows for a simulation of trade policy changes (bilateral tariff reductions) among trading countries. Finally, GSIM uses comprehensive yet relatively accessible data, utilizes minimum computational requirements and is therefore considered user-friendly.

5.2 The GSIM model

A Global Simulation Model has been developed by Francois and Hall (2003). GSIM is a partial equilibrium model widely used for an industry level analysis of trade liberalization. It assesses changes in welfare, prices, output and trade flows as a result of tariff removal and/or reduction of production/export subsidies. It is a user-friendly spreadsheet model that handles up to 25 regions and is available for public use. The model estimates the effects of trade liberalization in terms of changes in bilateral trade effects, welfare effects (producer surplus, consumer surplus and change in tariff revenue), price and output changes. The model inputs include bilateral trade at world prices, initial bilateral import tariffs, final bilateral import tariffs, composite demand elasticities, industry supply elasticities and elasticities of substitution.

The description of the model will follow that provided by Francois and Hall (2003) and complemented by Jammes and Olarreaga (2005) explanations that appear to be clearer at times. The model's solution set is reduced to the global prices that clear the global market (Francois and Hall 2003). Global equilibrium prices are then used to back solve for national results. It uses the log-linear (percentage change) representation of import demand, combined with generic export-supply equations. The reduced-form system of equations that includes as many equations as there are exporters is then solved for the set of world (exporter) prices. A detailed description of the equations is provided in section 5.3, Model equations, below.

The GSIM model is based on the assumption of national product differentiation, also known as the Armington assumption. The Armington assumption states that products originating from different regions (countries) are imperfect substitutes to each other. The GSIM differentiates between imports from different sources and treats them as imperfect substitutes based on national product differentiation. The product heterogeneity comes from the different bilaterally imposed policies (tariffs, etc.). In other words, different bilateral policies result in tariffs that can vary from one country to another and determine the elasticity of substitution (Armington elasticities). Armington elasticities determine the extent to which imports change by source. The GSIM also holds the elasticity of substitution constant and equal across all sources. This reduces the influence of market share on elasticities to zero. The relevant own and cross-price elasticities are also derived and included in global supply and demand definitions and clearing conditions.

5.3 Model equations

Demand side

According to GSIM, within each importing country *v*, import demand within product category *i* of goods from country *r* is a function of industry prices and total expenditure on the category:

$$(1)\ \mathrm{M}_{m,p,x} = \mathrm{f}(\mathrm{P}_{m,p,x}, \mathrm{P}_{\mathrm{m,p,\neq x}}, \mathrm{Y}_{\mathrm{m,p}}),$$

where $\mathrm{Y}_{\mathrm{m,p}}$ is the total expenditure of country *m* on product *p*, $\mathrm{P}_{\mathrm{m,p,x}}$ is the domestic price in country *m* (tariff inclusive) of product *p* exported by *x*, $\mathrm{P}_{\mathrm{m,p,\neq x}}$, is the price of other varieties.

The export price received by exporter on world markets and internal prices for the same good are connected as follows

$$(2)\ \mathrm{P}_{m,p,x} = \left(1 + t_{m,p,x}\right)P^{*}_{p,x} = T_{m,p,x}P^{*}_{p,x}$$

where $t_{m,p,x}$ is the tariff imposed by country *m* on its imports of product *p* from *x*, and $P^{*}_{p,x}$ is the world price of product *p* exported from *x*. Here, T=1+*t* is the power of the bilaterally imposed tariff. It is the proportional price markup achieved by the tariff *t* (Francois and Hall 2003).

By differentiating equation (1), applying the Slutsky decomposition of partial demand and taking advantage of zero homogeneity property of Hicksian demand Francois and Hall (2003) arrive at the following equation:

$$(3)\ \varepsilon_{m,p,x} = \theta_{m,p,x}\left(\varepsilon_{m,p} + \sigma_{m,p}\right)$$

$$(4)\ \varepsilon_{m,p,\neq x} = \theta_{m,p,\neq x}\varepsilon_{m,p} - \left(1 - \theta_{m,p,\neq x}\right)\sigma_{s,p}$$

Equations (3) and (4) define own price and cross-price demand elasticities respectively.
The $\theta_{m,p,x}$ is the expenditure share of product *p* exported by *x* in total imports of product *p* by country *m*, $\varepsilon_{m,p} < 0$ is the composite import demand function for product *p* in country *m*,

$\sigma_{m,p} > 0$ is the elasticity of substitution in country *m* for product *p* exported from different origins (countries), $\varepsilon_{m,p,x}$ is the import demand function in country *m* for product *p* exported from *x*, $\varepsilon_{m,p,\neq x}$ is the cross-price elasticity of the import demand function in country *m* for product *p* exported from *x*, when the price of product *p* exported from another countries $\neq x$ changes.

Supply side

Export supply to the world markets is defined by the function of the world price P^*:

$$(5)\ X_{p,x} = g(P^*_{p,x})$$

Through differentiation of equation (5) and rearranging in percentage terms one obtains the following definition of the export supply elasticity:

$$(8)\ \hat{X}_{p,x} = e_{p,x}\hat{P}^*_{p,x},\ \text{or}\ e_{p,x} = \frac{\hat{X}_{p,x}}{\hat{P}^*_{p,x}} > 0$$

Market Equilibrium

Now that demand and supply for each product is specified, the percentage world price change following the trade reform in one or more countries can be obtained by solving for the new price that re-equilibrates demand and supply for this product (in our case, wheat origination from different countries) (Jammes and Olarreaga 2005). Due to the imperfect substitutability, changes in tariffs on products exported by other countries result in changes in import demand as suggested by the cross-price elasticity in equation (3).

Jammes and Olarreaga (2005) explain the solution to changes in world prices following the trade policy reform in matrix notation. Matrix notation helps to obtain a quick analytical solution. $E_{m,p}$ is a diagonal *x* by *x* matrix of elasticities in country *m* for product *p*, where the elements on the diagonal are equal to $\frac{\varepsilon_{m,p,x}}{e_{p,x}}$ as provided by (3) and (8) and the off-diagonal elements are given as: $\frac{\varepsilon_{m,p,\neq x}}{e_{p,x}}$. P^*_p is a vector of percentage changes in world prices of product *p* and $T_{m,p}$ is a vector of changes on the tariff imposed by country *m* on imports of *p* from different countries. Further, Jammes and Ollarreaga (2005) denote $E_p = \sum_m E_{m,p}$ and $B_p = \sum_m E_{m,p}\, T_{m,p}$. Imposing market clearing conditions and solving for the changes in world prices yeilds:

$$(9)\ P_p^* = \left(I - E_p\right)^{-1} B_p$$

Once the percentage change in world prices is obtained using equation (9), changes export and import quantities, changes in tariff revenue, (import) consumer surplus and (export) producer surplus can be found.

Equation (8) is used to back solve for export quantities. Differentiating equation (1) gives us:

$$(10)\ \widehat{M}_{m,p,x} = \varepsilon_{m,p,x}\hat{P}_{m,p,x} + \sum_{\neq x} \varepsilon_{m,p,\neq x}\, \hat{P}_{\mathrm{m,p,\neq x}}$$

Equation (10) is used to back solve for import quantities.

A linear approximation to the change in (exporter) producer surplus is calculated as follows:

$$\Delta PS_{p,x} = P_{p,x}^* X_{p,x} \hat{P}_{p,x}^* \left(1 + \ e_{p,x} \frac{\hat{P}_{p,x}^*}{2}\right),$$

where $\hat{P}_{p,x}^*$ is the percentage change in the world price of good *p* exported from *x* (Jammes and Olarreaga 2005).

The linear approximation to changes in tariff revenue is provided as:

$$\Delta TR_{m,p,x} = t_{m,p,x} M_{m,p,x} P_{m,p,x}^* \left(\left(\hat{t}_{m,p,x}\right) + \hat{P}_{m,p,x}^* (1 + \varepsilon_{m,p,x})\right),$$

where $\hat{t}_{m,p,x}$ is the percentage change in the tariff imposed by *m* on good *p* exported from *x*.

The consumer surplus is given as follows:

$$\Delta CS_{m,p} = \sum_x M_{m,p,x} P_{m,p,x}^*\ T_{m,p,x} \left(\frac{1}{2}\varepsilon_{m,p}\left[\hat{P}_{m,p}\right]^2 sign\left(\hat{P}_{m,p}\right) - \ \hat{P}_{m,p}\right),$$

where $\hat{P}_{m,p}=\sum_x \theta_{m,p,x}\hat{P}^*_{p,x} + \hat{T}_{p,x}$

The change in welfare is a sum of changes in producer surplus, consumer surplus and tariff revenue by country.

5.4 Data

This study includes a total of 24 regions including major wheat exporting, importing countries and aggregated regions such as the rest of the world (ROW), the rest of South America, the rest of Eastern Europe and the rest of the Commonwealth of Independent States. The data required for the empirical analysis using the GSIM is trade values by the origin and destination, bilateral tariffs, trade with self[16], elasticieties of composite demand, supply and substitution. The full list of countries included in the model is reported in Table 1 in the Appendix A. (See Appendix A Table 1).

The year 2007 has been chosen as the base year for the analysis. The wheat market in 2007 is more or less representative of global equilibrium in the market. No major wheat bans occurred in 2007 unlike in the following years that also coincided with the world wide economic crisis and major spikes in food prices. Also, in 2007 none of the KRU countries have yet joined the WTO. The bilateral trade flows data at the HS[17] four-digit level that corresponds to wheat and meslin[18] and comes from the trade statistics for international development (Trademap n.d.) of the International Trade Center.

[16] Trade with self is an estimate of the sales in the domestic market. It is estimated as follows: Domestic production-Exports. Since the bilateral trade data is in world prices, domestic production was calculated using world prices. Data for calculating Domestic production is sourced from the FAO statistics website.

[17] HS is the Harmonized Commodity Description and Coding System (HS) of tariff nomenclature is an internationally standardized system of names in accordance with the World Customs Organization. HS-1001 corresponds to wheat and meslin.

18 Meslin refers to a mixture of wheat/rye. In trade, it is classified with wheat and represents an insignificant part of the entire HS 1001 wheat and meslin category.

Bilateral tariff data comes from numerous sources. The *ad valorum*[19] equivalents for specific MFN, non-MFN and other preferential tariffs were obtained from the market access map database (MacMap n.d.) of the International Trade Center and the Centre d'Etude Prospectives et d'Informations Internationales, WTO's Tariff Download Facility Tariff (Tariffdata n.d.), Tariff Analysis Online also by WTO (TAO n.d.) and World Integrated Trade Solution by the World Bank (WITS n.d.). The data has been complemented and reported electronically along with the comments and sources.

Aggregate import demand elasticity (E_m) values for most of the countries were adopted from Kee, Nicita and Ollareaga (2004). They provide a systematic estimation of import demand elasticities for a broad group of countries at a very disaggregated level. Import demand elasticity values for the EU, Kazakhstan, Russia, Pakistan, and aggregated regions such as the rest of CIS, the rest of South America, Eastern Europe and the ROW were approximated due to lack of data. Approximations are based on the rational provided by Kee, Nicita and Ollareaga (2004)[20]. Import demand elasticities assigned to each country and region are reported in Table 2 in the Appendix A (See Appendix A, Table 2).

An export supply elasticity (E_x) value of 1.5 (Francois and Hall 2003) was adopted for the major exporters of wheat (Australia, the US, Canada, Argentina, the EU (27), Brazil); for other countries and regions, the value 0.5 was adopted. This corresponds to the assumption of "a small country" (Holzner, 2008). Supply elasticity values for Russia, Kazakhstan and Ukraine vary between 0.5, 1 and 1.5 depending on the three alternative scenarios explained below.

[19] *Ad valerum* tariff on imports is specified as a percentage of the value of the good.

[20] Kee, Nicita, and Ollareaga (2004) found the following:
Import demand for homogeneous goods is more elastic than for heterogeneous goods. Import demand is more elastic and the disaggregate level. Thus, the higher is the disaggregation in terms of HS digit code, the larger is the magnitude (more negative) of the import demand. Import demand is more elastic in larger countries. This is due to the ability the large economy country to substitute away from the import to domestic production.

An elasticity of substitution (E_s) value of 5 (Francois and Hall 2003) was adopted for all countries and regions in the model. The value of 5 is often used in the literature (Fukita, Krugman and Venables 2000).

5.5 Scenarios

Three scenarios were analyzed in this study. Scenarios vary based on the assumption of "small versus big country", or in other words the relative effect of being able to respond to changes in market conditions. The first scenario assumes that Russia, Ukraine and Kazakhstan (RUK) are able to respond to changes in demand quickly. Therefore, the three countries take the export supply elasticity value of 1.5 (as with the rest of the major wheat export suppliers). The second scenario assumes that RUK are less responsive to demand changes. In this case, RUK were each assigned export supply elasticity of value 0.5. A third scenario is a worst-case scenario that assumes RUK countries to be nonresponsive to demand changes (export supply elasticity equal to zero), meaning RUK countries are not able to adjust their production output and respond to prices they are going to receive. Supply response elasticities of less than 1.5 in KRU countries might occur due to a limited price transmission between world and domestic markets. Countries in transition such as KRU countries often exhibit weak or limited price transmission. It means that firms in transition economies are less price responsive compared to those in modern market economies. Price transmission inadequacies usually occur due to problems in infrastructure and institutional barriers. Small values of supply elasticities assume that KRU countries will not be able to respond to changes in prices due to their transition problems and constraints which were discussed in Chapter 2.

The results of the scenarios run using the GSIM model are reported in Chapter 6.

Chapter 6: Results

6.1 Reporting the results

The GSIM model was run with the bilateral trade matrix at world prices, initial matrix of bilaterally applied import tariffs on wheat in *ad valorem* form, and the final matrix of bilateral tariffs in ad valorem form and finally the elasticities, yield trade liberalization effects. Trade liberalization effects are estimated in terms of changes in welfare, specifically, changes in producer surplus, consumer surplus, trade flows, tariff revenues and prices. The GSIM model generates new prices that clear markets. These prices yield new trade values and welfare effects.

A new trade liberalization equilibrium is assumed to be reached as a result of the KRU countries' accession to the WTO. Trade liberalization effects are specifically reflected in terms of changes in tariffs applied to the imports of wheat originating from the KRU region. As part of the accession to the WTO, the Black Sea region wheat exporters are entitled to have MFN tariffs applied to their exports rather than the previous non-MFN tariffs that were applied when they were non-members

Table 9 summarizes the liberalization effects for the first scenario[21]. Liberalization effects are reported in thousand dollars as well as in the percentage of total cereal production value for a better visualization of the magnitude of the changes. Values in the form of percentages of gross cereal production in 2007 for aggregated regions were dropped and separate countries are reported. Summaries of the effects for the other two scenarios will be reported in Table 1, 2 and 3 in the Appendix B. The three tested scenarios have not yielded significantly different results.

[21] 1st scenario assumes that KRU countries are able to respond to price changes with increase production and quantities available for export and, therefore, each is assigned a supply elasticity equal to 1.5

Different supply elasticity values for KRU countries had marginal impact on the outcome. Hence, further discussions of results will be based upon scenario 1 outcomes.

Table 9 Summary of Effects Scenario 1									
	welfare (in 1000 dollars)					other (in %)			
	Producer surplus	Consumer surplus	Tariff revenue	Change in subsidy payments	Net welfare effect	Change in Overall Consumer Prices	Change in Output	Producer Price for Home Good	Market Price for Home Good
	A	B	C	D	E= A+B+C+D				
Australia	-3376.8	1678.7	0.0	0.0	-1698.1	-0.10%	-0.2%	-0.10%	-0.10%
Argentina	-1092.1	434.5	14.1	0.0	-643.4	-0.03%	0.0%	-0.03%	-0.03%
Canada	-3350.3	402.6	0.2	0.0	-2947.6	-0.07%	-0.1%	-0.07%	-0.07%
EU (27)	-11457.2	24056.7	-22144.3	0.0	-9544.8	-0.09%	-0.1%	-0.04%	-0.04%
US	-7452.6	3587.8	-141.3	0.0	-4006.1	-0.06%	-0.1%	-0.05%	-0.05%
Turkey	-119789.5	316798.3	18874.9	0.0	215883.7	-4.22%	-2.9%	-1.96%	-1.96%
Kazakhstan	**72003.7**	**-44908.1**	**0.0**	**0.0**	**27095.7**	**2.27%**	**3.4%**	**2.27%**	**2.27%**
Ukraine	**5492.6**	**-5919.9**	**0.7**	**0.0**	**-426.6**	**0.25%**	**0.3%**	**0.22%**	**0.22%**
Brazil	-60.6	530.2	17.9	0.0	487.5	-0.02%	0.0%	-0.01%	-0.01%
Russia	**116093.1**	**-84017.7**	**0.7**	**0.0**	**32076.1**	**0.95%**	**1.4%**	**0.93%**	**0.93%**
Algeria	-64.6	606.0	0.0	0.0	541.3	-0.04%	0.0%	-0.02%	-0.02%
Egypt	1844.8	-11573.5	0.0	0.0	-9728.7	0.41%	0.3%	0.20%	0.20%
Morocco	13.4	-150.6	0.0	0.0	-137.2	0.01%	0.0%	0.01%	0.01%
Iran	559.4	-1177.2	-252.9	0.0	-870.8	0.06%	0.0%	0.03%	0.03%
China	-526.3	528.2	20.7	0.0	22.6	0.00%	0.0%	0.00%	0.00%
Japan	-12.4	688.7	130.5	0.0	806.8	-0.05%	0.0%	-0.01%	-0.01%
Korea	-0.3	194.3	1.1	0.0	195.1	-0.04%	0.0%	-0.02%	-0.02%
Indonesia	0.0	230.7	5.3	0.0	236.0	-0.03%	0.0%	0.00%	0.00%
India	1736.2	-6674.5	-6560.3	0.0	-11498.6	0.02%	0.0%	0.01%	0.01%
Pakistan	570.1	-1217.2	-238.0	0.0	-885.2	0.02%	0.0%	0.01%	0.01%
rest CIS	4701.6	-15069.5	3.9	0.0	-10364.0	0.91%	0.6%	0.41%	0.41%
rest East EUR	83.0	-609.5	-641.0	0.0	-1167.5	0.07%	0.0%	0.02%	0.02%
rest South Am	-1013.1	1863.5	153.6	0.0	1004.0	0.00%	0.0%	0.00%	0.00%
ROW	-27163.2	81380.8	-58537.0	0.0	-4319.5	-0.32%	-0.3%	-0.22%	-0.22%

	Welfare effects, in % of 2007 gross cereal production value				
	Producer surplus	Consumer surplus	Tariff revenue	Change in subsidy payments	Net welfare effect
Australia	-0.068	0.034	0.000	0.000	-0.034
Argentina	-0.018	0.007	0.000	0.000	-0.011
Canada	-0.042	0.005	0.000	0.000	-0.037
EU (27)	-0.017	0.036	-0.034	0.000	-0.014
US	-0.010	0.005	0.000	0.000	-0.005
Turkey	-1.313	3.473	0.207	0.000	2.367
Kazakhstan	**2.738**	**-1.708**	**0.000**	**0.000**	**1.030**
Ukraine	**0.115**	**-0.124**	**0.000**	**0.000**	**-0.009**
Brazil	0.000	0.004	0.000	0.000	0.004
Russia	**0.826**	**-0.598**	**0.000**	**0.000**	**0.228**
Algeria	-0.007	0.062	0.000	0.000	0.055
Egypt	0.035	-0.218	0.000	0.000	-0.183
Morocco	0.002	-0.019	0.000	0.000	-0.017
Iran	0.009	-0.019	-0.004	0.000	-0.014
China	-0.001	0.001	0.000	0.000	0.000
Japan	0.000	0.003	0.001	0.000	0.004
Korea	0.000	0.002	0.000	0.000	0.002
Indonesia	0.000	0.001	0.000	0.000	0.001
India	0.002	-0.009	-0.009	0.000	-0.015
Pakistan	0.008	-0.017	-0.003	0.000	-0.013

Source: Results extracted from the GSIM model output and own calculations

In general, it can be said that the welfare effects of the world wheat trade liberalization as a result of the KRU countries accession to the WTO are modest. Total welfare effects in thousand dollars were related to individual countries' gross cereal production values in 2007 (see Table 9). Net welfare effects as a share of gross cereal production value appear to be insignificant for most of the countries. To put these in perspective, the loss in Australian exports is around 11 million US dollars when the total value of exports of wheat from Australia is equal to 1.6 billion US dollars. Another example, the loss in EU's value of exports is approximately 46 million US dollars when the total value of exports is 3.8 billion US dollars. Therefore, for big exporting countries like Australia, Canada, US and EU, these values of loss are relatively insignificant. Turkey, Kazakhstan, Russia, and Algeria experience positive net welfare effects. The rest of the countries experience negligible net welfare effects.

Freer trade for KRU countries does not lead to significant changes in prices across the countries and regions. Those countries with the most restrictive tariffs (the EU, Turkey, China and ROW) show price declines after freer trade. Price declines are higher in Turkey because more wheat is imported than exported. As net exporters, KRU countries experience increase in wheat prices due to higher market access. Since trade liberalization is not uniform across all markets countries experience different changes in prices. As large exporters' trade diverts to freer markets, prices slightly rise in Egypt, Morocco, Iran, India, Pakistan, the rest of CIS and the rest of Europe. Slightly smaller amounts of wheat − in value terms − are exported to these countries after trade liberalization, which explains the marginal rise in prices.

The greatest tariff difference before and after accession is expected from EU, Turkey and China. Results show negative tariff revenues for EU. They are, however, very small. Turkey experiences positive changes in terms of tariff revenues. Larger volumes of exports might have compensated for overall reductions in tariffs. The difference in China's MFN and non-MFN

tariffs is large. However, the reductions in tariffs faced by KRU wheat imports to China and potential increases in import volumes were not captured by the model as a result of the absence of trade between KRU countries and China 2007. This shortcoming is due to model limitations that are discussed in Chapter 8. To address this flaw, positive trade will be recorded between KRU and China in 2007 to allow the model to capture the effects of tariff reductions. Another run of the model indeed showed increase in trade between all KRU countries and China as predicted. Increase in trade between China and KRU countries is very likely, particularly with its immediate neighbors Russia and Kazakhstan. Added trade between KRU countries and China did not alter previously obtained welfare effects to any important degree and had no impact on the directions (signs) of the changes.

Changes in trade flows appear to be consistent with the theory. More trade occurs in freer markets. Table 10 demonstrates the changes in trade flows after the liberalization. Trade flow changes are reflected in percentage terms.

Table 10. Percent changes in trade values of world wheat trade flows after liberalization

		destination																						
		Australia	Argentina	Canada	EU (27)	USA	Turkey	Kazakhstan	Ukraine	Brazil	Russia	Algeria	Egypt	Morocco	Iran	China	Japan	Korea	Indonesia	India	Pakistan	rest CIS	rest East Europe	rest South America	ROW
origin	Australia	0.3	0.0	0.0	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.4	0.4	0.6	0.0	0.0	0.0	0.5	-0.6
	Argentina	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	1.5	0.2	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.1	-1.0
	Canada	0.1	0.0	0.2	0.1	0.2	0.0	0.0	1.2	0.3	0.0	0.2	1.7	0.4	0.0	0.3	0.3	0.2	0.2	0.4	0.0	0.0	0.0	0.3	-0.8
	EU (27)	-0.1	0.1	0.0	0.0	0.1	-12.6	0.0	1.1	0.0	3.0	0.1	1.5	0.3	0.0	0.2	0.2	0.0	0.0	0.2	0.0	3.6	0.5	0.2	-0.9
	USA	0.0	0.0	0.1	0.1	0.2	-13.4	0.0	1.1	0.2	0.0	0.1	1.6	0.3	0.0	0.3	0.2	0.2	0.2	0.0	0.3	0.0	0.0	0.3	-0.8
	Turkey	0.0	0.0	9.6	9.6	0.0	-3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.2	10.1	0.0	8.7
	Kazakhstan	0.0	0.0	0.0	46.5	0.0	35.2	-3.3	-10.5	0.0	-8.5	-11.5	-10.1	-11.3	-11.2	0.0	0.0	0.0	-11.5	-11.3	-11.3	-8.0	-11.1	0.0	33.3
	Ukraine	0.0	0.0	0.0	-1.3	31.6	43.3	0.0	-0.2	0.0	1.7	0.0	0.2	-1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	-0.8	0.0	9.4
	Brazil	0.0	-25.0	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	-1.1
	Russia	0.0	0.0	0.0	-4.9	0.0	125.2	3.4	-3.8	0.0	-1.8	-4.8	-3.3	-4.6	0.0	0.0	0.0	-4.8	-4.8	-4.6	-4.6	-1.3	-4.4	0.0	5.9
	Algeria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Egypt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Morocco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.1
	Iran	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	China	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	-1.1
	Japan	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Korea	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Indonesia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	India	0.0	0.0	0.0	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.1
	Pakistan	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.0	0.0	0.0	0.0	0.0	-1.2
	rest CIS	0.0	0.0	0.0	-2.3	0.0	-14.8	0.0	-1.2	0.0	0.8	0.0	0.0	-2.0	0.0	0.0	0.0	-2.2	0.0	0.0	0.0	1.3	0.0	0.0	0.0
	rest East Europe	0.0	0.0	0.0	-0.3	-0.2	-14.7	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0
	rest South America	-0.3	-25.1	-0.2	-0.2	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.1
	ROW	0.8	0.0	0.0	0.9	1.0	-336.0	0.0	2.0	1.1	0.0	1.0	2.4	0.0	0.0	1.1	1.0	1.0	1.0	0.0	0.0	4.5	1.4	1.1	0.0

Source: Results extracted from GSIM model.

As is expected KRU, countries experience substantial changes in trade flows due to the tariff reductions manifest in important importing markets. Russia experiences a large increase in trade with Turkey, Kazakhstan, ROW and a marginal decrease in trade with the rest of the world importers. Increase in export values from Russia to Turkey and ROW are due to tariff reductions. The three percent increase in trade between Russia and Kazakhstan can not be attributed to tariff reductions but rather to a big difference in changes in prices in Russia and Kazakhstan. Ukraine's value of exports to the US, Turkey and ROW increased by 32, 43 and 9 percent respectively. There is also a marginal increase in trade with Russia, Egypt, the rest of the CIS as well as slightly negative changes in trade with EU, Morocco and rest of Europe. This is due to increased access to some markets and, hence, redistribution effects from one market to another. Kazakhstan trades 47, 35 and 33 percent more with EU, Turkey and ROW respectively. These changes also stem from tariff reductions. There is slightly less trade occurring with the rest of Kazakhstan's trading partners due to diversion of trade flows as a result of increased access in other markets. It is also worth mentioning that the EU's currently applied wheat import tariffs for high quality wheat and medium or low quality wheat from WTO members is 0 and 95 euro per ton. High quality wheat is identified as minimum 14 percent protein content while everything else below 14 percent is considered medium or low quality wheat. In the future, as a result of accession to the WTO, KRU country exporters might benefit from the absence of quotas for "high quality wheat".

The EU, the US, the rest of the CIS and the ROW have lower trade values with Turkey as their relative market access conditions erode relative to the KRU countries in Turkish markets. In general, major wheat exporting countries such as Argentina, Australia, Canada, the EU and the US do not appear to be negatively impacted by KRU's accession to the WTO to any important

degree. As their relative markets access conditions erode in the Turkish (for the EU and the US) and ROW markets (these are mostly represented by Middle Eastern and African markets), their trade flows are diverted and marginally distributed among other countries and regions at reduced prices.

Trade diversion as a result of KRU countries' obtaining improved access to markets has a marginal impact on wheat output values as well. Table 11 provides changes in production. The price changes as a result of the trade liberalization lead to changes in output produced. There is an output decline in Australia, Argentina, Canada, the EU, the US, Turkey and the ROW as a result of the decline in prices. The opposite is true for the countries experiencing higher prices for wheat. The KRU countries respond to higher prices with more output. Countries such as Egypt and the rest of the CIS experience increase in prices for domestic goods due to lower values of imports and, as a result, produce more output.

Table 11. Change in output percentage and value

Country	percent	in tonnes	original production in 2007 in tonnes
Australia	-0.16%	-213	13569380
Argentina	-0.05%	-78	16486530
Canada	-0.10%	-203	20054000
EU (27)	-0.06%	-752	120263646
US	-0.08%	-442	55820400
Turkey	-2.94%	-5072	17234000
Kazakhstan	**3.41%**	**5619**	**16466900**
Ukraine	**0.33%**	**457**	**13937700**
Brazil	-0.01%	-3	4114060
Russia	**1.40%**	**6917**	**49368000**
Algeria	-0.03%	-7	2318960
Egypt	0.30%	225	7379000
Morocco	0.01%	2	1582630
Iran	0.04%	64	15886600
China	0.00%	-38	109298296
Japan	-0.01%	-1	910100
Korea	-0.02%	0	7351
Indonesia	0.00%	0	0
India	0.01%	73	75806700
Pakistan	0.01%	28	23294700
rest CIS	0.62%	847	13618304
rest East EUR	0.03%	23	6805676
rest South Am	0.00%	-1	2987894
ROW	-0.33%	-1764	53993183

Source:Results extracted from GSIM model and own calculations

As can bee seen from Table 11, changes in output as a response to trade liberalization are, in general, modest. Some countries produce more and some less. Just looking at the percentage change can be deceiving, therefore percentage changes were reported in terms of tonnes. Changes in production values are negligible when compared to the original production tonnage recorded for 2007.

To ease the process of visualization of the results, KRU countries' changes in trade flow maps are provided in Appendix C. These maps were all generated using arc GIS[22] software.

Once again, it is worth mentioning that the results should be analyzed with great caution because they were generated by the partial equilibrium approach and not a general equilibrium approach. Nevertheless, this research enhances the understanding of trade liberalization and explains the possible outcomes of the KRU countries' accession to the WTO.

6. 2 Sensitivity analysis

Sensitivity analysis was performed to ensure the robustness of the results over changes in elasticity values. Assigning higher supply elasticities result in smaller producer price effects and larger output effects. Altering the supply elasiticities across countries slightly changes the magnitude of changes in consumer and producer welfare and as is predicted has no effect on the direction (sign) of the changes.

Lower values of substitution eleasticities lead to lower quantity and price response, and hence, lower welfare effects. Increasing these elasticity values does the opposite, but has no effect on the direction of the changes. Results of the sensitivity analysis are provided in Appendix B, Table 4 and Table 5.

[22] Arc GIS is a geographic information system that allows to visualizes values, in our case, trade flows in terms of American dollars.

6.3 Conclusion

The GSIM model was used to examine the impact of the KRU countries' accession to the WTO on world wheat trade. World wheat trade liberalization, reflecting the move to the MFN tariff as a result of accession, was simulated. Accession to the WTO is expected to bring more market access for KRU countries. Simulation results are consistent with the theory. Increased access to markets leads to more trade between KRU countries and previously restricted markets. KRU countries trade with now freer markets such as Turkey, the EU, China and the ROW expands. Major traditional wheat exporters such as Australia, Canada, the EU, and the US do not seem to be negatively impacted to any important degree from the accession of the KRU countries to the WTO. Their relative market access conditions, however, erode in Turkish (for the EU and the US) and ROW markets (these are mostly represented by Middle Eastern and African markets) and their trade volumes are diverted and marginally distributed among other countries and regions at reduced prices. Trade liberalization is not uniform across regions and, hence, leads to different net welfare changes across countries. However, those welfare changes appear to be modest.

Chapter 7 provides a discussion of the important findings and implications arising from the simulation exercises.

Chapter 7: Important findings and implications

This thesis indicates that the accession of the KRU countries to the WTO can be expected to result in observable changes in trade flows in the world wheat trade. Although net welfare effects appear to be relatively small, there is a potential for intensification of trade among KRU countries and their trade partners. Increases in the KRU's countries' export opportunities would come at the expense of the other major wheat exporters such as Canada, the US, Australia and the EU as their competitiveness erodes in several major importing markets (Turkey, the EU, and the ROW). The loss, however, does not appear to be significant in terms of their dollar values. Major exporters will be able to compensate the market access erosion by diverting and distributing exports among other importing markets. Canada, the US, Australia and the EU's market presence is more diverse in terms of geography than that of the KRU region. These countries hold an advantage in terms of transportation costs at this point in time. It is also believed that these countries have established themselves as reliable exporters in contrast to KRU countries. KRU countries have volatile production and are well known for their export bans. Therefore, traditionally large exporters such as the US, Canada and Australia are less likely to suffer as a result of the KRU's accession to the WTO.

Accession to the WTO can bring market access opportunities for KRU countries. Running scenarios with constrained supply elasticities among KRU countries did not alter the end results in any significant way. It is, however, questionable whether producers can capitalize on the opportunities provided by the WTO membership. This depends on factors such as future productivity, domestic policies, adaptability to climate changes and other socio economic factors. Infrastructure is one of the major constraints for KRU countries. Russia, Ukraine and Kazakhstan

are all putting considerable effort into improving the infrastructure for storing and transporting grain, especially for access to remote markets. If KRU countries overcome their present constraints and use their wheat producing resources efficiently, their presence in the world wheat trade arena will remain strong and gain in prominence.

Considering the majority of the large trading nations are already part of the WTO, less attention is given to the difference between the MFN and non-MFN tariffs. However, the later difference appears to be substantial especially in trade of agricultural commodities. It is important to note that the data on non–MFN tariffs is not easily accessible. WTO member countries are not obligated to report their schedules on non-MFN tariffs. Thus, it takes a major effort to compile non-MFN tariffs that are applied by member states of the WTO. No other studies which used pre-accession tariff rates were found. Large files of tariff schedules for some countries containing both MFN and non-MFN tariffs are accessible on the WTO website site. Information provided on the online websites like TRAINS and MacMap are at times inconsistent or provide MFN tariffs only.

Chapter 8: Conclusions

8.1 Summary of results

The WTO administers the agreed rules of international trade among 159 countries. Countries join the WTO to become integrated into the modern global economy. One of the mort important benefits that WTO membership provides is improved and more secure access to member countries' markets. Before enjoying the security provided by WTO membership, each country wishing to join the WTO has to go through a four-stage accession process. After joining the organization, countries are entitled to receive "most favored nation" treatment. It means, among other things, that new members move from facing non-MFN tariffs to MFN tariffs which all members of the WTO are extended.

World wheat is and likely will always be an important part of the global food basket. Wheat is both relatively nonperishable in storage and transport making it an ideal commodity for international movement. To date, wheat trade accounts for one third of the world grain trade and this trade is expected to double by 2050 in response to the growing world population.

Black Sea wheat exporting countries are emerging as major exporters and producers of wheat in the world. Their growing importance in world wheat trade has been evident since the early 2000s. Growing wheat exports from this part of the world are due to several factors including the collapse of the Soviet regime and its consequences in the agricultural sector. The decline in livestock numbers, marginal increase in yields and favorable weather conditions are believed to be the factors that contributed to the increase in wheat exports among KRU countries.

KRU countries have long wished to join the WTO. Negotiations for all three countries were long and are still in progress for Kazakhstan. Ukraine was the first to become an official member of the WTO in 2008, Russia joined in 2012 and Kazakhstan is expected to follow in the near future.

As an important wheat producing region, accession of the KRU countries to the WTO is expected to bring about important realignments in the world wheat trade flows as the countries move from facing non MFN to MFN tariffs in the world import markets.

This empirical study employing a partial equilibrium, multi region GSIM model provided useful insights into the implications of the accession of the KRU countries' into the WTO. Major exporting and importing countries (23 in total) including aggregated regions were included in the research. A number of simulations of world wheat trade liberalization were carried out to assess changes in world wheat trade flows, prices and changes in economic welfare. The results suggest that KRU countries gain access and, therefore, increase export values to previously highly protected markets such as the EU, Turkey, China and the ROW. More market access results in higher prices for KRU countries. This will come at the expense of the traditional major exporters such as the US, Australia, Canada and the EU. Losses as a result of the market access erosion for these countries are small in financial terms. Their diversified presence in all markets across the world allows them to divert and re-distribute their exports to other markets at slightly lower prices. In short, accession to the WTO brings export opportunities for KRU countries with no dramatic declines for the rest of the world. There are, of course, both losers and winners. However, both net welfare losses and gains to the rest of the countries, however, appear to be marginal. Major traditional wheat exporters will experience market access erosion in some markets but are most likely to cope with this problem by selling more to other markets.

8.2 How it adds to the literature

This thesis investigates an important real event in the world's wheat trade. Studies relating to KRU countries trade in specific commodities are scarce and largely descriptive. A study of world wheat trade liberalization carried out by Gomez-Plana and Devadoss (2004) pursues similar question, but fails to mimic the real world wheat trade scenario. The authors assume complete removal of all bilateral tariffs across all major wheat importing and exporting countries. Complete removal of trade barriers is, however, unlikely. In addition, Gomez-Plana and Devadoss (2004) did not differentiate between MFN versus non-MFN tariffs and appear to arrive at the average between the two.

This study contributes to the general understanding of the increasing importance of wheat exporters from the Black Sea region in world wheat trade. It provokes further discussions related to the accession of the KRU countries into the WTO.

8.3 Limitations of the Study

Limitations of this study can be divided into two categories: those that are attributable to the GSIM model and those specific to this study. This research utilizes GSIM model approach to assess the effects of the trade liberalization. Although the model has significant advantages, it also has a number of limitations that should be kept in mind. Firstly, it is worth remembering that GSIM's partial equilibrium approach belies its focus on only part of the total economy. It means that the model does not account for intersectoral linkages and possible income or resource re-allocation effects throughout the whole economy. Therefore, changes in the rest of the economy are not accounted for by the GSIM. This implies that the results of the trade liberalization scenarios might be under or overestimated. Secondly, the GSIM model is a static model that

compares scenarios at a given point in time. It does not allow for long term adjustments or transition periods that allow for dynamic economic effects. Thirdly, the model assumes full price transmissions. However changes in border prices might not be fully transmitted to producers and households, hence, actual responses to reforms might differ in reality from those projected by the analysis. Finally, the assumptions made with regard to the elasticity values may be a limitation. Values assigned across regions might not be accurate in reflecting the responsiveness to the price changes. The model is based on the representative agent assumption that does not differentiate between various groups within a particular region. The responsiveness to the price is kept the same among all of them.

The GSIM model analysis is based on the observed volumes of bilateral trade at a certain time. It captures the responses to trade liberalization between countries that are trade partners, but does not capture possible "new trade" that can potentially occur between non trading partners after the reduction of restrictive tariff rates. In order to address this shortcoming, the value of one dollar was recorded to trade values that were equal to zero to allow for positive trade responses where tariff changes are substantial[23].

Another major limitation specific to this study is lack of data. The production and export subsidies data are not included to the model. Therefore, this study is not inclusive of non-tariff based trade distorting factors that could shed more light on the effects of KRU countries accession to the WTO.

[23] For example, China and Kazakhstan is not reported as trading in 2007. However, since the difference in China's MFN vs non MFN tariffs is large, another model run was performed to test for this shortfall. Initial trade volumes from KRU-China were altered from zero values to one dollar (see chapter 6)

8.4 Areas of Future Research

Future research can potentially address the shortcoming of the present study. Most importantly, future studies should focus on trade distorting instruments such as industry specific production subsidies. Agricultural subsidization is one of the most difficult topics in the WTO. It is expected that the existing agricultural subsidies will be reduced following the accession to the WTO. However, developing countries accessing the WTO are given a transition period to lower the levels of agricultural support. Of course, not all types of subsidization are prohibited by the WTO regulations. The WTO regulations distinguish three types of support policies that are classified under three color boxes: green, blue and red[24].

For example, major wheat exporting countries such as Canada, the US and Australia have already expressed concerns regarding the level of transport subsidization for wheat exports, particularly in Kazakhstan. These transportation subsidies are most likely classified under the red box. As is suggested by the name "red box", these subsidies are prohibited by the WTO. Kazakhstan officials are using the "landlocked" argument and focusing on retaining a transition period.

In short, agricultural support policies are important in international trade. Therefore the inclusion of other trade distorting measures such as subsidization can yield more revealing insight into the effects of the accession to the WTO.

The shortcomings embedded in the modeling approach could be improved by the development of a new modeling initiative that would require considerable effort and time. Researchers could expand the scope of the existing general equilibrium models to assess the

[24] A more detailed discussion on the WTO regulations regarding support policies can be obtained from WTO (2010)

economy wide effects of the accession of the countries to the WTO and the ramifications for agriculture in general. The general equilibrium approach is data intensive yet could be carried out successfully given enough time and resources.

8.5 Conclusion

The contribution of this thesis includes an assessment of world wheat trade liberalization following the accession of the Black Sea region exporters into the WTO. It measures the effects of trade liberalization on world wheat trade flows, prices and economic welfare across different exporting and importing regions. Although, the thesis is limited by the exclusion of non-tariff based measures due to lack of data, the research provides insights to the changes that may be expected in world wheat trade. The thesis differs from other studies because it uses a partial equilibrium approach to explore a real world case rather than a hypothetical issue. Further, the thesis provided a discussion regarding the global trade in wheat, the KRU countries' emergence in the world wheat markets and their accession to the WTO. This thesis indicates that increased access to world markets as a result of accession to the WTO brings export opportunities for KRU countries at no major loss to other traditional exporters. Whether the Black Sea region exporters will be able to capitalize on the opportunity is, nevertheless, questionable and, hence, as is what the future holds.

References

ABARE (1996). *The MEGABARE model: Interim Documentation.* Canberra, Australian Bureau of Agriculture and Resource Economics.

Armington, Paul, S. (1969). *A Theory of Demand for Products Distinguished by Place of Production.* Vol. 16. Washington: International Monetary Fund.

Babkin, K.A, Kuznecov A. B, E. A Korchevoi, V. V Pronin, and V. A Samohvalova (2012). *Consequances of Russia's Accession to the WTO.* WTO inform , Moscow: WTO inform.

Bacchetta, M., C. Beverelli, O. Cadot, M. Fugazza, J-M. Grether, M. Helble, A. Nicita, R. Piermartini (2012). *A Practical Guide to Trade Policy Analysis.* Geneva: UNCTAD and the WTO.

Baltinfo, n.d. *Logistics Problems Hamper Russian Grain Exports (translation from russian).* http://www.baltinfo.ru/2009/12/18/Problemy-logistiki-meshaiut-eksportu-rossiiskogo-zerna-120835 (accessed March 12, 2013).

Bank, World. *Bilateral Tariff Data.* World Bank. econ.worldbank.org.

Benirschka, M, and W.W Koo (1995). *World Wheat Policy Simulation Model: Description and Computer Program Documentation.* Department of Agricultural Economics. Fargo: North Dakota State University.

Boersch, M. (2013) *Pulse Production in Ukraine Russia and Kazakhstan.* Presentation For SPG, Saskatoon Mercantile Consulting Venture Inc., Winnipeg, Canada.

Devadoss, S., M. Helmar, and W. H. Meyers (1990). *The World Wheat Trade Model: Specification, Estimation, and Validation.* Vols. Technical Report 90-TR14. Center for Agrculture and Rural Development. Ames, Iowa: Iowa State University.

Dumans, T, and D Nivet (2003). *Perception of Black Sea Wheat by European Users: What competition for French wheat?* Paris: Ecole Superieur d'Agriculture d'Angers.

FAO n.d. "FAO Cereal Supply and Demand Brief." Rome: Food and Agriculture Organization. www.fao.org/worldfoodsituation/wfs-home/csbd/en/ (accessed April 2, 2013).

FAO, 2003. *World Agriculture Towards 2015/2020.* Edited by Jelle Bruinsma. London: Food and Agriculture Organization.

FAOSTAT n.d. *FAOSTAT. Animal Production.* www.faostat.fao.org (accessed March 29, 2013).

FAOSTATa n.d. *FAOSTAT.Cereal Production. Yeild Information.* faostat3.fao.org (accessed April 1, 2013).

Felix, Kogan (1981). *"Grain production on the USSR. Present Situation, Perspectives for Development and Methods for Prediction."* Staff Report, Washington: United States Department of Agriculture.

Fellmann, Thomas, and Olexandr Nekhay (2012). *Agricultural Sector and Market Developements: a Special Focus on Ukraine, Russia and Kazakhstan.* European Commission Join Research Centre Institute for Prospective Technological Studies, Luxembourg: European Commission.

Francois, J.F., and H.K Hall (2003). *Global Simulation Analysis of Industry-Level Trade Policy.* Tinbergen Institute, CERP, Washington: US Commerce Department.

Fukita, M, P Krugman, and A Venables (2000). *The Spacial Economy- Cities, Regions and International Trade.* Cambridge, MA; MIT Press.

Gomez-Plana, A., and S Devadoss (2004). A spatial Equilibrium Analysis of Trade Policy Reforms on The World Wheat Markets. *Applied Economics,* 36 (15): 1643-1648.

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

Holzner, Mario (2008). GSIM Measurment of the Effects of the EU accession of the Balkans and Turkey on Agricultural Trade. *South East European Journal of Economics and Business* 3 (1): 7-14 .

Holzner, Mario, and F Peci (2012). *"Measuring the Effects of Trade Liberalization in Kosovo."* Vienna: The Vienna Institute for International Economic Studies.

Inmaculada, Martinez-Zarzosa, and Suarez-Burguet Celestino (2005). Transport Costs and Trade: Empirical Evidence for Latinoamerican Imports From the European Union. Journal of International Trade and Economic Development, 14 (3): 353-371.

Ivus, Olena, and Aaron Strong (2007). Modeling Approaches to the Analysis of Trade Policy: Computable General Equilibrium and Gravity Models. In *Handbook on Internaitonal Trade Policy*, William Kerr and James Gaisford, (eds.). Cheltenham: Edward Elgar Publishing Limited, pp 44-54.

Jammes, Olivier, and Marcelo Olarreaga (2005). *Explaininf SMART and GSIM*. Washington: The World Bank .

Kee, Hiau Looi, A Nicita, and M Olarreaga (2004). Import Demand Elasticities and Trade Distortions. *The Review of Economics and Statistics* 90 (4): 666-682.

Leudjou, Roland (2012). The Doha Round and Food Security in the Dairy Sector in Cameroon: A Global Simulation Model (GSIM) Approach. *The Estey Centre Journal of International Law and Trade Policy* 13 (1) : 115-130.

Liefert, Olga, William Liefert, and Eric Luebenhusen (2013). *Rising Grain Exports by the Former Soviet Union Region.* Washington: United States Department of Agriculture.

MacMap n.d. *macmap.org.* Geneva: International Trade Center.

Meyers, William, H., Patrick Westhoff, Jacinto Fabiosa, and Dermot, J. Hayes (2010). "The FAPRI Global Modeling System and Outlook Porcess." *Journal of International Agricultural Trade and Developement* 6 (1): 1-19.

Mutambatsere, Emily (2006). *Trade Policy Reforms in the Cereals Sector of the SADC Region: Implication on Food Security.* Department of Applied Economics and Managment. Cornell University. Ithaca: Cornell University.

Nicita, A, and M Olarreaga (2006). Trade, Production and Protection Database 1974-2004. *World Bank Econ Review* 21 (1): 165-171.

OECD-FAO (2012). OECD-FAO Agricultural Outlook 2012-2021 Database. *OECD Statistics website.* June 2012. http://stats.oecd.org/index.aspx?Queryld=23336 (accessed April 18, 2013).

Prikhodko, Dmitri (2009). *Grain Markets in Kazakhstan, Russia and Ukraine.* New York: FAO.

Pugachev, N (2012). *Ukraine's Accession to the WTO: Accession Conditions.* Presentation. Moscow: Ministry of Agriculture of Russia Training Centre.

Roningen, V., D. Praveen, and J. Sullivan (1991). *Documentation of the Static World Policy Simulation (SWOPSIM) Modeling Framework.* Economics and Research Service. Staff Report No. AGES 9151. Washington: US Department of Agriculture.

Russian Federation Federal State Statistics Service. *Agriculture. Livestock.* www.gks.ru (accessed April 12, 2013).

Serletis, George, and James Fetzer (2008). *Modeling the Impact of the US Tobacco Quota Buyout. Working Paper No 2008-06-A.* Washington: US International Trade Commission.

State statistics services of Ukraine. *Stock-breeding.* www.ukrstat.gov.ua (accessed March 28, 2013).

Statistics Agency of Kazakhstan n.d. *Agriculture. Cattle and bird livestock.* www.eng.stat.kz (accessed March 1, 2013).

Takayama, T, and G. G. Judge (1971). *Spatial and Temporal Price and Allocation Models.* Amsterdam: North Holland Publishing Co.

TAO n.d. WTO: Tariff Analysis online. tariffanalysis.wto org.

Tariffdata n.d. *tariffdata.wto.org.* WTO.

Tongeren, F. W., H. Neijl, and Y. Surry (2001). Global Models Applied to Agricultural and Trade Policies: A Review and Assessment. *Agricultural Economics* 26 (2): 149-172.

Trademap n.d. *www.trademap.org.* Geneva: International Trade Center.

UN Department of Economic and Social Affairs, Population Division (2011). *World Population Prospects: The 2010 Revision. CD-ROM Edition.* United Nations Department of Economic and Social Affairs. New York: United Nations. esa.un.org/wpp/ Excel-Data/population.htm (accessed April 14, 2013).

US Census Bureau, n.d. *International Programs. World Population 1950-2050.* http://www.census.gov (accessed November 29, 2012).

USDAa, n.d *USDA Wheat Baseline, 2012-21.* www.ers.usda.gov (accessed March 21, 2013).

USDA (2013). *FAS Production, Supply and Distribution Online (USDA PS&D).* http://www.fas.usda.gov/psdonline/ (accessed January 17, 2013).

USDA, n.d. *Trade.World wheat maret.* http://www.ers.usda.gov (accessed January 1, 2013).

USITC (2004). *The US Applied eneral Equilibrium Model.* Vols. Note No. 2004-01-A. US Office of Economic Research. Washington: International Trade Commission.

Vanzetti, D., S. Fernandez, and V Chau (2005). *Banana Split: How EU Policies Devide Global Producers.* Vol. 31. Policy Issues in International Trade and Commodities Study Series. New York and Geneva: United Nations.

Vanzetti, David, and Ralf Peters (2004). *"User Manual and Handbook on Agricultural Trade Policy Simulation Model."* Policy Issues in International Trade and Commodities Study Series No. 24. Geneva: United Nations Conference on Trade and Development.

Vassilieva, Y, and Levin Flake (2011). *Overview of Russian Grain Port Capacity and Transportation.* GAIN report N:RS1149, Washington: United States Department of Agriculture.

Wandel, J. (2008) *Agroholdings ot clusters in Kazakhstan's Agri-Food Sector?* Almaty: German-Kazakh University.

Weigand, Chad (2011). *Wheat Import Projections Towards 2050.* Arlington: US Wheat Associates.

WITS. *World Trade Integrated Solutions.* Washington: World Bank. www.wits.worldbank.org.

Worz, J, O Pindyuk, M Holzner, and V Astrov (2008). *"Russia's WTO accession in the Meduim and Long Run-A Global Simulation Model (GSIM) approach."* Vienna: The Vienna Institute for International Economy.

WTO (1996). *Accession of the Republic of Kazakhstan: Memorandum on the Foreighn Trade.* Geneva: World Trade Organization.

WTO Information and External Relations Devision (2011). *Understanding the WTO Fiftth Edition.* Geneve: World Trade Organization.

WTO n.d. *Ten Benefits of the WTO Trading System.* http://www.wto.org/english_e/whatis_e/10ben_e/10b00_e.htm (accessed May 1, 2013).

WTO (2010). *Understanding the WTO Fifth Edition.* Edited by World Ttade Organization Information and External Relations. Geneva: World Trade Organization.

Appendix A

Figure 1. Map of KRU's exit routes to the world markets

Existing routs

Future routs

Table 1. List of countries included in the model

Australia	EU(27) is:	rest CIS is:	rest East Europe is:	rest South America is:
Argentina	Belgium	Armenia	Croatia	Bolivia
Canada	Bulgaria	Azerbaijan	Serbia	Chile
Eu(27)	Czech Republic	Belarus	Montenegro	Colombia
US	Denmark	Kyrgyzstan	Bosnia	Ecuador
Turkey	Germany	Moldova	Herzigovina	Guyana
Kazakhstan	Estonia	Tajikistan	Albania	Paraguay
Ukraine	Ireland	Uzbekistan	Kosovo	Peru
Brazil	Greece	Turkmenistan	Macedonia	Suriname
Russia	Spain			Uruguay
Algeria	France			Venezuela
Egypt	Italy			
Morocco	Cyprus			
Iran	Latvia			
China	Lithuania			
Japan	Luxembourg			
Korea	Hungary			
Indonesia	Malta			
India	Netherlands			
Pakistan	Austria			
rest CIS	Poland			
rest East Eur	Portugal			
rest South Am	Romania			
ROW	Slovenia			
	Slovakia			
	Finland			
	Sweden			
	United Kingdom			

Table 2. Aggregate Import demand elasticities

	Composite Demand
Australia	-2.49
Argentina	-2.52
Canada	-2.29
Eu(27)*	-3
US	-3.39
Turkey	-1.97
Kazakhstan*	-1.46
Ukraine	-1.46
Brazil	-3.38
Russia*	-2
Algeria	-1.59
Egypt	-1.78
Morocco	-1.45
Iran	-1.87
China	-2.54
Japan	-4.05
Korea	-2.08
Indonesia	-2.09
India	-3.26
Pakistan*	-1.25
rest CIS*	-1.25
rest East Eur*	-1.25
rest South Am*	-1.5
ROW*	-1.5

From: Kee, Nicita and Ollareaga (2004)
* approximations

Appendix B

The three tested scenarios lead only to marginally different results. Different supply elasticity values for KRU countries had an only small impact on the outcome. Hence, main discussions of results were based upon scenario 1 outcomes.

Assigning different supply elasticities for KRU countries is as a crude proxy for potential differences in transition economies' ability to respond to price changes compared to modern market economies. First scenario assumes that the wheat industry in Russia, Ukraine and Kazakhstan (RUK) are able to respond to changes in demand to a similar degree as the industry in modern market economies. Therefore, the three countries take the export supply elasticity value of 1.5 (as with the rest of the major wheat export suppliers). Second scenario assumes that RUK are less responsive to demand changes. In this case, RUK were each assigned export supply elasticity of value 0.5. Third scenario, where KRU countries are each assigned export supply elasticity values equal to zero, is a worst-case scenario that assumes KRU countries are not able to respond to any degree to changes in prices.

Table 1. Summary of Effects

	welfare (in 1000 dollars)					other (in %)			
	Producer surplus	Consumer surplus	Tariff revenue	Change in subsidy payments	Net welfare effect	Change in Overall Consumer Prices	Change in Output	Producer Price for Home Good	Market Price for Home Good
scenario 1									
Kazakhstan	**72003.7**	**-44908.1**	**0.0**	**0.0**	**27095.7**	**2.27%**	**3.4%**	**2.27%**	**2.27%**
Ukraine	**5492.6**	**-5919.9**	**0.7**	**0.0**	**-426.6**	**0.25%**	**0.3%**	**0.22%**	**0.22%**
Russia	**116093.1**	**-84017.7**	**0.7**	**0.0**	**32076.1**	**0.95%**	**1.4%**	**0.93%**	**0.93%**
scenario2									
Kazakhstan	**71198.5**	**-44908.1**	**0.0**	**0.0**	**26290.5**	**2.27%**	**3.4%**	**2.27%**	**2.27%**
Ukraine	**5486.6**	**-5919.9**	**0.7**	**0.0**	**-432.6**	**0.25%**	**0.3%**	**0.22%**	**0.22%**
Russia	**115554.7**	**-84017.7**	**0.7**	**0.0**	**31537.7**	**0.95%**	**1.4%**	**0.93%**	**0.93%**
scenaario 3									
Kazakhstan	**70795.9**	**-44908.1**	**0.0**	**0.0**	**25887.9**	**2.27%**	**3.4%**	**2.27%**	**2.27%**
Ukraine	**5483.6**	**-5919.9**	**0.7**	**0.0**	**-435.6**	**0.25%**	**0.3%**	**0.22%**	**0.22%**
Russia	**115285.5**	**-84017.7**	**0.7**	**0.0**	**31268.4**	**0.95%**	**1.4%**	**0.93%**	**0.93%**

Source: extracted from the GSIM model results

Table 1. provides a brief comparison of the three scenarios. Export supply elasticity of value 0.5 in Scenario 2, resulted in slightly lower value of producer surplus across KRU countries and, hence, lower values of net welfare effects in Kazakhstan and Russia as well as a marginal increase in Ukraine's negative net welfare effects. The magnitude of changes, however, appears to be negligible. Scenario 3, where export supply elasticity is equal to zero across KRU countries, yields lower producer surplus values than in all previous two scenarios. Once again, these changes appear to be very small. Changes in prices were insufficient to produce any changes in other results values rounded at ten digit level[25].

The model was, however, tested for the responsiveness to changes in supply elasticities and yielded theoretically consistent results.

Sensitivity analysis was performed and reported in Table 2 and 3 of the Appendix B.

[25] The difference in price changes across three scenarios was negligible to the extent that no discernible impact on trade flows was detected given the degree of rounding built into the GSIM model.

Sensitivity analysis was performed to ensure the robustness of the results over changes in elasticity values. Table 3 reports sensitivity analysis results with respect to export supply elasticities. Assigning higher supply elasticities result in smaller producer price effects and larger output effects. Altering the supply elasiticities across all countries slightly changes the magnitude of changes in consumer and producer welfare and, as is predicted, has no effect on the direction (sign) of the changes.

Table 2. Sensativity analysis. Higher values of supply elasticities(increase by 0.5 across all countries)
Summary of Effects

	welfare					other			
	Producer surplus	Consumer surplus	Tariff revenue	Change in subsidy payments	Net welfare effect	Change in Overall Consumer Prices	Change in Output	Producer Price for Home Good	Market Price for Home Good
	A	B	C	D	E= A+B+C+D	percent	percent	percent	percent
Australia	-3077.8	1530.2	0.0	0.0	-1547.5	-0.10%	-0.2%	-0.10%	-0.10%
Argentina	-994.0	393.9	14.1	0.0	-586.0	-0.03%	-0.1%	-0.03%	-0.03%
Canada	-3090.8	371.5	0.2	0.0	-2719.1	-0.06%	-0.1%	-0.06%	-0.06%
EU27	-10624.9	24062.1	-21974.9	0.0	-8537.7	-0.09%	-0.1%	-0.04%	-0.04%
US	-7014.4	3380.1	-141.3	0.0	-3775.6	-0.05%	-0.1%	-0.05%	-0.05%
Turkey	-105538.9	303962.6	21856.2	0.0	220279.9	-4.05%	-3.5%	-1.75%	-1.75%
Kazakhstan	64178.8	-39831.5	0.0	0.0	24347.4	2.02%	4.0%	2.02%	2.02%
Ukraine	4689.6	-5085.0	0.6	0.0	-394.8	0.21%	0.4%	0.19%	0.19%
Brazil	-51.2	480.9	16.7	0.0	446.4	-0.02%	0.0%	0.00%	0.00%
Russia	103918.1	-75022.6	0.6	0.0	28896.1	0.84%	1.7%	0.84%	0.84%
Algeria	-55.6	561.8	0.0	0.0	506.1	-0.04%	0.0%	-0.02%	-0.02%
Egypt	1505.6	-10164.6	0.0	0.0	-8659.0	0.36%	0.3%	0.17%	0.17%
Marocco	9.5	-115.6	0.0	0.0	-106.0	0.01%	0.0%	0.01%	0.01%
Iran	433.5	-982.4	-224.3	0.0	-773.2	0.05%	0.0%	0.02%	0.02%
China	-464.1	466.3	19.2	0.0	21.4	0.00%	0.0%	0.00%	0.00%
Japan	-10.8	643.1	122.1	0.0	754.4	-0.05%	0.0%	-0.01%	-0.01%
Korea	-0.3	182.7	1.0	0.0	183.4	-0.03%	0.0%	-0.01%	-0.01%
Indonesia	0.0	219.7	5.1	0.0	224.8	-0.03%	0.0%	0.00%	0.00%
India	1404.1	-5812.6	-5851.0	0.0	-10259.6	0.02%	0.0%	0.01%	0.01%
Pakistan	405.9	-984.0	-212.0	0.0	-790.2	0.01%	0.0%	0.01%	0.01%
rest CIS	3635.7	-12865.4	3.4	0.0	-9226.3	0.78%	0.6%	0.32%	0.32%
rest East Europe	63.3	-530.1	-573.2	0.0	-1040.0	0.07%	0.0%	0.02%	0.02%
rest South America	-816.7	1608.5	143.6	0.0	935.4	0.00%	0.0%	0.00%	0.00%
ROW	-25186.9	81240.9	-58012.3	0.0	-1958.3	-0.32%	-0.4%	-0.20%	-0.20%

Source: Results extracted from GSIM model

Table 4 provides a sensitivity analysis results with respect to elasticities of substitution. Lower values of substitution elasticities lead to lower quantity and price response, and hence, lower welfare effects. Increasing these elasticity values does the opposite, but has no effect on the direction of the changes.

Table 3. Sensativity analysis. Lower values of substitution elasticities (equal to 2 across all countries)
Summary of Effects

	welfare					other			
	Producer surplus	Consumer surplus	Tariff revenue	Change in subsidy payments	Net welfare effect	Change in Overall Consumer Prices	Change in Output	Producer Price for Home Good	Market Price for Home Good
	A	B	C	D	E= A+B+C+D	percent	percent	percent	percent
Australia	-560.2	278.0	0.0	0.0	-282.2	-0.02%	0.0%	-0.02%	-0.02%
Argentina	-170.6	52.0	16.9	0.0	-101.7	0.00%	0.0%	0.00%	0.00%
Canada	-508.4	61.0	0.0	0.0	-447.4	-0.01%	0.0%	-0.01%	-0.01%
EU(27)	3010.9	14157.9	-20572.6	0.0	-3403.9	-0.06%	0.0%	0.01%	0.01%
US	-1198.8	713.9	-153.3	0.0	-638.2	-0.01%	0.0%	-0.01%	-0.01%
Turkey	-1380.5	194694.4	-86921.6	0.0	106392.2	-2.63%	0.0%	-0.02%	-0.02%
Kazakhstan	38745.2	-24395.5	0.0	0.0	14349.8	1.24%	1.9%	1.24%	1.24%
Ukraine	2283.9	-2552.9	0.0	0.0	-269.0	0.11%	0.1%	0.09%	0.09%
Brazil	11.0	62.6	1.1	0.0	74.7	0.00%	0.0%	0.00%	0.00%
Russia	60248.9	-43753.2	0.0	0.0	16495.7	0.49%	0.7%	0.49%	0.49%
Algeria	1.6	-65.4	0.0	0.0	-63.8	0.00%	0.0%	0.00%	0.00%
Egypt	109.0	-5383.2	0.0	0.0	-5274.1	0.19%	0.0%	0.01%	0.01%
Morocco	8.1	-316.6	0.0	0.0	-308.5	0.03%	0.0%	0.00%	0.00%
Iran	12.9	-350.8	-35.1	0.0	-373.0	0.02%	0.0%	0.00%	0.00%
China	-52.8	53.9	0.9	0.0	2.0	0.00%	0.0%	0.00%	0.00%
Japan	7.3	101.4	17.9	0.0	126.6	-0.01%	0.0%	0.00%	0.00%
Korea	0.0	31.0	0.1	0.0	31.1	-0.01%	0.0%	0.00%	0.00%
Indonesia	0.0	-23.3	-0.4	0.0	-23.7	0.00%	0.0%	0.00%	0.00%
India	-683.9	-1954.1	-911.9	0.0	-3549.8	0.01%	0.0%	0.00%	0.00%
Pakistan	59.2	-410.2	-32.2	0.0	-383.2	0.01%	0.0%	0.00%	0.00%
rest CIS	915.3	-6604.6	0.3	0.0	-5689.0	0.40%	0.1%	0.08%	0.08%
rest East Europe	49.2	-477.7	-82.7	0.0	-511.2	0.06%	0.0%	0.01%	0.01%
rest South America	-39.2	179.1	6.6	0.0	146.4	0.00%	0.0%	0.00%	0.00%
ROW	-9135.0	67465.2	-60882.1	0.0	-2551.8	-0.26%	-0.1%	-0.07%	-0.07%

Source: Results extracted from GSIM model

Appendix C

Figure 1. Change in Russia's wheat export flows after liberalization

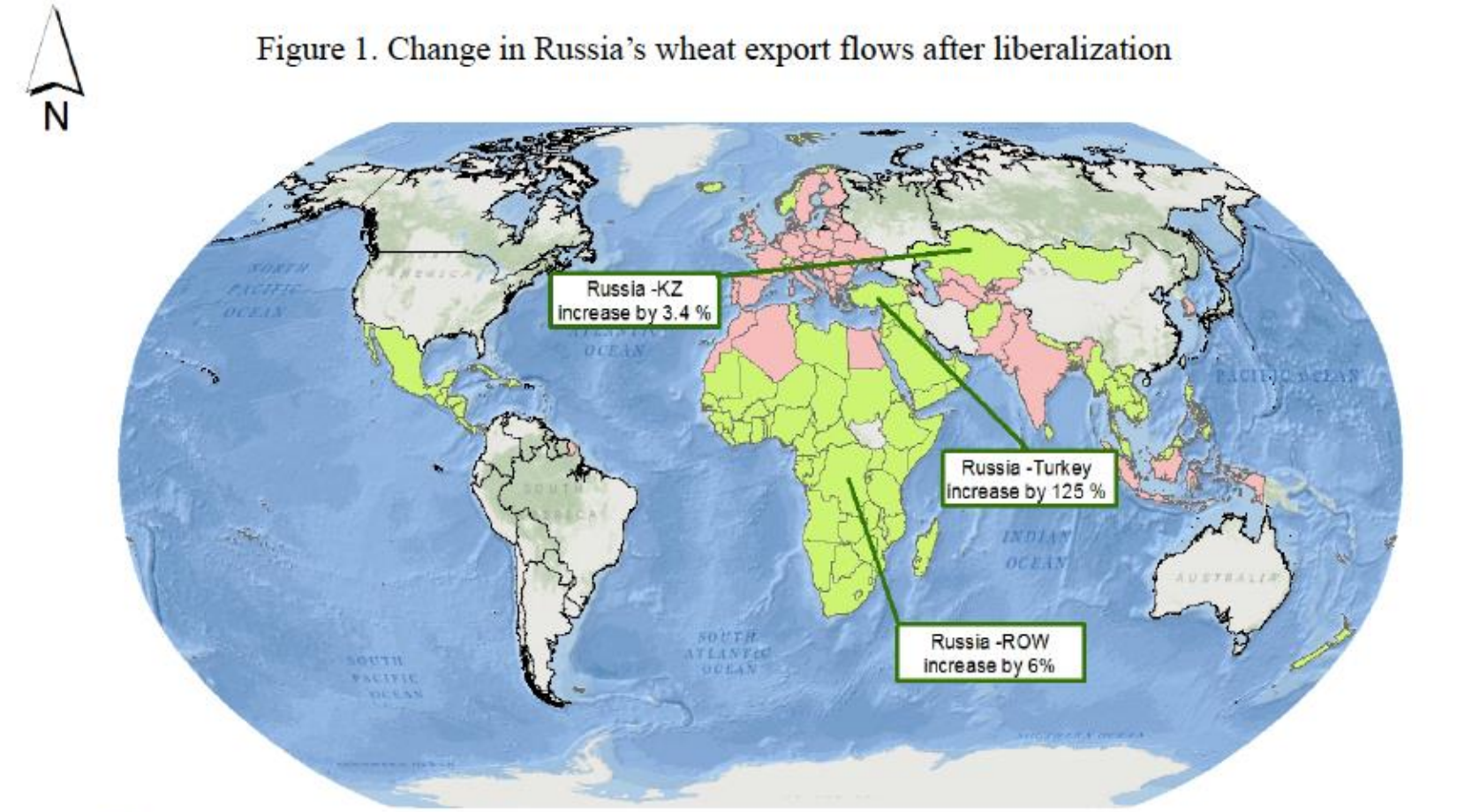


Figure 2. Change in Ukraine's wheat export flows after liberalization

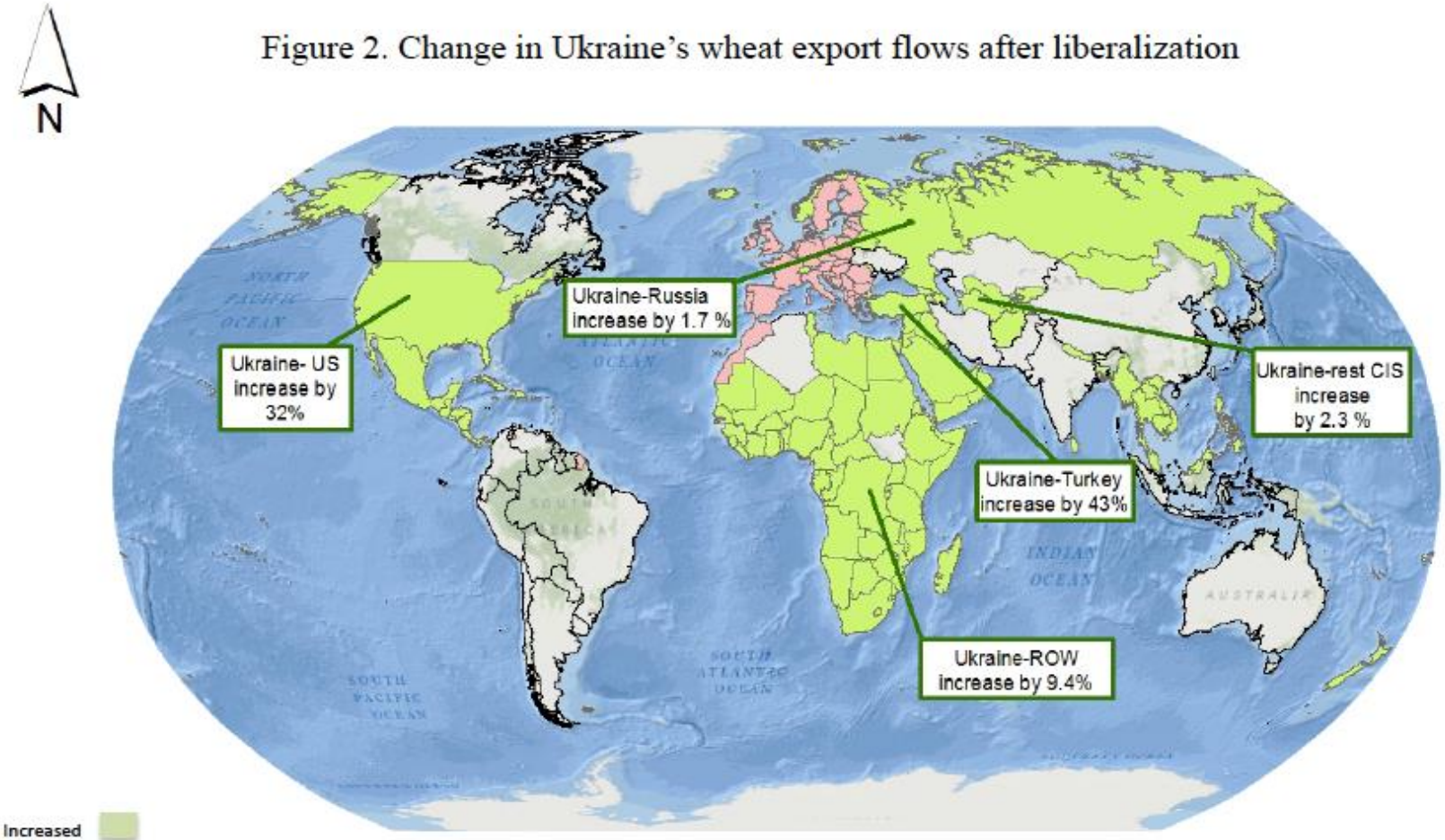
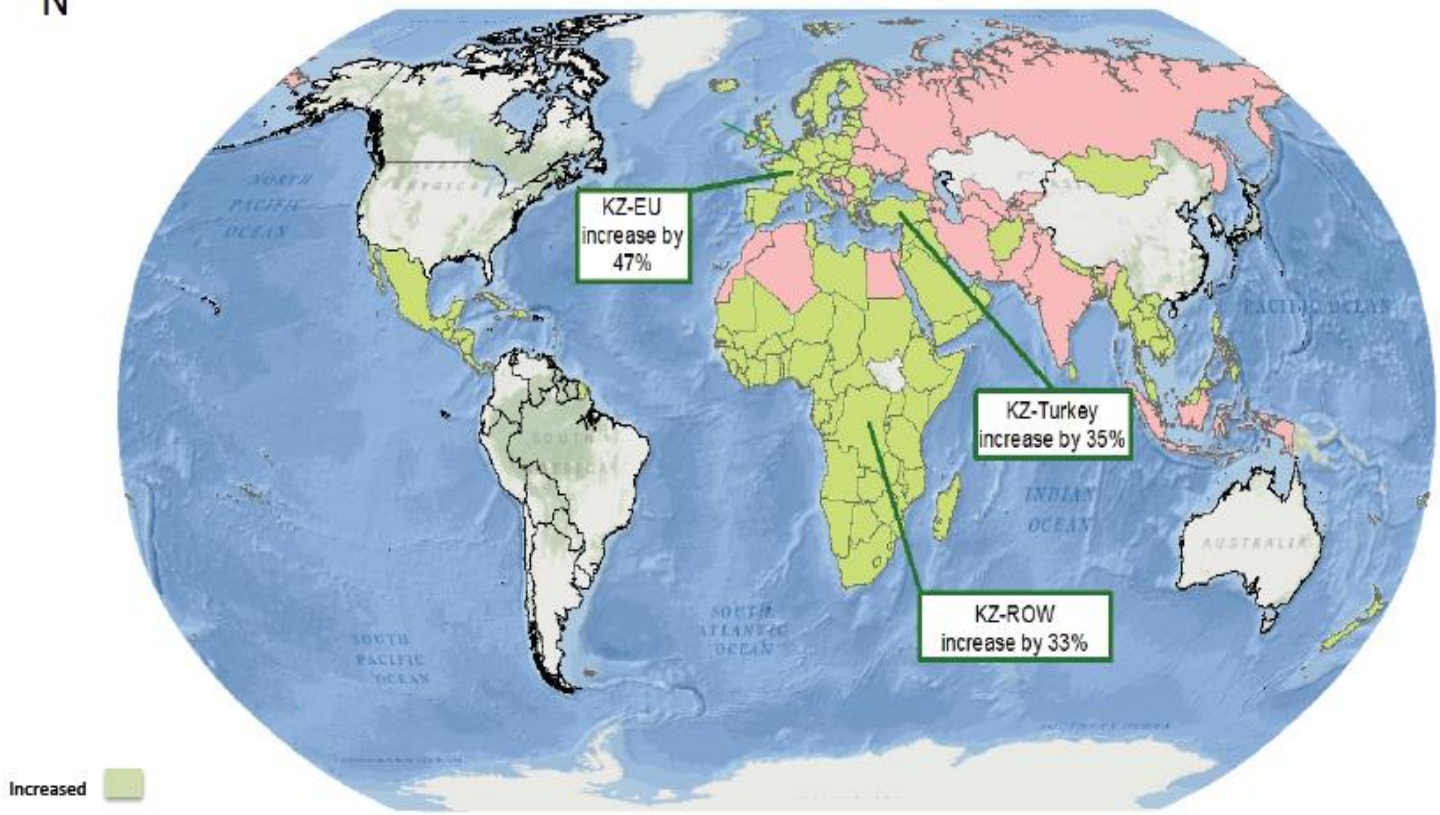


Figure 3. Change in Kazakhstan's wheat export flows after liberalization



The maps above were generated to the ease the visualization of the results. They were all generated using GIS software. Each map presents the changes in trade flows between KRU countries and their export destinations. Increases or decreases in trade is represented by green and pink colours respectively.

Countries and regions with no colouration represent no or very small change in quantities traded. The most important changes in trade flows are also indicated with callout boxes.