Price discrimination and market power in the international wheat market: The case of Kazakhstan, Russia and Ukraine

Dissertation

zur Erlangung des Grades

Doktor der Wirtschaftswissenschaft (Dr. rer. pol.)

der Juristischen und Wirtschaftswissenschaftlichen Fakultät

der Martin-Luther-Universität Halle-Wittenberg

Prof. Dr. Thomas Glauben

Prof. Dr. Ingo Pies

vorgelegt von

Diplom-Volkswirt Gulmira Gafarova

Halle (Saale),

April 23, 2017

1

Erster Gutachter:	Prof. Dr. Thomas Glauben
Zweiter Gutachter:	Prof. Dr. Ingo Pies
Tag der mündlichen Prüfung:	08.10.2018
Erscheinungsjahr:	2018

Table of Contents

ACKNOWLEDGEMENTS

Undertaking this PhD has been a truly life-changing experience for me and it would not have been possible to do without the support and guidance that I received from many people.

Firstly, I would like to express my sincere gratitude to Prof. Dr. Thomas Glauben for all his continuous supervision, valuable feedback on my research and financial support along my PhD study at the Leibniz Institute of Agricultural Development in Transition Economies (IAMO). Without his support and encouragement this PhD would not have been achievable.

My deepest gratitude is also to my day to day supervisor Dr. Oleksandr Perekhozhuk for his limitless support and valuable advices. His huge believe and motivation helped me to achieve this success.

I am also grateful to Prof. Dr. Ingo Pies for his useful advices on my presentation in the Department of Economics which helped to shape my doctoral presentation in a better way.

I am especially grateful to all my colleagues and friends at IAMO: Brett, Giorgi, Ilkay, Ivan, Kerstin, Miranda, Vasyl and many others, for their friendship and the warmth along this long and difficult way, and making my stay in Halle more colourful and enjoyable.

I am indebted to my parents Mahir Gafarov and Azada Gafarova, and my sister Leman Gafarova and her lovely family for their valuable support and believe in every single step I took throughout this PhD. Moreover, I have to mention the person whom I am inspired of from my childhood, my grandfather Prof. Dr. Mahammadhasan Gafarov. He was the person I always felt proud and my motivation on deciding for PhD was derived from his successes.

Last but not the least, my special and deepest thanks go to my husband. He is truly my life friend, supporter and motivator, and always stands by me whatever I decide for. I am happy that, despite all the difficulties, we successfully managed to come to the end of this long way together. I also have to mention my respects to his parents for their support.

This dissertation was supported by Volkswagen Foundation through MATRACC project “The Global Food Crisis – Impact on Wheat Markets and Trade in the Caucasus and Central Asia and the Role of Kazakhstan, Russia and Ukraine.”

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES IN APPENDIX

LIST OF ABBREVIATIONS

3SLS	Three-stage least squares
ADF	Augmented Dickey-Fuller panel unit root test
AER	Amplification of exchange-rate effects
AIC	Akaike Information Criterion
APK	Agribusiness Information Consulting Company
ARMSTAT	National Statistical Service of the Republic of Armenia
AZSTAT	The State statistical Committee of the Republic of Azerbaijan
BIC	Bayesian Information Criterion
CBAR	The Central Bank of Azerbaijan
CED	Price discrimination via constant elasticity of demand
CIF	Cost, Insurance and Freight
CPI	Consumer Price Index
EBRD	European Bank for Reconstruction and Development
EUROSTAT	Official EU statistical data
FAOSTAT	Statistics Division of the Food and Agricultural Organization of the United Nations
FOB	Free on Board
FPMA	Food Price Monitoring and Analysis Tool
GDP	Gross Domestic Product
GEOSTAT	National Statistics of Georgia
GMM	Generalized method of moments
GTIS	Global Trade Information Services
HHI	Herfindahl-Hirschman Indexes
IKAR	Institute for Agricultural Market Studies
IMF	International Monetary Fund
KAZSTAT	Agency of the Republic of Kazakhstan on Statistics
KRU	Kazakhstan, Russia and Ukraine
LCPS	Local currency price stability
MENA	Middle East and North African
N3SLS	Nonlinear three-stage least squares
NBG	National Bank of Georgia
NEIO	New Empirical Industrial Organization
OANDA	Online Forex Trading and Currency Services
OECD	Organization for Economic Cooperation and Development

PP	Phillips-Perron panel unit root test
PTM	Pricing to market
RDE	Residual Demand Elasticity
ROSSTAT	Russian Federation Federal State Statistics Service
SUR	Zellner's seemingly unrelated regression
USDA	The United States Department of Agriculture
UN Comtrade	United Nations Commodity Trade Statistics Database
WTO	World Trade Organization

SUMMARY

Wheat plays a crucial role in satisfying the world's growing demand for foodstuffs, as it is one of the most important staple foods. Due to the natural and climatic conditions, most world's countries cannot produce sufficient amount of wheat in order to satisfy the domestic demand and import it from wheat exporting countries.

According to the descriptive analysis, because of the substantial changes in the world wheat market, market shares of the main wheat exporting countries have been significantly affected. As a result of implementing restructuring policies in the agricultural production, consumption, and trade sectors in the 1990s, and attaining a significant rise in the wheat production in the 2000s, Kazakhstan, Russia and Ukraine (KRU) managed to stimulate their wheat exports. The KRU countries have been known as non-traditional wheat exporters in the world market. Starting from 2002, they emerged into the world wheat market as important wheat exporters (Liefert et al., 2013). Therefore, the pricing behaviour of KRU exporters has become a vital issue. According to the literature, even though the pricing behaviour of the traditional wheat exporters has been well investigated, the KRU wheat market lacks this investigation.

This thesis consists of three studies on the KRU wheat market and especially, its role in the South Caucasus wheat import market. The main purpose of this thesis is to investigate whether KRU exporters are able to exercise price discrimination and possess market power in their main destination countries, and how competitive is the South Caucasus wheat import market.

Based on the pricing to market (PTM) model, the first study investigates the pricing behaviour of KRU exporters in response to bilateral exchange rate fluctuations over the period 1996-2012. The fixed-effects method has been applied on the annual panel data of HS 4 digit code 1001. The number of destination countries differs across the exporting countries: 48 for Kazakhstan, 71 for Russia, and 65 for Ukraine. The results demonstrate that KRU exporters are able to exercise price discrimination in several destinations, but in most of them they either face perfect competition or set common markups in imperfectly competitive markets. More precisely, in most destinations Kazakhstan and Ukraine stabilize local currency prices, whereas Russia amplifies the effect of destination-specific exchange rate changes. It is concluded that there are three main reasons which prevent KRU to have market power in most of the destinations: first, KRU wheat production is highly dependent on weather; second, KRU exporters mainly export an undifferentiated quality of wheat; and third, KRU wheat exports are periodically encountered export restriction policies.

The second study employs the residual demand elasticity (RDE) approach to target the analysis of market power of Kazakh and Russian wheat exporters in the South Caucasus region. Because of political relations and geographic locations, the South Caucasus region is one of the main export markets of KRU exporters. Three-stage least squares (3SLS) estimation for systems of simultaneous equation and Zellner's seemingly unrelated regression (SUR) methods have been used for this investigation. Quarterly data from 2004 to 2014 have been applied over the HS 6 digit code 100190 and 100199. The results show that Kazakh exporters are able to exercise market power only in the Georgian wheat market, while Russian exporters are able to do so in both Armenian and Georgian markets. Neither country is able to exercise market power in the Azerbaijani wheat market. Further, Kazakh and Russian wheat exporters constrain each other's market powers in the Azerbaijani and Georgian markets. Similarly, Ukrainian exporters are able to intervene to Kazakh and Russian exporters' market powers in the Azerbaijani and Georgian wheat markets, but not in the Armenian wheat market.

The third study quantifies the degree of market imperfection in the Azerbaijani and Georgian wheat import markets. The new empirical industrial organization (NEIO) approach has been implemented through the nonlinear three-stage least squares (N3SLS) estimator. This study prefers a structural approach and simultaneously estimates the demand function and the first-order condition equation. The HS 4 digit code 1001 quarterly data have been used from 2004 to 2015. Imported wheat and wheat flour from the competitor country are accepted as substitute goods. In order to have non-linear demand function, the product of import price and time trend is included as interim term into the demand function. The results demonstrate that both the Azerbaijani and Georgian wheat markets are performing competitively. That refers to the case that neither Kazakh, nor Russian wheat exporters are able to exercise market power in the Azerbaijani and Georgian wheat import markets.

1 GENERAL INTRODUCTION

1.1 Problem statement

Due to the reasons that wheat is one of the most important food stables in the world, and because of climate differences, most countries cannot produce abundant quantity of wheat to meet the local demand, they become dependent on wheat imports. Therefore, wheat exporting countries' decisions across the export quantities and prices are crucial issues from global food security perspective.

According to the FAOSTAT database, although the world wheat production was less than 700 million tonnes at the beginning of the 2000s, it increased to more than 850 million tonnes in 2014. The share of top 15 wheat producers was stable on around 68% over this period. Among these top 15 wheat producers, most of them are considered as traditional wheat exporters, namely, Argentina, Australia, Canada, France, Germany, the United Kingdom and the United States of America. Because of some substantial changes in the world wheat market, the FAOSTAT data demonstrate that, the share of traditional wheat exporters decreased from 87% in 2000 to 62% in 2013, meaning that wheat export market became less concentrated. One of the main reasons of this process was that starting from the beginning of the 2000s Kazakhstan, Russia and Ukraine (KRU) joined into the world wheat market as important wheat exporters and the world wheat market became more competitive.

The collapse of the Soviet Union led to realize structural changes in the newly established economies. In the 1990s, the countries applied new policies in their agriculture sector. Because of an increase in yields and favourable weather conditions in the 2000s (with the exceptions of 2003 and 2010 years), some countries achieved a massive increase in the wheat production. As a result, since 2002, KRU, also known as Black Sea region countries, or non-traditional wheat exporters, have become important players in the world wheat market (Liefert et al., 2013). According to the FAOSTAT database, the share of non-traditional wheat exporters increased from 5% in 2000 to 16% in 2013. More precisely, KRU total wheat production increased from 54 million tonnes in 2000 to 97 million tonnes in 2014. Over the period 2000-2014 KRU produced 1190 million tonnes of wheat, of which 17%, 60% and 23% shares belong to Kazakhstan, Russia and Ukraine, respectively.

Although KRU countries are gaining rapidly in the world wheat market, because of weather-dependent production, periodically applied export restriction policies and political relations with the importing countries their share is very unstable in the world export market. This

instability significantly affects their reputation in the world wheat market. Despite this fact, it is forecasted that KRU grain export will follow an upward trend in the coming years, since KRU has not yet reached its limits of production capacities and still have the potential to expand grain areas and increase wheat yields. Moreover, due to the slower growth in domestic wheat consumption, KRU grain (especially, wheat) exports will increase, and KRU total market share will reach 26% by 2023 (OECD-FAO, 2014).

According to the UN Comtrade database, KRU main export destinations are South Caucasus (Armenia, Azerbaijan and Georgia), Central Asia (Kyrgyz Republic, Tajikistan, Turkmenistan and Uzbekistan), MENA countries, Turkey and others. As a leading wheat producer and exporter in Central Asia, Kazakhstan is the main wheat exporter to the other Central Asian countries. Over the period 2000-2015, Kazakhstan possessed, on average more than 95% market shares in the Kyrgyz Republic, Tajikistan, Turkmenistan and Uzbekistan. South Caucasus region, especially Azerbaijan and Georgia are also important destinations for Kazakhstan and Russia. Over the period 2000-2015, Kazakh average market shares were 51% and 21%, respectively in Azerbaijan and Georgia, while Russian shares were 47% and 70%, respectively. Ukraine also exports wheat in a small quantity to Georgia. Except South Caucasus and Central Asian regions, MENA region is also very important destination market for KRU, especially for Russia and Ukraine. Over the period 2000-2015, Egypt imported 35% and 10% of the demanded wheat from Russia and Ukraine, respectively. Moreover, Kazakhstan and Russia possessed 13% and 16% market shares, respectively, in the Iranian market, on the same period of time. The other MENA countries, especially, Israel, Libya and Yemen for Russia, and Israel, Morocco, and Tunisia for Ukraine are considered as important wheat export destinations. Turkey is also very important trade partner for KRU. Kazakhstan, Russia and Ukraine owned 13%, 57% and 5% market shares in the Turkish wheat market over the period 2000-2015.

In the background of this situation, this thesis is based on three studies and aims to analyse the KRU wheat market and, its role especially in the South Caucasus wheat import market. By using the pricing to market model, the first study investigates the price-discriminating behaviour of KRU exporters in their all possible destinations. The second study employs the residual demand elasticity approach to analyse the extent of market power exercised by Kazakh and Russian exporters in the South Caucasus wheat market. Finally, the third study determines how competitive is the Azerbaijani and Georgian wheat import market based on new empirical industrial organization approach. In order to present a broader picture of the

KRU wheat market, additional chapter is provided to demonstrate the descriptive analysis of the world wheat market, the KRU wheat market and its role in the South Caucasus wheat import market.

Pricing to market model (PTM) has been widely used in the international trade to analyse whether the exporting country (firm) is able to price discriminate in the destination country in response to the changes in bilateral exchange rate. Price discrimination occurs when an exporter sets different markups across the destination countries to adjust to variations in exchange rates. If the exporting country's currency depreciates, import prices do not necessarily change proportionally, and thus relative world prices can be affected. Against this background, an export price implicitly contains a destination-specific markup over marginal cost; that is, exporters charge the importing countries on an individual basis according to the importers' demand characteristics (Pall et al., 2013). Krugman (1987) was the first to describe a special type of rice discrimination, called PTM. There is a growing scientific literature investigating the price-discriminating behaviour of the traditional wheat exporters during various time periods and find some evidence of price discrimination exercised in destination countries (Brown, 2001; Carew, 2000; Carew and Florkowski, 2003; Glauben and Loy, 2003; Griffith and Mullen, 2001; Jin, 2008; Knetter, 1989, 1993). However, the KRU wheat market lacks this investigation, except the analysis of Russian wheat market by Friebel et al. (2015) and Pall et al. (2013). The aim of this thesis is to close this gap. As KRU is rapidly increasing in the world wheat market and has potential to grow further in the future, the pricing behaviour of KRU exporters has become a vital issue. In order to investigate whether KRU price discriminate in their all possible destinations, the fixed-effects method has been applied on the annual data of HS 1001 over the period 1996-2012. The number of destination countries differs across the exporting countries: 48 for Kazakhstan, 71 for Russia and 65 for Ukraine.

Although the PTM model detects the price discriminating behaviour of the exporting countries, it cannot further analyse the extent of it. The residual demand elasticity (RDE) approach not only allows one to identify the extent of market power, but also explains it by the combination of demand conditions, market conduct and market structure. Instead of dealing with a structural demand system involving all firms in an industry, the RDE approach focuses only on the estimation of a single equation. Originally, the RDE approach was introduced by Baker and Bresnahan (1988) and later developed by Goldberg and Knetter (1999). This approach represents the effects of export quantity, cost shifters and demand

shifters on export price by taking into account the reactions of competing countries. Despite its advantages, few studies have applied the RDE approach to determine the market power of the exporting country in destination countries' agricultural products markets. Rather, most studies analysed a particular market power, especially in beer and meat export markets. The literature pertaining to market power analysis in wheat markets remains quite limited (Carter et al., 1999; Cho et al., 2002; Pall et al., 2014; Yang and Lee, 2001). This study uses the three-stage least squares (3SLS) estimation for systems of simultaneous equations and Zellner's seemingly unrelated regression (SUR) methods to determine the extent of market power of Kazakh and Russian exporters in the South Caucasus region (Armenia, Azerbaijan and Georgia). Quarterly FOB data have been applied on export unit value and quantity data over the period 2004-2014.

Because Azerbaijani and Georgian wheat import markets are politically and geographically important destination markets both for Kazakhstan and Russia, the third study uses a static structural model to determine the degree of market imperfection in the Azerbaijani and Georgian wheat import markets. The new empirical industrial organization (NEIO) approach has been implemented through the nonlinear three-stage least squares (N3SLS) estimator. This approach simultaneously estimates the demand function and the first-order profit maximization condition to compute the degree of market imperfection. Although there is a large literature estimating NEIO approach in the food and agricultural sector, only few of them are related to the agricultural trade markets (Buschena and Perloff, 1991; Deodhar and Sheldon, 1995, 1996, 1997; Karp and Perloff, 1989, 1993; Lopez and You, 1993; Love and Murniningtyas, 1992; Nwachukwu, 2011; Steen and Salvanes, 1999). Quarterly CIF data have been applied on import unit value and quantity data over the period 2004-2015.

1.2 Research objectives

This thesis aims to investigate three main research questions: first, whether KRU exporters are able to price discriminate in their important destination markets; second, whether Kazakh and Russian wheat exporters have market power in the South Caucasus wheat markets, if yes, what is the extent of their market powers; and third, whether Azerbaijani and Georgian wheat import markets are imperfectly competitive.

This thesis contributes to the literature on price discrimination and market power. First, it analyses all three non-traditional wheat exporters' ability to price discriminate in their all

possible wheat export destinations. Second, it deeply examines whether Kazakh and Russian wheat exporters have market powers in the South Caucasus wheat market, and determines the extent of market power in Armenian, Azerbaijani and Georgian wheat markets. Third, this thesis investigates the degree of market imperfection in Azerbaijani and Georgian wheat import markets.

1.3 Structure of the thesis

The rest of the thesis is organized as follows. The next chapter provides the descriptive analysis of the world wheat market, the KRU wheat market and its role in the South Caucasus wheat import market. Chapter 3 describes the main theoretical and empirical approaches on price discrimination and market power. That is tracked by three studies. Chapter 4 presents the first study, which investigates the discriminatory behaviour of the KRU exporters in all possible destinations. The second study is introduced in Chapter 5, which analyses the extent of market power of Kazakh and Russian exporters in the South Caucasus wheat market. Chapter 6 presents the third study, which determines the imperfect competition in the Azerbaijani and Georgian wheat import markets. The final chapter provides the main outcomes and conclusions of the thesis.

1.4 References

Baker, J. B., and T. F. Bresnahan (1988). Estimating the Residual Demand Curve Facing a Single Firm. *International Journal of Industrial Organization,* 6(3): 283-300.

Brown, J. (2001). Price Discrimination and Pricing to Market Behavior of Canadian Canola Exporters. *American Journal of Agricultural Economics,* 83(5): 1343–49.

Buschena, D. E. and J. M. Perloff (1991). The creation of dominant firm market power in the coconut oil export market. *American Journal of Agricultural Economics,* 73(4): 1000-1008.

Carew, R. (2000). Pricing to Market Behavior: Evidence from Selected Canadian and U.S. Agri-Food Exports. *Journal of Agricultural and Resource Economics,* 25(2): 578–95.

Carew, R., and W. J. Florkowski (2003). Pricing to Market Behavior by Canadian and U.S. Agri-Food Exporters: Evidence from Wheat, Pulse and Apples. *Canadian Journal of Agricultural Economics,* 51(2): 139–59.

Carter, C. A., Maclaren, D., and A. Yilmaz (1999). How Competitive is the World Wheat Market? *Working Paper, No.99-002.* Department of Agricultural and Resource Economics, University of California, Davis.

Cho, G., Jin, H. J., and W. W. Koo (2002). The Competitive Structure of U.S. Grain Exports in Asian Countries. *Selected Paper for presentation at Annual Conference of the American Agricultural Economics Association (AAEA), Long Beach, California.*

Deodhar, S. Y. and I. M. Sheldon (1995). Is Foreign Trade (Im)perfectly Competitive?: An Analysis of the German Market for Banana Imports. *Journal of Agricultural Economics,* 46(3): 336-348.

Deodhar, S. Y. and I. M. Sheldon (1996). Estimation of imperfect competition in food marketing: A dynamic analysis of the German banana market. *Journal of Food Distribution Research,* 27(3): 1-10.

Deodhar, S. Y. and I. M. Sheldon (1997). Market Power in the World Market for Soymeal Exports. *Journal of Agricultural and Resource Economics,* 22(1): 78-86.

Friebel, Kerstin, O. Perekhozhuk and T. Glauben (2015). Price Discrimination in Russian Wheat Exports: Evidence from Firm-level Data. *Journal of Agricultural Economics,* 67(3): 722–740.

Glauben, T., and J.-P. Loy (2003). Pricing-to-Market versus Residual Demand Elasticity Analysis of Imperfect Competition in Food Exports: Evidence from Germany. *Journal of Agricultural & Food Industrial Organization,* 1 (1): 1–19.

Goldberg, P. K., and M. M. Knetter (1999). Measuring the intensity of Competition in Export Markets. *Journal of International Economics,* 47(1): 27-60.

Griffith, G., and J. Mullen (2001). Pricing-to-Market in NSW Rice Export Markets. *Australian Journal of Agricultural and Resource Economics,* 45(3): 323–334.

Jin, H. (2008). Competitive Structure of Canadian Wheat Exports in the World Market. *Applied Economics Letters,* 15(13): 1059–64.

Karp, L. S. and J. M. Perloff (1989). Dynamic Oligopoly in the Rice Export Market. *The Review of Economics and Statistics,* 71(3): 462-470.

Karp, L. S. and J. M. Perloff (1993). A Dynamic Model of Oligopoly in the Coffee Export Market. *American Journal of Agricultural Economics*, 75: 448-457.

Knetter, M. M. (1989). Price Discrimination by U.S. and German Exporters. *American Economic Review*, 79(1): 198–210.

Knetter, M. M. (1993). International Comparisons of Pricing-to-Market Behavior. *American Economic Review*, 83(3): 473–86.

Krugman, P. (1987). Pricing to Market When Exchange Rate Changes. *Real-Financial Linkages among Open Economies*. S.W. Arndt and J.D. Richardson, eds. Cambridge, MA: MIT Press.

Liefert, O., W. Liefert, and E. Luebehusen (2013). Rising Grain Exports by the Former Soviet Union Region: Causes and Outlook. U.S. Department of Agriculture, Economic Research Service, Outlook WHS-13A-01, Washington, DC.

Lopez, R. A. and Z. You (1993). Determinants of Oligopsony Power: The Haitian Coffee Case. *Journal of Development Economics*, 41: 275-284.

Love, A. and E. Murniningtyas (1992). Measuring the Degree of Market Power Exerted by Government Trade Agencies. *American Journal of Agricultural Economics*, 74(3): 546-555.

Nwachukwu, I. N., Onyenweaku, C. E., Nwaru, J. C. and C. Paveliuc-Olariu (2011). Measuring the Degree of Market Power in the Export Demand for Nigerian Cocoa: An Analysis of Dutch Market. *Journal of Social and Development Sciences*, 2(3): 94-103.

OECD-FAO (2014). Agricultural Outlook 2014. OECD Publishing. http://dx.doi.org/10.1787/agr_outlook-2014-en (accessed June 11, 2015).

Pall, Z., O. Perekhozhuk, R. Teuber, and T. Glauben (2013). Are Russian Wheat Exporters Able to Price Discriminate? Empirical Evidence from the Last Decade. *Journal of Agricultural Economics*, 64(1): 177–196.

Pall, Z., Perekhozhuk, O., Glauben, T., Prehn, S., and R. Teuber (2014). Residual demand measures of market power of Russian wheat exporters. *Agricultural Economics*, 45(3): 381-91.

Steen, F. and K.G. Salvanes (1999). Testing for market power using a dynamic oligopoly model. *International Journal of Industrial Organization*, 17(2): 147-177.

Yang, S-R., and W-J. Lee (2001). Exporters' Market Power in Agricultural Import Markets in Korea. *Selected Paper for presentation at the Annual Conference of the American Agricultural Economics Association (AAEA), 5-8 August, Chicago, Illinois.*

2 DESCRIPTIVE ANALYSIS OF THE WHEAT MARKET

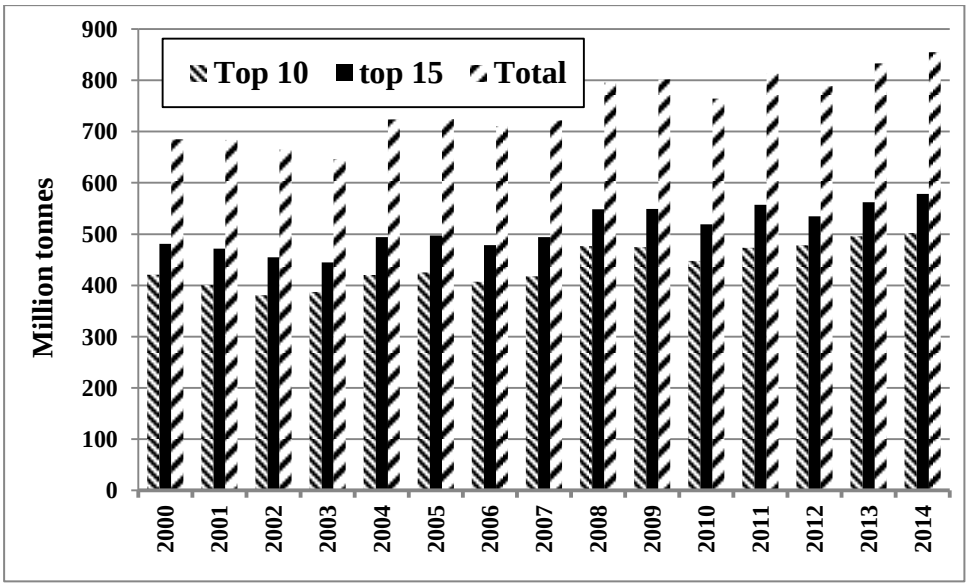
2.1 Descriptive analysis of the world wheat market

This chapter describes the development of the global wheat production, consumption and trade and the role of traditional and non-traditional (Kazakhstan, Russia and Ukraine) wheat exporters in this development. As Kazakhstan, Russia and Ukraine joined into the world wheat export market at the beginning of the 2000s, the time period 2000-2014 (in some cases, 2000-2013) is used as a descriptive analysis.

2.1.1 World wheat production

World wheat production follows an upward trend (see Figure 2.1). Although world wheat production was less than 700 million tonnes at the beginning of the 2000s, due to a rise in yield it increased to more than 700 million tonnes during 2004-2007. It increased to 800 million tonnes of wheat in 2008 and stagnated until 2010. Recent years' statistics demonstrate that wheat production is 850 million tonnes in the world (see Figure 2.1).

Figure 2.1. Trend in world wheat production



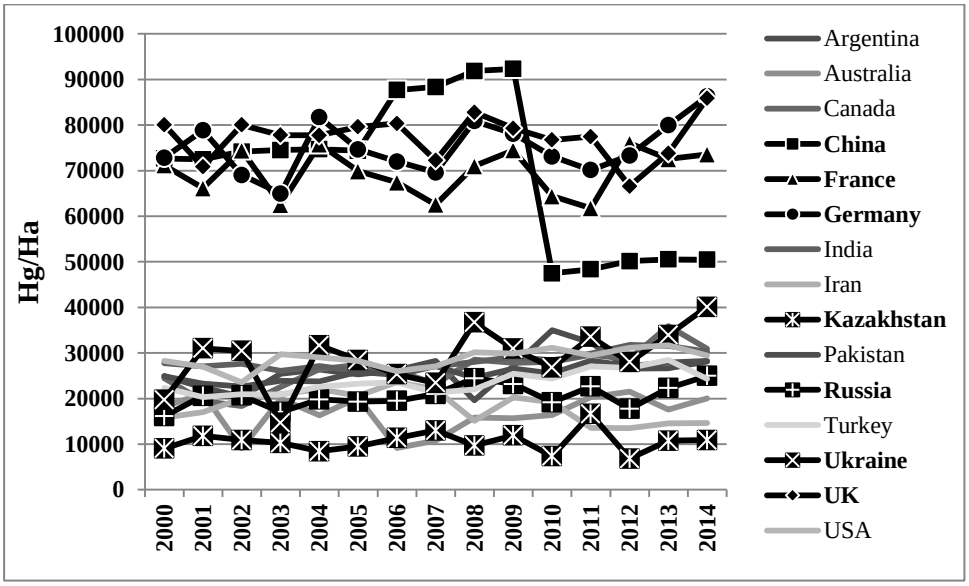
Source: Own presentation based on the FAOSTAT data

The geographic locations of the main wheat producers are various. According to the FAOSTAT database, the world top 10 wheat producers are Australia, Canada, China, France, Germany, India, Pakistan, Russia, Turkey and the United States of America (USA) over the period 2000-2014. The world top 15 wheat producers include also Argentina, Kazakhstan, Iran, the United Kingdom (UK) and Ukraine. Obviously Russia is among the world's top 10

wheat producers, but Kazakhstan and Ukraine are in top 15. The average share of top 10 wheat producers is around 59%, while top 15 is 68% over the period 2000-2014.

The highest yield in wheat, which was between 60-90 thousand Hg/Ha, is observed in China and three European countries, France, Germany and the UK over the period 2000-2014 (see Figure 2.2). The yield in China was following an upward trend until 2010. In 2010, the yield sharply decreased 2 times to 48 thousand Hg/Ha, and it is stagnated almost to that level in the next years until 2014. The wheat yield in three European countries was around 60-80 thousand Hg/Ha until 2013. In 2013, Germany and the UK faced increasing yield in wheat, while France had a stable yield in wheat. The rest of the top 15 wheat producers, including Kazakhstan, Russia and Ukraine, usually had the yield in wheat in the range of 5-40 thousand Hg/Ha over the same time period.

Figure 2.2. Wheat yield of the world's top 15 producers

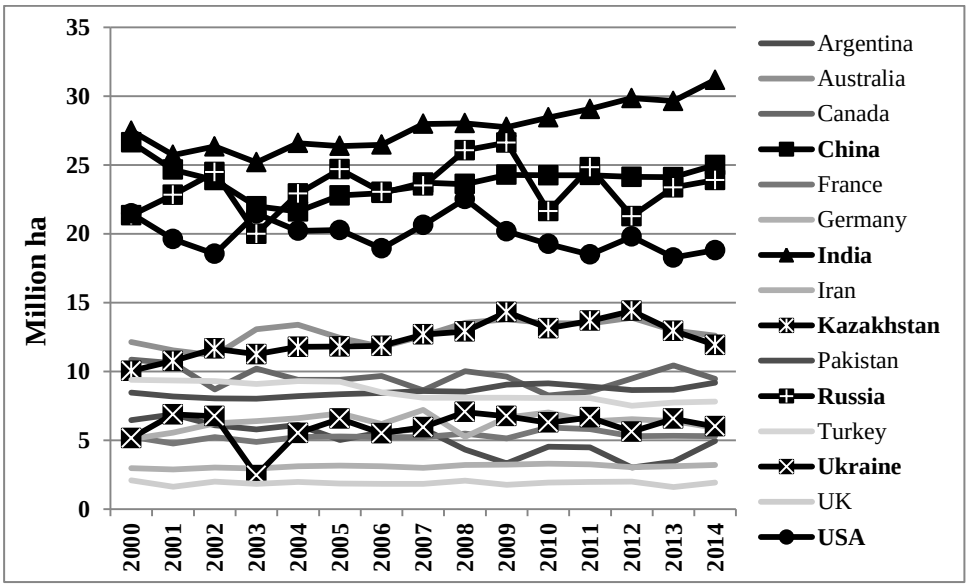


Source: Own presentation based on the FAOSTAT data

Naturally, China, India, Russia and the USA used the largest area for wheat production in compare to other top 15 wheat producers over the period 2000-2014 (see Figure 2.3). Specifically, India used 25-30 million ha area to produce wheat until 2012, but the recent statistics show that it increased to more than 30 million ha area in 2014. China was decreasing its area for wheat production until 2004, but since 2005 there is an increasing and stable trend in the area for wheat production. Although Russia used around 20-25 million ha area for wheat production until 2008, in the next two years Russia increased its wheat area to 27 million ha area. However, in 2010, Russia decreased its wheat area to the previous level, and it is quite volatile. The USA used around 19-21 million ha area for wheat production until

2008. In 2008, it increased to 23 million ha, and later decreased to its previous level. The other top 15 wheat producers used 2-14 million ha area for wheat production. Specifically, Kazakhstan used around 10-14 million ha area for wheat production, while Ukraine used only 5-8 million ha.

Figure 2.3. Wheat harvested area of the world's top 15 producers



Source: Own presentation based on the FAOSTAT data

2.1.2 World wheat consumption

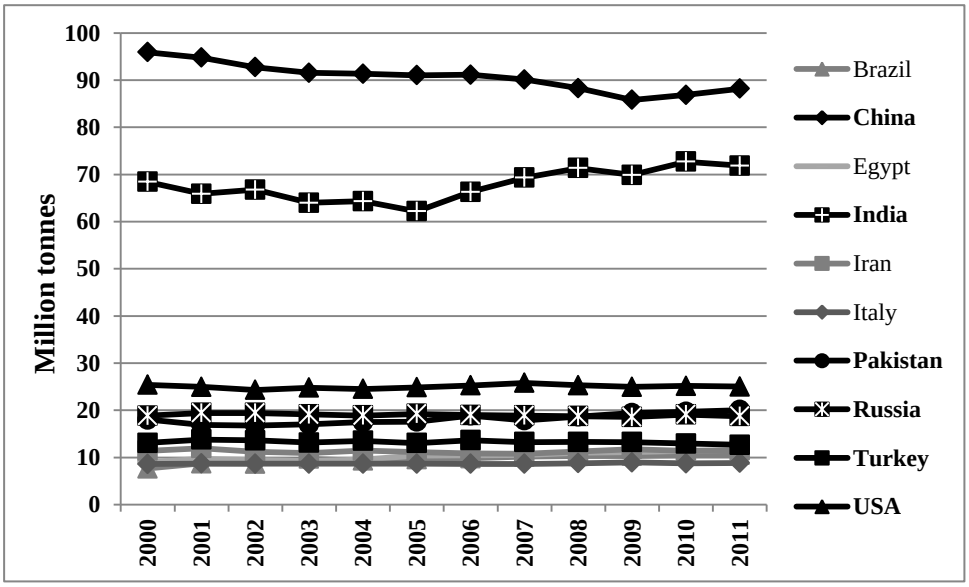
The demand for wheat is usually driven by the growing population in developing countries. The world population increased from 7.3 billion in 2000 to 8.3 billion in 2013. It is forecasted that the world population will grow from 7.4 billion in 2016 to 8.1 billion in 2025, and 95% of it will be contributed by the growth in developing countries (OECD-FAO, 2016).

According to the FAOSTAT data, the average shares of top 10 and top 15 wheat producers in the world population are 43% and 46%, respectively. Therefore, most of the wheat produced by the top 10 and top 15 producers are domestically consumed. Specifically, from top 15 wheat producers, China, India, Iran, Pakistan and Turkey domestically consume 90-100% of the produced wheat. Similarly, Germany, Russia, the UK and Ukraine consume 70-90%, France, Kazakhstan and the USA consume 40-70%, Argentina, Australia and Canada consume less than 40% of the locally produced wheat.

Based on the FAOSTAT statistics, over the period 2000-2011, 728 million tonnes of wheat is consumed in the world. The highest share of the consumed wheat belongs to food, which is

around 71% (520 million tonnes). That is followed by the wheat, consumed for feed with 17% (121 million tonnes). The rest is shared among seed (5%), processed (less than 1%), waste (around 3%) and other (around 4%) purposes. More than half of the annually consumed wheat for food purposes is used up by top 10 largest wheat consumer countries (see Figure 2.4). China is a leader among these countries with 17%, which is 90-95 million tonnes of wheat consumed for food purposes. The second largest consumer is India with 13%, that 60-70 million tonnes of wheat, while the third largest is the USA with only 5%, which is 25 million tonnes of wheat. The fourth and fifth places are shared by Pakistan and Russia with 4% each, which is 18 million tonnes and 19 million tonnes, respectively. The next is Turkey with only 3% (13 million tonnes). The rest of four countries, each take approximately 2%.

Figure 2.4. Largest wheat consumers for food



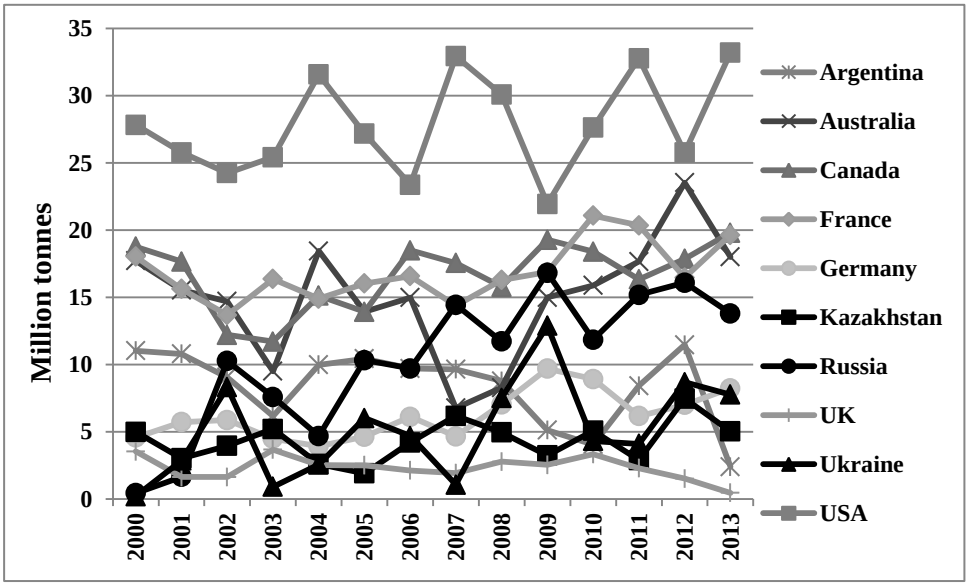
Source: Own presentation based on the FAOSTAT data

The second driver that affects the demand for wheat is per capita income growth. An increase in per capita income causes several changes in consumer preferences. However, these changes are different in developed and developing countries. In other worlds, as per income increases in developed countries, consumers usually decrease an intake of cereals and switch to consume more meat, fish and dairy products, as well as sweeteners. On the other hand, as the income elasticity of demand for food is higher in developing countries, the growing income will be spent more on food. That means, a growth in income will lead to a higher growth in consumption of all types of food products, including cereals, oilseeds, sugar, meat, dairy and fish. However, the highest growth in developing countries will be observed in consumption of sugar and vegetable oil.

2.1.3 World wheat trade

Based on the UN Comtrade statistics, the traditional wheat exporters - Argentina, Australia, Canada, France, Germany, the UK, and the USA - have been the major wheat exporters in the world market. Since the beginning of the 2000s, KRU, also called non-traditional wheat exporters, joined into the world wheat export market with significant shares. Traditional and non-traditional wheat exporters together are top 10 wheat exporters in the world. The annual exports of top 10 wheat exporters is around 100-130 million tonnes of wheat, which means, they possess around 80-90% share in the world export market (see Figure 2.5). The world's largest wheat exporter is the USA, with 25-35 million tonnes of wheat, which is around 20% market share. Argentina, Australia, Canada, France and Russia, each produces on average 10-20 million tonnes of wheat. That means each of them possesses around 10-15% share in the world market. Germany, Kazakhstan, Ukraine and the UK, each produces around 2-10 million tonnes of wheat, that is around 2-10% share in the world wheat market.

Figure 2.5. Trend in wheat exports of the world's top 10 wheat exporters

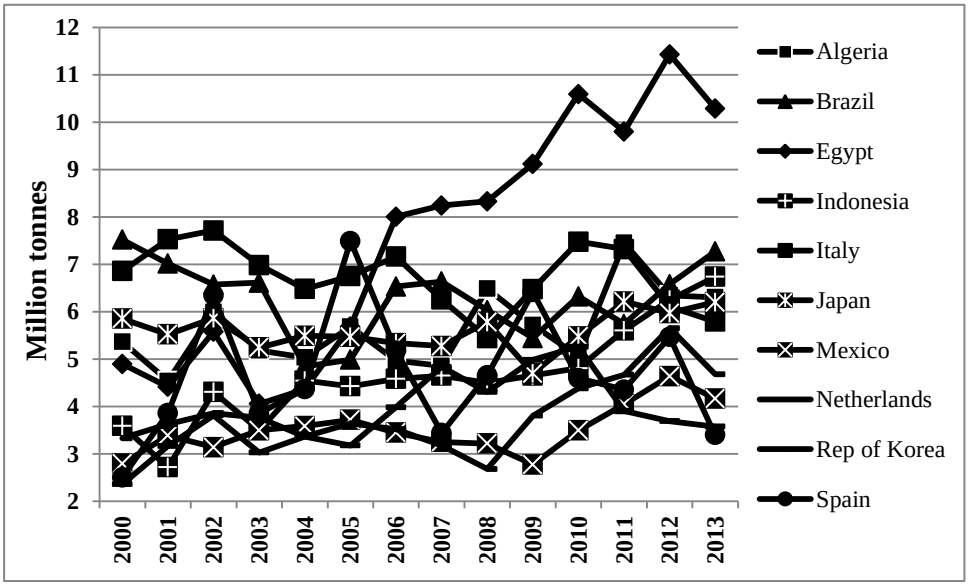


Source: Own presentation based on the FAOSTAT data

As non-traditional wheat exporters joined into the world wheat market as potential important players, the shares of the traditional wheat exporters have been significantly affected. According to the FAOSTAT and UN Comtrade statistics, the total share of the traditional wheat exporters decreased from 87% in 2000 to 67% in 2002, and later to 62% in 2013. On the other hand, from the beginning of the 2000s, the share of non-traditional wheat exporters increased from 5% in 2000 to 19% in 2002, and later peaked to 22% in 2009.

The world's top 10 wheat importers are Algeria, Brazil, Egypt, Indonesia, Italy, Japan, Mexico, Netherlands, Republic of Korea and Spain (see Figure 2.6). In total, they import 40-60 million tonnes of wheat, which is around 40% of the total imported wheat in the world. Egypt is the largest wheat importer in the world. On average, Egypt was importing 4-6 million tonnes of wheat from the beginning of the 2000s until 2005. Since 2006, Egypt started to import 8 million tonnes of wheat for the next three years. In 2009, its wheat imports increased to 9 million tonnes, and in the next year it peaked to more than 11 million tonnes. The share of Egypt in the world wheat market has increased from 4% in 2000 to 6% in 2006, and later stagnated on 7%. Algeria, Brazil, Japan and Italy, each of them is annually importing 5-7 million tonnes of wheat. In other words, each of them is taking 4-6% market share in the world wheat market. Indonesia, Mexico, Netherlands, Republic of Korea and Spain, each of them is annually importing 3-5 million tonnes of wheat. Individually each of them is taking 2-4% market share in the world wheat market.

Figure 2.6. Trend in wheat imports of the world's top 10 wheat importers



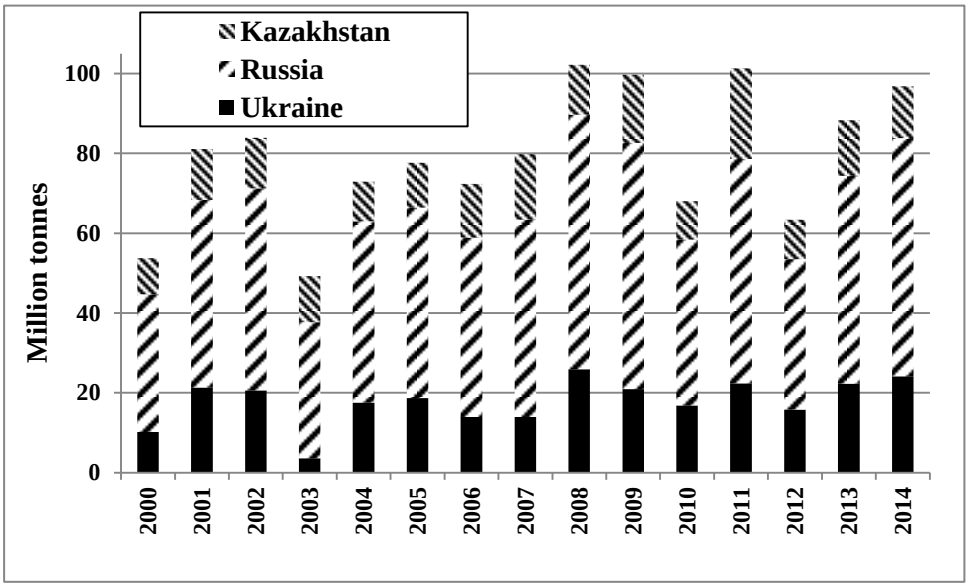
Source: Own presentation based on the FAOSTAT data

2.2 Descriptive analysis of the KRU wheat market

Historically, wheat was the main crop type for KRU in terms of area harvested. Although barley was second important crop type, the area used for barley production tend to decrease. Maize was a less important crop type in KRU. However, starting from 2010, because of a gradual increase in the harvested area, its production increased in Russia and Ukraine.

The collapse of the Soviet Union led to apply restructuring policies in the agriculture sectors of the newly established economies in the 1990s. Further, due to the rise in wheat yields and favourable weather conditions, KRU had a significant increase in their wheat production in the 2000s (Liefert et al., 2013). From 2000 until 2014, KRU produced 1190 million tonnes of wheat, of which 16%, 61% and 23% shares belong to Kazakhstan, Russia and Ukraine, respectively (see Figure 2.7). In other words, Kazakhstan, Russia and Ukraine produced 196, 726 and 268 million tonnes of wheat, respectively, over the period 2000-2014.

Figure 2.7. KRU wheat production



Source: Own presentation based on the FAOSTAT data

Based on the FAOSTAT and UN Comtrade statistics, KRU managed to increase the total market share from 5% in 2000 to almost 19% in 2002. This share briefly peaked at 22% in 2009 and later declined to 15% in 2011. In 2015, KRU surpassed all other competitors except the European Union with 22% share in the world wheat export market. Consequently, since 2002, KRU, also known as Black Sea region wheat exporters, became important players in the world market.

There are three main reasons that stimulated the growth in KRU grain exports: first, favourable weather and precipitation in 2002-2009; second, relatively low domestic demand for grain in KRU; and third, an increase in agricultural subsidies, which boosted the productivity in grain production. However, the role of second reason is stronger in compare to the third. A decline in domestic demand for wheat played more important role in stimulating KRU wheat exports than the productivity.

Although KRU grain production follows an upward trend, the domestic demand for grain consumption increases at a slower rate. It is forecasted that the total population in all three countries will decline and per capita income will increase, which will lead to some changes in consumer diets (shifting away from consuming grain). In the background of increasing grain prices and demand in the world market, this would cause an increase in KRU grain exports. It is projected that KRU's market share will reach 26% by 2023 (OECD-FAO, 2014).

Even though KRU countries are gaining rapidly in the world wheat market, because of weather-dependent production, periodically applied export restriction policies and political relations with the importing countries their share is very unstable in the world export market. This instability significantly affects their reputation in the world market and has given them the stigma of being unreliable as wheat suppliers. Thus, most importing countries usually have short-term contracts with the KRU countries. Additionally, the production of the low quality wheat undermines KRU's intention to increase their wheat export. There are several forecasts about the future trend in KRU grain production and export. On the one hand, because of some reasons, it is forecasted that KRU grain export will follow an upward trend in the coming years: first, KRU has not yet reached its limits of production capacities and still have the potential to expand grain areas and increase wheat yields. Second, as the domestic consumption in KRU is stable that would stimulate its market share in the world wheat export market (Tothova, Meyers, and Goychuk, 2013). Third, due to the technological changes, Russian grain yield will increase, and by 2019 grain production and grain export will reach 125 and 50 million tonnes, respectively (Schierhorn et al., 2012). Fourth, as Russia is a WTO member, it will prefer to import low-cost beef to produce domestically. That will be one reason to increase the grain export. On the other hand, it is forecasted that an increasing temperature in the grain producing areas of KRU will cause an increase in winter precipitation and a decrease in summer precipitation. That will bring frequent droughtiness to the region, decrease productivity, and will lead to a decline in grain production and export in all three countries.

2.2.1 Kazakh wheat market

Kazakhstan is a landlocked country without direct access to the world market. However, Kazakhstan is one of the main grain producer and exporter in the world market. According to the UN Comtrade statistics, Kazakhstan was the third-largest wheat exporter among the Commonwealth of Independent States economies, behind only Russia and Ukraine in 2013. According to the USDA report (2010), Kazakhstan consists of 14 oblasts, but 75% of Kazakh wheat is produced only in 3 oblasts: Kostanai, Akmola, and North Kazakhstan.

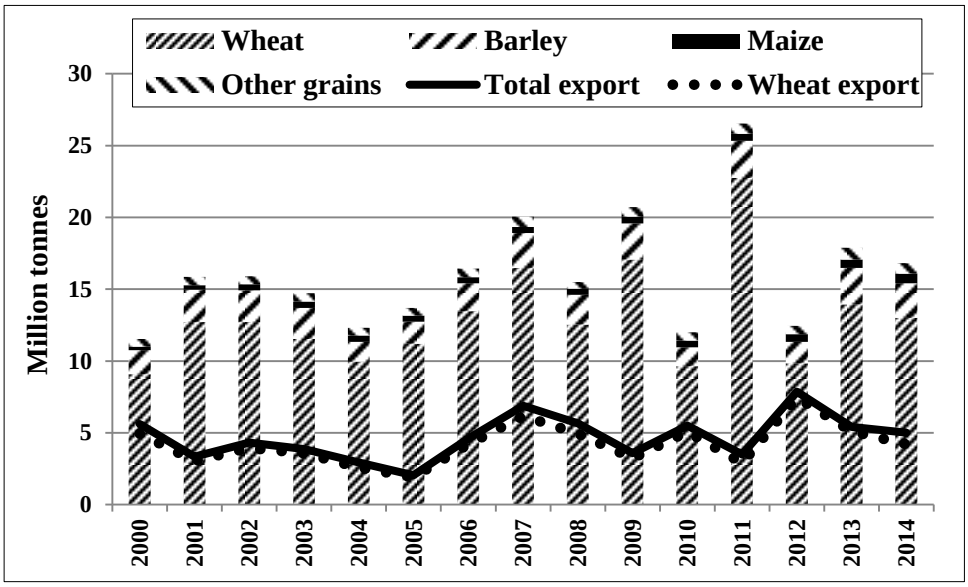
Because of a dry climate, Kazakh wheat quality is considered higher in compare to Russian and Ukrainian wheats. Class 1 wheat (protein content no less than 13.5%), class 2 wheat (no less than 12.5%) and grade 3 wheat (no less than 12%) are considered as milling quality wheat types. Class 4 wheat (no less than 11.5%) and class 5 wheat (less than 11.5%) are used for feed wheat. On average, 75% of the produced wheat is milling quality wheat. Akmola and southern Kostanai oblasts usually produce high protein content wheat (14%) (USDA, 2010).

Kazakhstan produces mainly spring wheat (95%) (USDA, 2010). Kazakh grain production is highly dependent on weather conditions. After the independence, Kazakhstan achieved a noticeable growth in grain production starting from 2000. Kazakh annual grain production was between 10-15 million tonnes until 2007 (see Figure 2.8). Because of a harsh drought in Kazakhstan in 2004, grain production decreased to 12 million tonnes. Starting from 2004, Kazakh grain yield increased because of using high quality seeds and that stimulated the grain production. Additionally, according to the FAOSTAT data, because of favourable weather conditions and relatively more planted area, Kazakh grain production increased to 20 million tonnes in 2007. The next year was considered as a bad year, since lower wheat yield led to a decline in wheat production (as well as grain production). Because the grain area (especially, wheat area) was extended in 2009, grain production increased to 21 million tonnes (wheat production increased to 17 million tonnes). However, again because of a severe drought in 2010, Kazakh grain production decreased by 8 million tonnes to 12 million tonnes. Due to a sharp increase in wheat yield (from 7 thousand Hg/Ha to 17 thousand Hg/Ha), Kazakh grain production peaked to its historical record in 2011, which was around 27 million tonnes. However, severe drought in 2012, sharply decreased Kazakh grain production again to 12 million tonnes. In recent years, Kazakh grain production is stable on 17-18 million tonnes.

Historically, the development of Kazakh wheat production has traced its grain production (see Figure 2.8). Over the period 2000-2014, Kazakhstan produced 242 million tonnes of grain, of

which 81% (or, 196 million tonnes) was only wheat, 13% was barley (31 million tonnes) and only 3% was maize (7 million tonnes).

Figure 2.8. Kazakh grain production and exports



Source: Own presentation based on the FAOSTAT and UN Comtrade data

Based on the FAOSTAT database, Kazakh domestic wheat consumption increased from 5.6 million tonnes in 2000 to 7.5 million tonnes in 2007, and later to 8 million tonnes in 2009. The highest wheat consumption in Kazakhstan was observed in 2011, which was around 9 million tonnes. The highest proportions of the domestically consumed wheat are used for food and seed (28% and 30%, respectively). The rest of it is used for feed (23%) and the other purposes (20%).

As mentioned above, due to the weather-dependent wheat production, periodically applied export restriction policies and political relations with the importing countries Kazakh wheat exports is not stable. Until 2005, Kazakh total grain exports decreased, and in 2005, because of the stronger competition with Russia, Kazakhstan reached the lowest record ever in its grain exports, which was only 2 million tonnes. That is followed by a sharp increase in its grain exports in the next two years. In 2007, because Kazakh wheat production significantly increased, its grain exports reached to almost 7 million tonnes that was the highest quantity since the independence. Obviously, Kazakh wheat exports follow its total grain exports across the observed years (see Figure 2.8). Therefore, the implementation of export ban on wheat in 2008 (from April until September) reflects itself in both grain and wheat export records. Because of the lower world import demand and stronger competition with Russia, Kazakh grain exports decreased to 3.6 million tonnes in 2009. Due to unstable grain production in the

coming two years, that was followed by an increase to 5.5 million tonnes in 2010, and later by a decrease to 3.5 million tonnes in 2011. Because Kazakhstan achieved the record grain production in 2011 and stored quite large amount, its grain exports peaked to almost 8 million tonnes in the next year. However, because of poor harvest in 2012, Kazakh grain exports decreased in the coming years.

Geographically, Kazakhstan is located in Central Asia, and is a leading wheat producer and exporter in this region. As it is a landlocked country, its main customers are neighbour countries. According to the UN Comtrade database, over the period 2000-2015, Kazakhstan possessed, on average, more than 95% market shares in the Kyrgyz Republic, Tajikistan, Turkmenistan and Uzbekistan. Kazakhstan is also important wheat exporter in South Caucasus region (especially in Azerbaijan and Georgia). Kazakh average shares in Azerbaijan and Georgia are 51% and 21%, respectively, in the same period. Kazakhstan also exports large quantity of wheat to Iran and Turkey. On average, Kazakhstan possessed 13% shares in the Iranian and Turkish wheat markets, separately. Afghanistan is also in the list of most important export destinations for Kazakhstan, with a share of 64% over the period 2000-2015.

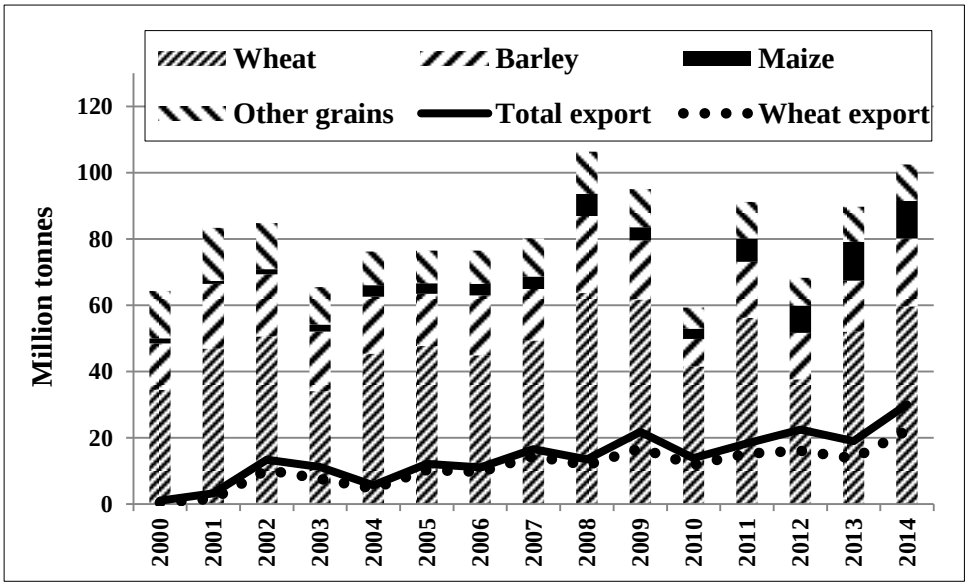
2.2.2 Russian wheat market

Russia is one of the fast growing wheat exporting countries in the world market. Russia was previously a net wheat importer, but in 2002 it became a net wheat exporter and in 2013 was the fifth-largest wheat exporter in the world. Russian grain is mainly cultivated in 4 regions: Central, South, Volga and Siberia. Among these 4 regions, Volga is the largest grain producing area of Russia, mainly specialized in production of spring-wheat and barley (Oxfam, 2011).

Similar to Kazakh grain production, Russian grain production is also dependent on weather conditions. According to the FAOSTAT data, in 2000, Russian annual grain production was slightly more than 64 million tonnes. However, due to an increase in wheat yield, it reached to 83 million tonnes in 2001 (see Figure 2.9). Severe winter in 2003 decreased Russian grain production to 66 million tonnes. Because of stable wheat yield, Russian grain production faced stagnation during 2004-2008. In 2008, the grain area increased by 5% and Russia reached its highest record in grain production which was 106 million tonnes. However, because the Russian government decided to slightly decrease the grain producing areas during 2008-2011, grain production started to decrease in 2009, and did not return to its 2008 level

until 2014. Severe drought in 2010 significantly affected Russian grain production and it decreased to 59 million tonnes. Although grain production increased to 91 million tonnes in 2011, due to a severe drought in 2012, Russian grain production again decreased to 68 million tonnes. In the next two years, Russian grain production increased, and reached to 103 million tonnes in 2014.

Figure 2.9. Russian grain production and exports



Source: Own presentation based on the FAOSTAT and UN Comtrade data

Historically, the trend in Russian wheat production has traced its grain production (see Figure 2.9). Over the period 2000-2014, Russia produced 1220 million tonnes of grain, of which 60% (or, 726 million tonnes) was wheat, 21% was barley (253 million tonnes) and only 6% was maize (72 million tonnes).

During 2000-2005, Russian domestic wheat consumption was stable between 38-40 million tonnes. However, in the next two years, it followed a downward trend and reached to 34 million tonnes in 2007. In 2008, there was a sharp increase in Russian wheat consumption from 34 million tonnes to 47 million tonnes. Later, a sharp decrease followed it and Russian domestic wheat consumption reached to 30 million tonnes in 2010. However, in the next year it came back to its initial level, 40 million tonnes. According to the FAOSTAT statistics, on average, the half of the domestically consumed wheat is used for food. The rest of it is used for feed (33%) and seed (15%).

Until 2002, Russian annual grain exports were quite low. However, starting from 2002 Russia became important player in the world wheat market with more than 13 million tonnes of total

grain exports (see Figure 2.9). However, the application of export duty policy on wheat in 2004 decreased Russian total grain exports to 6 million tonnes. That was followed by a gradual increase until 2007. Again, because Russia implemented export tax on wheat from the beginning of November 2007 until the end of April 2008 (10% until January 2008, 40% later on), Russian grain exports decreased to 14 million tonnes (wheat exports decreased to 12 million tonnes) in 2008. In 2009, Russian total grain exports peaked to 22 million tonnes. Because of severe drought and wildfires, the Russian government applied export restriction policy on wheat in 2010. As a result, Russian grain exports decreased to 14 million tonnes in 2010. Obviously, Russian wheat exports follow its grain exports until 2011 (see Figure 2.9). Due to the small wheat crops, Russia applied export ban on wheat from the beginning of January 2011 until the end of June 2011. Therefore, Russian wheat exports did not increase as much as its grain exports. Russian grain exports reached to 23 million tonnes in 2012. Russia achieved its historical record in grain exports in 2014 which was slightly more than 30 million tonnes (wheat exports was 20 million tonnes).

According to Russian Institute for Agricultural Market Studies (IKAR), because Russian milling industry does not performing well, it becomes harder for Russian exporters to negotiate with the farmers over the third class wheat price. The importers are usually interested in buying the third class wheat from Russia, since they prefer to buy fourth class or feed wheat from Bulgaria, Romania and Ukraine.

Egypt is the most important wheat export destination for Russia. According to the UN Comtrade data, on average, 24% of Russian wheat was exported to Egypt over the period 2000-2015. In other words, since 2002, Russian wheat exports to Egypt have been gradually increasing, and in 2012, one-third of Russian wheat (more than 5 million tonnes) was exported only to Egypt. Russia is also considered as important trade partner for Egypt, because, on average 35% of the demanded wheat was bought only from Russia over the period 2000-2015. The second most important wheat export destination for Russia is Turkey. On average, Russia possessed 12% share in Turkish market over the period 2000-2015. Since 2007, Russian wheat exports to Turkey have been increasing, and in 2014, one-fifth of Russian wheat (more than 4 million tonnes) was exported to Turkey. Russia is also important wheat exporter for Turkey, since 57% of the imported wheat was only from Russia over the period 2000-2015. South Caucasus (especially, Azerbaijan and Georgia) is also important wheat markets for Russian wheat. Over the period 2000-2015, Russia exported more than 14 million tonnes of wheat to Azerbaijan and Georgia. From 2004, Russian export to Azerbaijan

started to increase, and it reached to more than 1 million tonne in 2015. As Georgia is geographically closer to Ukraine and other EU wheat exporters, Russian exports to Georgia has been fluctuating between 200-600 thousand tonnes over the period 2000-2015. Over the period 2000-2015, Russian average market shares in Azerbaijani and Georgian wheat markets were 47% and 70%, respectively. The other important destinations of Russia include Yemen, Iran, Italy, Israel, Bangladesh and Libya.

2.2.3 Ukrainian wheat market

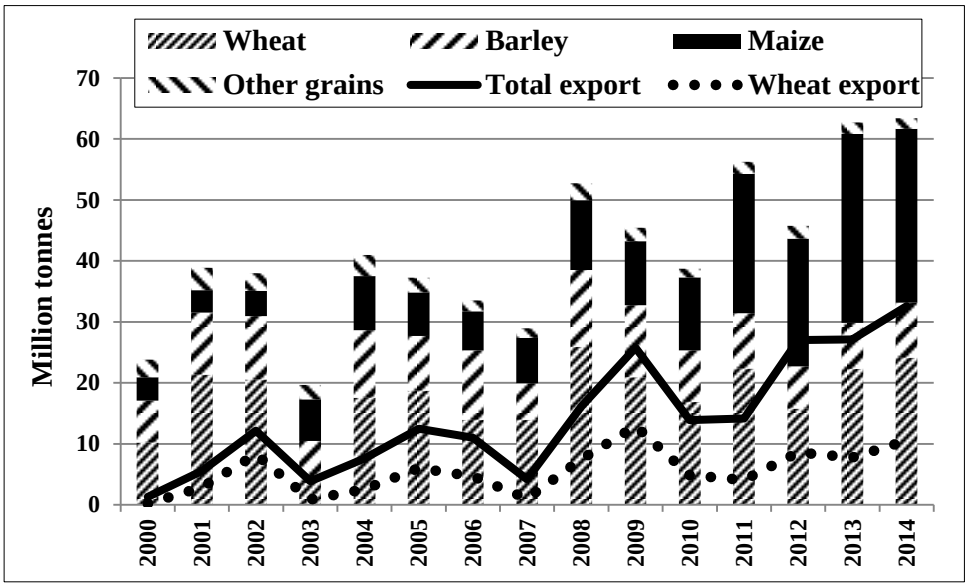
Central and South-Central parts of Ukraine are key production zones of wheat. More than 95% of the Ukrainian wheat is winter wheat. Ukraine is one of the main suppliers of feed wheat. Low and medium qualities of wheat take the largest share in the Ukrainian wheat exports (FAO, 2012). Starting from 2000, Ukrainian annual grain production increased and reached to 39 million tonnes in 2001. Because Ukrainian grain production is highly dependent on weather conditions, it is quite volatile (see Figure 2.10). Severe winter in 2003 substantially decreased Ukrainian grain production to 20 million tonnes. However, after 2003, Ukraine enjoyed favourable weather and its grain production increased to more than 40 million tonnes in 2004. During 2004-2005 years, Ukrainian grain production faced stagnation in the grain yield. However, because of the drought in 2007 there was a sharp decrease in yield and production (FAO-EBRD, 2010). As the largest decrease was observed in the barley yield, barley production was only 6 million tonnes. Therefore, the total grain production declined to 29 million tonnes in 2007. Because Ukraine had favourable weather conditions and sown areas for wheat and maize were extended in 2008, Ukrainian grain production peaked to 53 million tonnes (wheat production 26 million tonnes). However, severe drought in 2010 significantly decreased Ukrainian grain production to 39 million tonnes. In 2011, because of an increase in wheat yield and a sharp increase in maize production, Ukrainian grain production reached to 56 million tonnes. However, the next year's severe drought caused a decline in Ukrainian grain production. In the following two years, Ukraine achieved the highest grain production which was around 63 million tonnes (23 million tonnes of wheat).

Ukrainian grain production consists of three main crops: wheat, barley and maize (see Figure 2.10). Over the period 2000-2014, Ukraine produced 626 million tonnes of grain, of which 43% (or, 268 million tonnes) was wheat, 22% was barley (137 million tonnes) and 30% was

maize (186 million tonnes). In recent years, maize become an important crop type in Ukraine and starting from 2011 maize production exceeded wheat and barley productions.

Ukrainian domestic wheat consumption is very unstable. It increased from 11 million tonnes in 2000 to 14 million tonnes in 2002. This was followed by a sharp decline in 2003 to 9 million tonnes. During 2004-2007, Ukrainian total wheat consumption fluctuated between 11-13 million tonnes. However, in 2008, there was a sharp increase in domestic consumption and it reached to 15 million tonnes. Again, in 2009 there was a sharp decline and domestic wheat consumption decreased to 10 million tonnes. In the following two years, domestic wheat consumption gradually increased, and in 2011 it was more than 13 million tonnes. This unstable total consumption is caused by unstable consumption of wheat for feed. On average, the highest proportion of the domestically consumed wheat is used for food (which is 46%). The rest of it is divided mainly between feed (37%) and seed (13%) wheats.

Figure 2.10. Ukrainian grain production and exports



Source: Own presentation based on the FAOSTAT and UN Comtrade data

Ukraine takes advantage of the availability of grain export terminals and its geographic proximity to the EU and the Middle East and North African (MENA) countries. Asian and African countries usually import milling wheat, while EU countries prefer to import feed wheat from Ukraine (FAO, 2012).

In 2013, Ukraine was the seventh-largest wheat exporter in the world. However, because of export restriction policies and infrastructure development policies, Ukrainian grain exports are not stable. After the independence, Ukrainian wheat exports were stimulated, its grain

exports increased from 1 million tonne in 2000 to 12 million tonnes in 2002 (see Figure 2.10). However, because of poor wheat production in 2003, Ukrainian wheat exports decreased to 4 million tonnes. Ukrainian grain exports peaked to 13 million tonnes in 2005 due to the new wheat stocks. In October 2006, Ukraine implemented export quotas on wheat, barley and maize and the exports of these crops decreased to 5, 5 and 2 million tonnes, respectively. The quota on barley was abolished in June 2007, and thus barley exports decreased to 2 million tonnes. The quotas on all three crop types were applied again in July 2007and it lasted until December 2007. New quotas on wheat and barley were implemented in January 2008 and it continued until July 2008. Due to an increase in sown areas for wheat, Ukraine achieved large grain harvest in 2008. Therefore, the quota quantities increased and it stimulated grain exports (especially wheat exports) in 2008 in compare to 2007. Because Ukraine set several export quotas during 2006-2008, it had to increase the closing grain stocks (4 million tonnes of grains) (Grueninger and von Cramon-Taubadel, 2008). As a result, in 2009 Ukraine achieved the highest grain exports, 26 million tonnes, after the independence. Due to poor harvest, Ukrainian grain exports significantly decreased in 2010. However, starting from 2012, Ukrainian grain exports again increased and reached to 33 million tonnes in 2014.

Due to its low-quality, Ukrainian wheat is usually used for the livestock feeding. In order to provide the demand of the domestic milling industry for high-protein wheat, Ukraine usually imports wheat from Kazakhstan and Russia. Due to the severe winter in Ukraine in 2003, the domestic production was not enough to meet the local demand. Therefore, Ukraine had to import 3.4 million tonnes of wheat in 2003.

Spain and Egypt are the most important export destinations for Ukraine. Over the period 2000-2015, Ukraine exported more than 13 million tonnes of wheat to each of the destination, which is together almost one-third of Ukrainian exported wheat. The other North African countries, especially, Morocco and Tunisia are also important wheat export markets for Ukraine. Over the period 2000-2015, 3 and 5 million tonnes of wheat were exported, respectively. The other important export destinations for Ukraine are Israel, Republic of Korea, Bangladesh, Italy, the Philippines and Thailand.

2.3 Descriptive analysis of the role of KRU in South Caucasus wheat market

South Caucasus region consists of three countries: Armenia, Azerbaijan and Georgia. All three countries are middle-income countries, with bread and bakery products being main staple foods that play an important role in providing the population's demand for protein and energy. Although South Caucasus region is situated in agriculturally suitable area, due to limited possibilities for the extension of wheat production, all three countries are not able to completely provide the domestic demand for wheat and import from abroad. Because of geographic proximity, as well as historical trade relationships, South Caucasus countries mainly import wheat from KRU. All three South Caucasus countries are former Soviet Union countries; therefore they own similar infrastructure with KRU, which makes the wheat import from KRU more convenient. According to the UN Comtrade database, the share of KRU in total import of South Caucasus increased from 70% in 2000 to almost 100% in 2015.

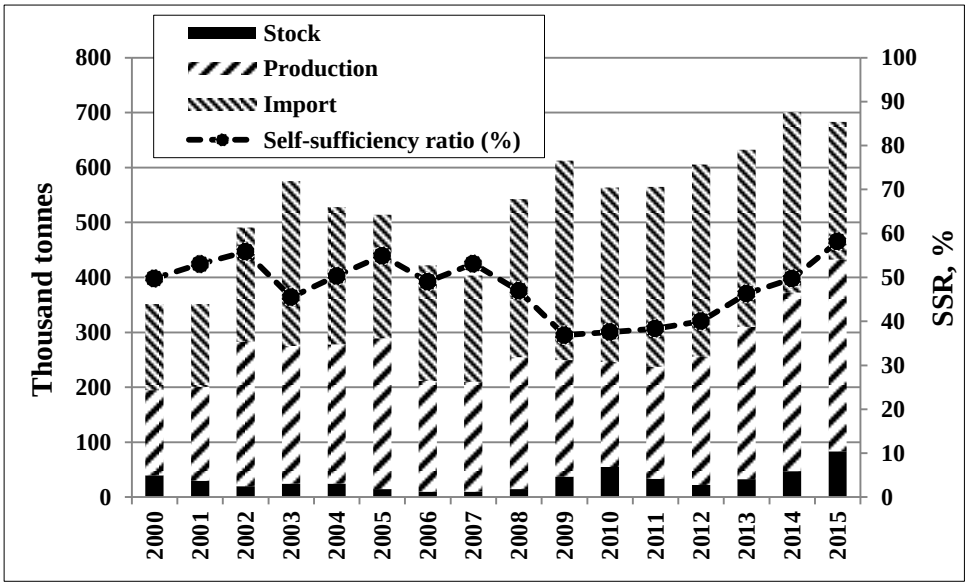
2.3.1 Armenian wheat market

According to the ARMSTAT database, Armenian GDP followed an upward trend; it started from 1,000 billion AMD (2 billion USD) in 2000 to 5,000 billion AMD (10 billion USD) in 2015. However, the share of agricultural sector in total GDP followed a downward trend; it decreased from 25% at the beginning of the 2000s to 17% in recent years. This share is yet higher than the shares in Azerbaijan and Georgia. According to National Statistical Service of Armenia, about 300-350 thousand ha area is sown area in Armenia of which about 55% is used for cultivation of grains and leguminous plants. The average annual consumption of bread and bakery products in Armenia is 140 kg per person. Although the population growth in Armenia is stable, its total wheat supply is very volatile. According to the EUROSTAT database, Armenian households were spending up to 60% of their income on food and non-alcoholic beverages at the beginning of the 2000s, but recently this share decreased to 45%.

Although the agricultural sector significantly contributed to GDP in Armenia, the country is not yet able to provide the population's demand for wheat. Average self-sufficiency ratio (SSR) of wheat in Armenia was fluctuating around 50% from 2000 until 2008. SSR decreased to 40% in 2008, but recent trend shows that Armenia is able to meet almost 60% of the domestic need for wheat (see Figure 2.11). Armenia produces the lowest amount of wheat in South Caucasus, which varies from 200-350 thousand tonnes per year. However, recent years' trend shows that there is an upward trend in the Armenian wheat production. The highest

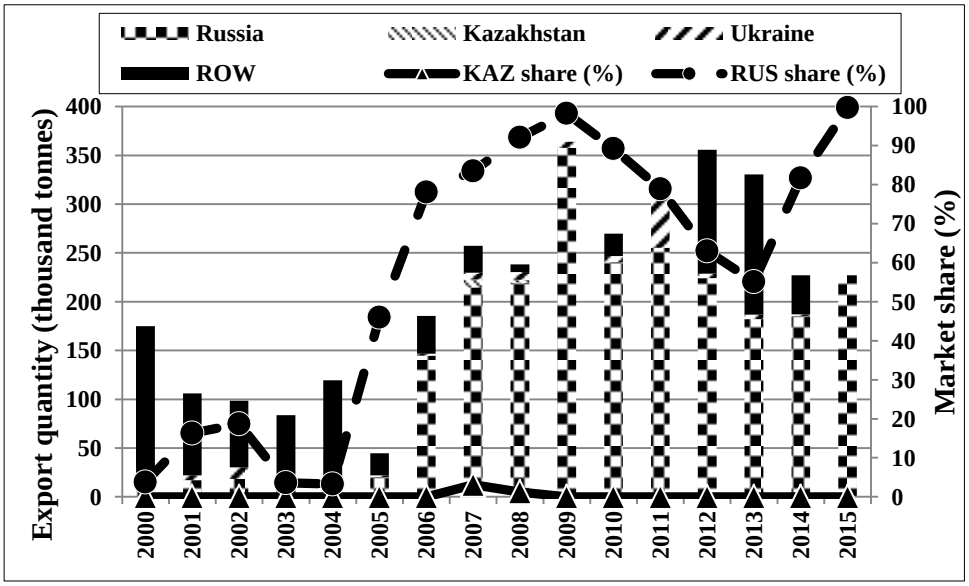
amount of wheat was produced in 2015 which was 350 thousand tonnes. Armenia meets the half of the domestic demand of what by importing from abroad. Armenian annual wheat imports recorded as 150-350 thousand tonnes. That is also the lowest amount of wheat import in South Caucasus. Because the Armenian population is fewest in South Caucasus, the total supply of wheat is the smallest in Armenia.

Figure 2.11. Composition of wheat supply in Armenia



Source: Own presentation based on the USDA data

Figure 2.12. Market shares of the main exporters in the Armenian wheat market



Source: Own presentation based on the UN Comtrade data

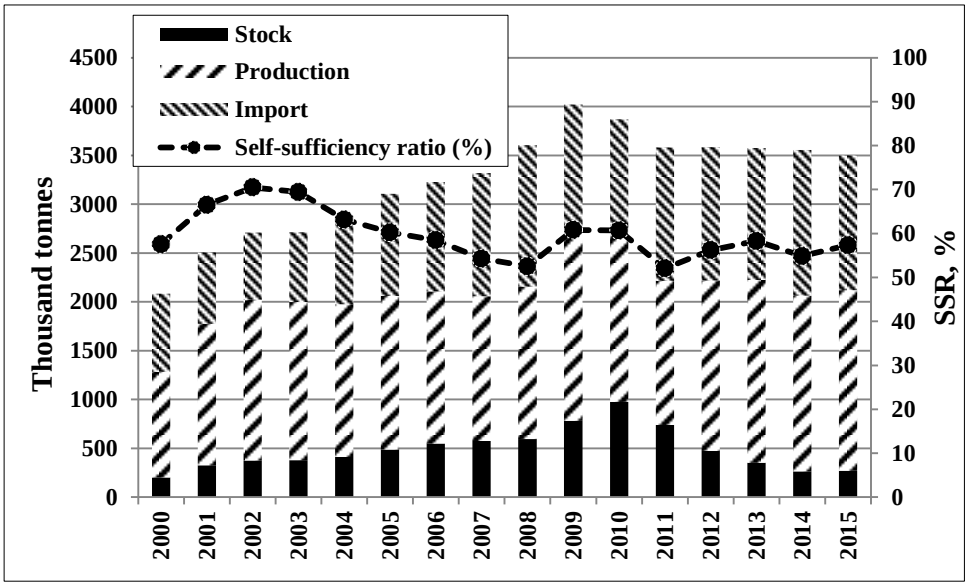
Figure 2.12 depicts how the market shares of the main wheat exporters change from 2000 to 2015 in the Armenian wheat market. Armenian annual wheat imports were less than 200 thousand tonnes from 2000 to 2006. During 2002-2005, Armenia was importing wheat mainly from the EU (Germany, Sweden and the UK) countries and the USA. Starting from 2006, Armenian wheat imports significantly increased and Russia became a leading wheat exporter to Armenia with the export quantity ranging from 150-350 thousand tonnes per year. Therefore, Russian market share significantly increased to almost 80% in 2006. Although Russian share is quite volatile, in recent years it peaked up to 100%. The main reasons of having Russia almost the only exporter to the Armenian wheat market are locational disadvantages, political instability and poor infrastructure. Due to these reasons, Armenia is not able to diversify its wheat import, and this makes Russia a leading exporter in this market.

2.3.2 Azerbaijani wheat market

According to the AZSTAT database, Azerbaijani GDP was below 10 billion AZN (6 billion USD) at the beginning of the 2000s, but it increased to more than 60 billion AZN (35 billion USD) in recent years. However, the share of agricultural sector in total GDP started to decrease from 16% in 2000 to 5% in 2015. According to State Statistical Committee of Azerbaijan, about 1200-1700 thousand ha area is sown area in Azerbaijan of which about 60% is used for cereal cultivation. The average annual consumption of bread and bakery products in Azerbaijan is 150 kg per person. In order to satisfy the domestic demand for wheat, Azerbaijan imports around 1-1.5 million tonnes of wheat per year (see Figure 2.13). Due to the highest population growth in South Caucasus, Azerbaijani total supply of wheat is almost 6 times higher in Armenia and around 3 times higher in Georgia. According to the EUROSTAT database, Azerbaijani households were spending up to 55% of their income on food and non-alcoholic beverages at the beginning of the 2000s, but this share decreased to around 40% in recent years.

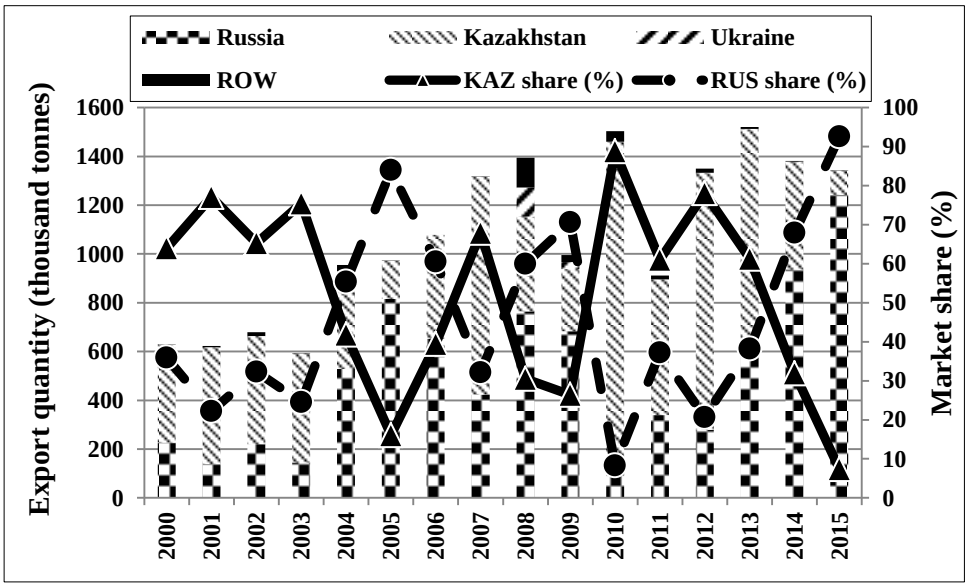
Azerbaijan possesses the highest amount of wheat production (mostly winter wheat) in the region, varying from 1-2 million tonnes per year. The highest amount was produced in 2009, which was about 2 million tonnes (see Figure 2.13). However, Azerbaijan cannot fully meet the domestic demand for wheat. Average SSR of wheat is about 60% in Azerbaijan over the period 2000-2015. That means around 40% of the demanded wheat is imported from abroad.

Figure 2.13. Composition of wheat supply in Azerbaijan



Source: Own presentation based on the USDA data

Figure 2.14. Market shares of the main exporters in the Azerbaijani wheat market



Source: Own presentation based on the UN Comtrade data

Azerbaijan is the largest buyer of wheat in the South Caucasus region, importing twice the amount of Georgia, and almost 6 times more than the amount of Armenia. Azerbaijani annual wheat imports were around 600 thousand tonnes until 2004. However, from 2004 Azerbaijani wheat imports started to increase, and peaked to more than 1.5 million tonnes in 2010. The most important wheat exporters to the Azerbaijani wheat market are Kazakhstan and Russia (see Figure 2.14). They almost share the Azerbaijani wheat market with the market shares of

52% and 48%, respectively. This high rate of import is because the Azerbaijani population (9.5 millions) is 3 times more than Armenians and 2 times more than Georgians.

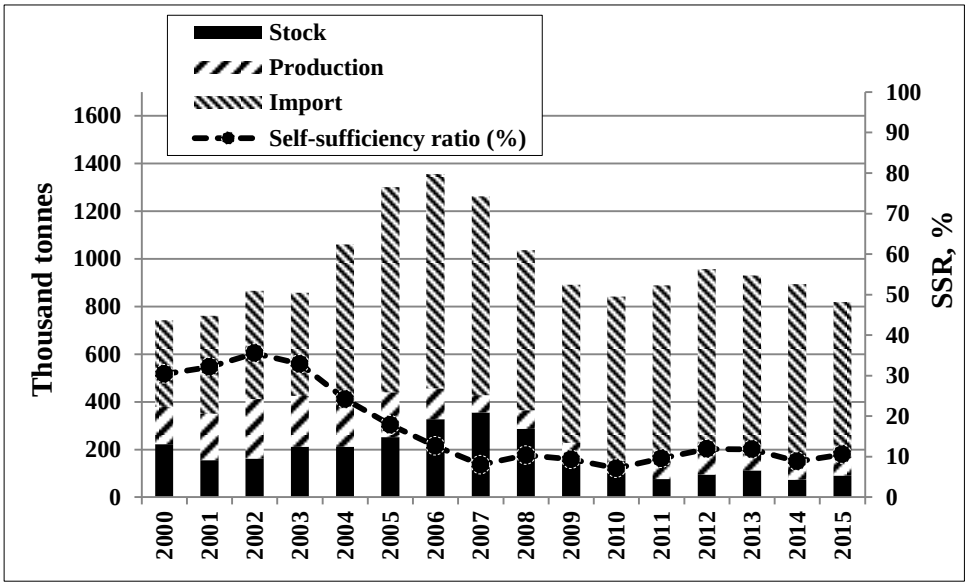
2.3.3 Georgian wheat market

According to the GEOSTAT database, Georgian GDP was below 10 billion GEL (4 billion USD) from 2000 until 2005. Starting from 2005 it increased and reached to 32 billion GEL (13 billion USD) in 2015. Although the share of agricultural sector in total GDP was above 20% at the beginning of the 2000s, it decreased to 9% in recent years. According to National Statistics Office of Georgia, about 250-300 thousand ha area is sown area in Georgia of which about 75% is used for cultivation of grain crops (spring and winter crops). Although the population growth in Georgia is stable, its total supply of wheat is very volatile. According to the EUROSTAT database, Georgian households were spending up to 45% of their income on food and non-alcoholic beverages at the beginning of the 2000s, but this share decreased to 35% in recent years.

Until 2006, Georgia was producing 150-200 thousand tonnes of wheat per year. However, starting from 2007 Georgian annual wheat production decreased to less than 100 thousand tonnes (see Figure 2.15). Average SSR of wheat in Georgia is about 17% over the period 2000-2015. Low SSR in wheat enhances dependency of Georgian wheat market on foreign exports. Obviously, the largest part of the domestic demand for wheat is satisfied by importing from abroad. Georgia was importing around 400 thousand tonnes of wheat per year until 2004. Its annual wheat imports increased to 800-900 thousand tonnes during 2004-2007 years, but from 2007, Georgian wheat imports decreased to its initial level (see Figure 2.15).

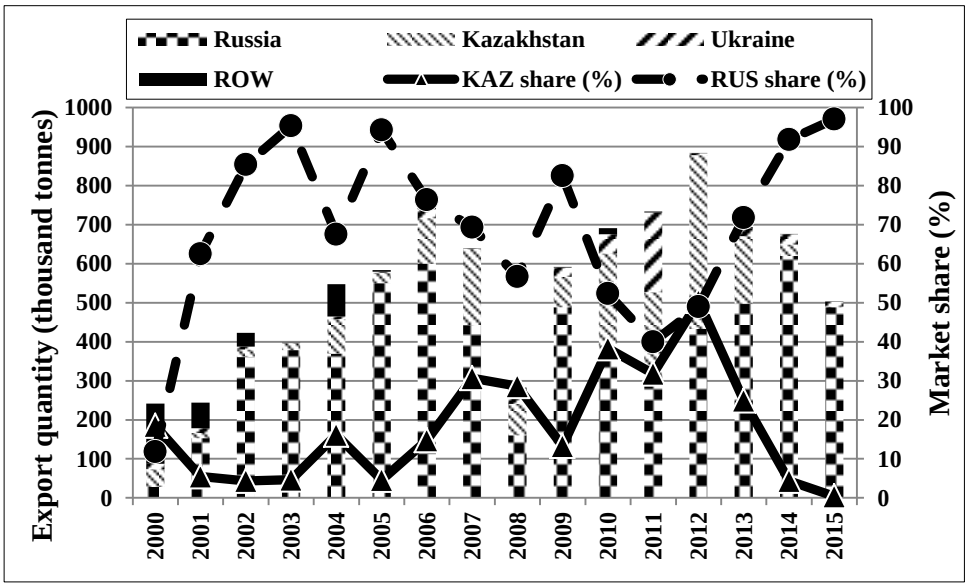
Figure 2.16 below describes how the main exporters' market shares change from 2000 to 2015 in the Georgian wheat market. Georgian annual wheat imports were slightly more than 200 thousand tonnes at the beginning of the 2000s. Starting from 2002, Georgian wheat imports increased and peaked to 900 thousand tonnes in 2012. Due to the reason that, Georgia enjoys its locational advantages of being much closer to Russia and Ukraine, compared to Armenia and Azerbaijan, it has most diversified wheat import policy in the South Caucasus. Although Georgia buys most of the demanded wheat from Russia (on average 70%), the other exporting countries – Kazakhstan (18%) and Ukraine (5%) have significant roles in satisfying Georgian demand for wheat.

Figure 2.15. Composition of wheat supply in Georgia



Source: Own presentation based on the USDA data

Figure 2.16. Market shares of the main exporters in the Georgian wheat market



Source: Own presentation based on the UN Comtrade data

2.4 References

FAO (2012). Wheat export economy in Ukraine. http://www.fao.org/fileadmin/user_upload/Europe/documents/Publications/Policy_Stdies/Ukrain_wheet_2012_en.pdf

FAO-EBRD (2010). Ukraine: Grain Sector Review and Public Private Policy Dialogue. Report Series No. 15, Rome, Italy. http://www.fao.org/docrep/018/i3337e/i3337e.pdf (accessed November 14, 2016).

Grueninger, M., and von Cramon-Taubadel, S. (2008). Competitive agriculture or state control: Ukraine's Response to the global food crisis. World Bank, Washington. http://siteresources.worldbank.org/INTUKRAINE/Resources/WorldFoodCrisisandRoleofUkraine.pdf (accessed November 25, 2016).

OECD-FAO (2014). Agricultural Outlook 2014. OECD Publishing. http://dx.doi.org/10.1787/agr_outlook-2014-en (accessed June 11, 2015).

OECD-FAO (2016). Agricultural Outlook 2016-2015. OECD Publishing. http://dx.doi.org/10.1787/agr_outlook-2014-en (accessed November 5, 2015).

Oxfam Research Reports (2011). The Impact of Russia's 2010 grain export ban. https://www.oxfam.org/sites/www.oxfam.org/files/file_attachments/rr-impact-russias-grain-export-ban-280611-en_3.pdf

Schierhorn, F., D. Muller, A. Prishchepov and A. Balmann (2012). Grain potentials on abandoned cropland in European Russia. *Selected Paper for presentation at the Annual World Bank Conference on Land and Poverty, World Bank, Washington, April 23-26.*

Tothova, M., W. H. Meyers, and K. Goychuk (2013). Productivity Growth and Variability in KRU: Evidence and Prospects. *Selected Paper for presentation at the Public Trade Policy Research and Analysis Symposium Productivity and Its impacts on Global Trade, Seville, Spain, June 2–4.*

USDA (2010). Kazakhstan Agricultural Overview. file:///E:/IAMO/Dissertation/_TO%20DO/KRU%20reports/KAZ_2010_USDA_Kazakhstan%20Agricultural%20Overview.pdf

3 THEORETICAL AND EMPIRICAL APPROACHES FOR TESTING AND MEASURING PRICE DISCRIMINATION AND MARKET POWER IN THE INTERNATIONAL WHEAT EXPORT MARKETS

"Price discrimination is present when two or more similar goods are sold at prices that are in different ratios to marginal costs" (Varian, 1989, p. 598). More precisely, price discriminating seller charges different prices to different customers based on their willingness to pay for the good. The conditions of price discrimination are: first, the seller should have market power, and set price above marginal costs; second, the seller should identify the customers that are willing to pay more for the good from the others, and third, arbitrage should be costly, so that customers might not easily resale the products (Goldberg and Knetter, 1999).

According to Pigou's classification (1920), price discrimination has three types. First degree price discrimination (also called perfect price discrimination) is present when the seller charges the most the customer would be willing to pay for each unit. In other words, different prices are charged not only for different customers, but also for different units of the products. Second degree price discrimination is present when the seller charges the same price to all customers, but the price differs for different units. This happens if the customers are heterogeneous and the seller cannot identify multiple unit demand. Third degree price discrimination is present when the seller charges different prices to different customers not taking into account the units of the product. More precisely, in the third degree price discrimination different prices are set for different customers groups according to their demand curves.

As discussed above, in order to price discriminate the seller should have market power. According to Lerner (1934), the seller with market power will set a price above marginal costs. This ability is calculated by the Lerner index:

$$L = \frac{P - MC}{P} = \frac{1}{E_d} \qquad 3.1$$

where P is the market price, MC is the marginal costs and E_d is the residual demand elasticity of the seller. Residual demand is the difference between the market demand and the competitors' supply. Hence, the seller is able to price discriminate only if its residual demand elasticity is inelastic and the seller faces a downward sloping demand curve in the imperfectly

competitive market. Otherwise, if the residual demand is elastic, price discrimination cannot occur. This happens in perfectly competitive markets, where price equals marginal costs.

From equation 3.1, the market price will be:

$$P = MC\frac{E_d}{E_d - 1} \qquad 3.2$$

which depends on both the marginal costs and the residual demand elasticity. The term $\frac{E_d}{E_d - 1}$ is called markup that is the seller charges over marginal costs. That is influenced by the market demand and the competitors' supply.

If the residual demand elasticity of the customer is low the price discriminating seller is able to charge higher prices to this customer. That applies to the international trade. The exporter tends to set lower prices to the products which sell to the country where residual demand is more elastic. The reason is that the importing country with more elastic residual demand is too sensitive to price changes. Inversely, the exporter charges higher prices in the importing country where the residual demand is less elastic.

Except the elasticity of the residual demand, the exporting country also considers the changes in the exchange rates, since the demand for the exporting country's product depends on the local currency price in the importing country (Knetter, 1989). The change in the exchange rate creates a gap between the prices paid by the importing country and the price received by the exporting country. For example, depreciation of the importing country's currency with respect to exporting country's currency increases the local currency price paid by the importer in a given price in the exporting country's currency (Knetter, 1989). After considering the effect of the exchange rate, equation 3.2 will be changed to:

$$P = MC\frac{E_d}{E_d - 1}\, e \qquad 3.3$$

where e is the bilateral exchange rate between the exporting and importing countries. Equation 3.3 describes how the changes in exchange rate would affect the export price. More precisely, the changes in the bilateral exchange rate will change the marginal cost of the exporting country in the currency of the importing country.

In the international economics, the relationship between the import prices and the exchange rates are called "pass-through relationship" (Knetter, 1989). If there is proportional relationship between the import prices and the exchange rates, pass-through is considered as

complete. Otherwise, the failure of the domestic prices of the imported goods to increase in a proportion to the exchange rates is called “incomplete pass-through” (Knetter, 1989).

The changes in exchange rates will have different effects on export price in perfectly and imperfectly competitive markets. As the residual demand is infinite, and the export price equals the marginal costs in perfectly competitive market, and the changes in exchange rate will directly affect the export price. In imperfectly competitive market, the changes in the exchange rate will have different effects on the export price depending on the elasticity residual demand. First, if the elasticity of the residual demand is constant, then changes in exchange rates will not have any effect on the optimal markup charged by the exporting country but will change the price paid by the importing country. Second, if the elasticity of the residual demand is not constant, then the shifts in the exchange rates will change the optimal markup charged by the exporting country; that is, the local currency price paid by an importing country will change. Specifically, in case of depreciation of the importing country’s currency, if the elasticity of the residual demand becomes more elastic as the local price of the exported product increase, the exporter tends to decrease the optimal markup and stabilize the effect of the exchange rate changes. Knetter (1989) called this form of price discrimination “local currency price stabilization”. On the other hand, in case of depreciation of the importing country’s currency, if the elasticity of the residual demand becomes less elastic as the local price of the exported product increase, the exporter amplify the effect of exchange rate changes. This form of price discrimination is called “amplification of the exchange rate” (Knetter, 1989).

3.1 A panel test for price discrimination: a pricing-to-market approach

As discussed above, price discrimination is present when the exporter charges different markups in different destination markets to adjust the changes in the exchange rates. Krugman (1987) was the first to describe a special type of price discrimination – pricing to market (PTM). He argues that “PTM is present whenever import prices fail to fall in proportion to the exchange rate appreciation”. The exporter’s ability to price discriminate depends both on the elasticity of demand that the exporter faces in different importing countries and on its relationship to the common marginal cost (Carew and Florkowski, 2003). An export price implicitly contains a destination-specific markup over marginal cost; that is, exporters charge

the importing countries on an individual basis according to the importers' demand characteristics (Pall et al., 2013).

In an imperfectly competitive market the changes in the exchange rate affect the pricing behaviour of an exporter, since these changes create large gaps between the prices set by the seller and those paid by the buyer, which consequently cause price discrimination (Lavoie and Liu, 2007).

Price discrimination has been extensively analysed in the international trade across different product types and most studies confirm that the exporters price discriminate in the international grain market. Pick and Park (1991) investigate the US export markets for wheat, corn, cotton, soybean and soybean meal and oil. The authors find the strongest evidence of market power in the wheat market, since China and the Soviet Union exercise monopsony power as the largest wheat importers from USA. However, for corn, cotton and soybean markets, the hypothesis of exercising price discrimination by the US exporters is rejected. The US wheat export market has also been analysed by Pick and Carter (1994) together with the Canadian wheat market. By using the Knetter (1989) model, the authors find the evidence of PTM in both the US and Canadian wheat export markets, and highlight an important effect of USD/CAD exchange rate on both exporters' pricing behaviours.

Further, Yumkella et al. (1994) examine the US and Thai rice export markets, and find out that USA price discriminates in parboil and long grain rice markets, while Thailand in long grain rice market. The pricing behaviour of the Australian NSW Japonica rice exporters has been examined by Griffith and Mullen (2001). The authors argue that the Australian exporters exercise price discrimination in their 2 out of 4 main destination markets.

Carew (2000) investigates the pricing behaviours of the US and Canadian exporters in the wheat, pulse and tobacco markets, and argues that the US exporters have stronger market power in wheat export markets in compare to other markets. The Canadian exporters mainly amplify the effect of exchange rate fluctuations in the wheat and pulse markets. Similarly, Carew and Florkowki (2003) test the evidence of PTM in the US and Canadian wheat, pulse and apple export markets. The authors apply Knetter (1989) model and confirm that in most destination countries the US exporters stabilize local currency prices, whereas the Canadian exporters amplify the effect of exchange rate changes.

Another study on the competitive structure of the Canadian wheat exports has been investigated by Jin (2008). Again, based on the Knetter (1989) model, the author tests the

existence of price discrimination in the Canadian wheat export market. He argues that the Canadian wheat exporters are able to exercise PTM behaviour only in 5 out of 19 countries. However, in most destinations, they are selling wheat at a discounted price. Similarly to Pick and Park (1991), the US wheat, corn and soybean export markets have been analysed by Jin and Miljkovic (2008). The authors consider the competitive structure of the US market and confirm the existence of PTM in all analysed markets. Due to the US domination in the world corn market, the strongest evidence of price discrimination exercised by the US exporters is observed in corn export market. Moreover, the results show that the US exporters apply PTM in more wheat export destinations than soybean export destinations.

Despite the extensive literature of the PTM model, most studies focus on traditional grain export markets, especially on US and Canadian wheat markets. Pall et al. (2013) close this gap by examining the Russian wheat export markets in 25 destinations. The authors conclude that Russian exporters exercise price discrimination with constant markup only in 2 countries, and are able to employ PTM behaviour in 5 countries. However, in most destinations, Russia behaves as a competitive exporter.

To analyse the imperfect competition the PTM model offers a suitable framework (Jin and Miljkovic, 2008). This model requires panel data. The advantages of the PTM model are: first, it is easy to implement and explain; second, it is investigated by estimation of a single equation; third, it considers the destination-specific demand differences through country-effects, and accounts undetected common marginal costs through time-effects. However, this model cannot consider uncertainty and adjustment costs and is not able to distinguish between temporary and permanent exchange rate changes (Carew, 2000). Most studies use a fixed-effects panel method to employ the PTM model.

3.2 A time series measure for a potential market power: a residual demand approach

Some studies focus on the market structure and competition on international markets using econometric approaches that not only analyse the existence of market power and price discrimination, but also quantify its economic significance and explain its sources (Goldberg and Knetter, 1997). Although the PTM model only identifies the existence of market power, the residual demand elasticity (RDE) approach also identifies the extent of it and explains it by the combinations of demand conditions, market conduct and market structure. This approach was introduced by Baker and Bresnahan (1988), and later developed by Goldberg

and Knetter (1999). The RDE approach represents the effects of export quantity, cost shifters and demand shifters on export price by taking into account the reactions of competing countries (Glauben and Loy, 2003).

The RDE approach has some advantages over other trade models, like PTM and exchange rate pass-through (ERPT). This model accounts the effect of the third country, like competitors in the importing country. The RDE model does not require detailed data on all price elasticities of demand, marginal costs and conduct parameters (Goldberg and Knetter, 1999). Instead of dealing with a structural demand system, the RDE approach focuses only on the estimation of a single equation (Poosiripinyo and Reed, 2005). Unlike the PTM model, the RDE approach explicitly shows the relationship between export price and volumes (Zhang et al. 2007). This approach is based on a principle that the exporter with a download sloping residual demand curve is able to have market power by affecting the export price. The exporting country can increase or decrease the export prices depending on its market share in the importing country, the number of competitors in the market and the location of the importing country. Inversely, the exporter with a flat residual demand curve is not able to affect the export prices, and have market power in the importing country.

Several studies have focused on an investigation of market power analysis in grain market, especially in wheat market, by implementing the RDE approach. For example, Carter et al. (1999) investigate the evidence of market power of Australian, Canadian and US wheat exporters in the Japanese market. The results show that the US exporters are price makers, while the Australian and Canadian exporters are price-takers in the Japanese wheat import market. Similarly, Yang and Lee (2001) examine whether Australian, Canadian and US wheat exporters, and Chinese and US corn exporters have market powers in the South Korean markets. The authors confirm that there is imperfect competition in the South Korean wheat market. All three exporters have market powers in this market. However, the Chinese and US corn exporters are price-takers in the South Korean market.

Cho et al. (2002) analyse the evidence of market power of the US wheat exporters in 6 Asian countries – Indonesia, Japan, Korea, Malaysia, Philippine and Singapore. The authors find out that the US exporters have market powers in the Korean, Malaysian, Philippines and Singapore wheat markets, but no market power in the Indonesian and Japanese wheat markets.

A competitive structure of the soybean import market has been examined by Song et al. (2009). The authors investigate US - China market power in the soybean market through two-country partial equilibrium trade model. The results confirm that the market powers of the Chinese soybean importers excel the market powers of the US soybean exporters.

Pall et al. (2014) test whether Russian wheat exporters exercise market power in its 8 main destinations. For the first time, the authors apply instrumental variable Poisson pseudo maximum-likelihood estimator to employ the RDE approach. They conclude that Russia has market power in 5 out of 8 countries – Albania, Azerbaijan, Egypt, Georgia and Greece, while in Lebanon, Mongolia and Syria they have no market power.

The RDE studies are categorized regarding the methods used to examine the market power. Although some studies use multiple-equation (systems of simultaneous equation) methods to analyse the RDE approach (Baker and Bresnahan, 1988; Cho et al., 2002; Goldberg and Knetter, 1999; Song et al., 2009), the majority of them prefer single-equation model. The studies implementing the RDE model use time-series data.

3.3 A static measure of a degree of market imperfection: a market structure approach

Except examining the existence of market power in an importing country, investigating whether an exporter exercises price discrimination in an importing country, it is also important to analyze whether there is market imperfection in a market. Market imperfection is present when an exporter has a market power and is able to price discriminate in an importer's market. Using their dominant positions in the market, big players restrict small rivals to enter into the market (Muazu et al., 2015).

The degree of market imperfection is measured through the structural models. One of the most applicable structural models is the new empirical industrial organization (NEIO) approach. This approach was introduced by Bresnahan (1989). The main principle is that the demand function and the first-order profit maximization condition should be simultaneously estimated.

Based on demand and cost functions and hypothesis relating to the firms' strategies, the NEIO approach investigates the presence of market power (Deodhar and Sheldon, 1997). This approach focuses more on market conduct aspects (such as, an individual firm's behaviour and strategic reactions in the industry) (Digal and Ahmadi-Esfahani, 2002). The disadvantages of the NEIO approach are that they cannot define the sources of market power

and have limited practical contributions in competition policy settings (Bresnahan, 1989; Connor, 1998). More precisely, due to the data requirements and sensitivity to specification errors, it is difficult to employ the NEIO approach (Hyde and Perloff, 1995).

Most of the studies employing the NEIO approach examine the retail food industry in the USA. There are only few studies which apply the NEIO approach to the agricultural trade markets. The NEIO studies are categorized into two groups based on an idea of applying static or dynamic frameworks. A number of studies with a static framework exceed a number of studies with a dynamic framework.

By applying the dynamic framework, Karp and Perloff (1989) investigate whether the rice export market is competitive. The authors treat Thailand, Pakistan and China as main exporters, while the other rice exporters as fringes. According to their conclusions, even though the rice export market is oligopolistic, it is closer to competition rather than collusive. Similarly, Buschena and Perloff (1991) apply a dominant firm and competitive fringe model to examine the oligopoly power in the Philippine coconut oil export market. The authors consider the Philippines as a dominant exporter, and Malaysia, Indonesia, Sri Lanka, New Guinea and the Ivory Coast as fringe exporters. The results show that prior to the 1970s the Philippine coconut oil export market was competitive. At the beginning of the 1970s, there were some legal and institutional changes which allowed the Philippines to exercise market power in the coconut oil export market.

The existence of imperfect competition in the Japanese domestic and foreign wheat markets was simultaneously investigated by Love and Murniningtyas (1992). The authors conclude that Japan has stronger monopsony power in the world wheat market, but there is no restriction in the domestic resale market.

Similarly to their analysis on the rice market, Karp and Perloff (1993) apply dominant firm and competitive fringe model to examine the degree of competitiveness in the coffee export markets. They treat Brazil and Colombia as main exporters, while the other coffee exporters as fringe. The authors confirm that coffee export market is competitive, since Brazil and Colombia compete with each other in this market. Lopez and You (1993) analyse the existence of oligopsony power in the Haitian coffee export market through a two-equation model. The results reveal that the main drivers of the oligopsony power are institutional arrangements and domestic market conditions.

The degree of market imperfection has been analysed by Deodhar and Sheldon (1995, 1996) in the German banana import market in terms of both static and dynamic frameworks. In the static framework analysis, they estimate both the demand function and the industry first-order profit maximization condition, and conclude that firms demonstrate Cournot-Nash behaviour by charging the price above marginal costs in the German banana import market. Similarly, in the dynamic framework analysis, the authors use a dynamic conjectural variations parameter, and confirm that German banana import market is not competitive and firms' behaviours are close to Cournot-Nash situation. However, the degree of market imperfection is stronger in a dynamic framework in compare to a static one. Few years later, Deodhar and Sheldon (1997) employ a structural model to examine the degree of market imperfection in the world soymeal export market and confirm the presence of perfect competition.

The analysis of French fresh salmon market has been examined by Steen and Salvanes (1999). The results reveal that as the largest producer, Norway has market power in the short-run, but the French salmon import market is rather competitive in the long-run. Further, Nwachukwu et al. (2011) analyse the degree of market power in the export demand for Nigerian cocoa in the Dutch market. The authors conclude that there is competitiveness in the Dutch cocoa market.

3.4 References

Baker, J. B., and T. F. Bresnahan (1988). Estimating the Residual Demand Curve Facing a Single Firm. *International Journal of Industrial Organization,* 6(3): 283-300.

Bresnahan, T. F. (1989). Empirical studies of industries with market power. In *Handbook of industrial organisation*, edited by R. Schmalensee and R.D. Willig, vol. 2, Chapter 17, Amsterdam, North Holland.

Buschena, D. E. and J. M. Perloff (1991). The creation of dominant firm market power in the coconut oil export market. *American Journal of Agricultural Economics*, 73(4): 1000-1008.

Carew, R. (2000). Pricing to Market Behavior: Evidence from Selected Canadian and U.S. Agri-Food Exports. *Journal of Agricultural and Resource Economics,* 25(2): 578–95.

Carew, R., and W. J. Florkowski (2003). Pricing to Market Behavior by Canadian and U.S. Agri - Food Exporters: Evidence from Wheat, Pulse and Apples. *Canadian Journal of Agricultural Economics,* 51(2): 139–59.

Carter, C. A., Maclaren, D., and A. Yilmaz (1999). How Competitive is the World Wheat Market? *Working Paper, No.99-002.* Department of Agricultural and Resource Economics, University of California, Davis.

Cho, G., Jin, H. J., and W. W. Koo (2002). The Competitive Structure of U.S. Grain Exports in Asian Countries. *Selected Paper for presentation at Annual Conference of the American Agricultural Economics Association (AAEA), Long Beach, California.*

Connor, J. M. (1998). What can we learn from ADM global price conspiracies? Department of Agricultural Economics, Purdue University, West Lafayette.

Deodhar, S. Y. and I. M. Sheldon (1995). Is Foreign Trade (Im)perfectly Competitive?: An Analysis of the German Market for Banana Imports. *Journal of Agricultural Economics*, 46(3): 336-348.

Deodhar, S. Y. and I. M. Sheldon (1996). Estimation of imperfect competition in food marketing: A dynamic analysis of the German banana market. *Journal of Food Distribution Research*, 27(3): 1-10.

Deodhar, S. Y. and I. M. Sheldon (1997). Market Power in the World Market for Soymeal Exports. *Journal of Agricultural and Resource Economics*, 22(1): 78-86.

Digal, L. N. and F. Z. Ahmadi-Esfahani (2002). Market power analysis in the retail food industry: a survey of methods. *Australian Journal of Agricultural and Resource Economics*, 46(4): 559-584.

Glauben, T., and J.-P. Loy (2003). Pricing-to-Market versus Residual Demand Elasticity Analysis of Imperfect Competition in Food Exports: Evidence from Germany. *Journal of Agricultural & Food Industrial Organization,* 1 (1): 1–19.

Goldberg, P. K., and M. M. Knetter (1999). Measuring the intensity of Competition in Export Markets. *Journal of International Economics,* 47(1): 27-60.

Griffith, G., and J. Mullen (2001). Pricing-to-Market in NSW Rice Export Markets. *Australian Journal of Agricultural and Resource Economics,* 45(3): 323–334.

Hyde, C.E. and J. M. Perloff (1995). Can market power be estimated? *Review of Industrial Organisation,* 10: 465-485.

Jin, H. (2008). Competitive Structure of Canadian Wheat Exports in the World Market. *Applied Economics Letters*, 15(13): 1059–64.

Jin, H., and D. Miljkovic (2008). Competitive Structure of U.S. Grain Exporters in the World Market: A Dynamic Panel Approach. *Journal of International Economic Studies*, 12(1): 33–63.

Karp, L. S. and J. M. Perloff (1989). Dynamic Oligopoly in the Rice Export Market. *The Review of Economics and Statistics*, 71(3): 462-470.

Karp, L. S. and J. M. Perloff (1993). A Dynamic Model of Oligopoly in the Coffee Export Market. *American Journal of Agricultural Economics*, 75: 448-457.

Knetter, M. M. (1989). Price Discrimination by U.S. and German Exporters. *American Economic Review*, 79(1): 198–210.

Krugman, P. (1987). Pricing to Market When Exchange Rate Changes. *Real-Financial Linkages among Open Economies*. S.W. Arndt and J.D. Richardson, eds. Cambridge, MA: MIT Press.

Lavoie, N., and Q. Liu (2007). Pricing-to-Market: Price Discrimination or Product Differentiation? *American Journal of Agricultural Economics*, 89(3): 571–81.

Lerner, A. P. (1934). The Concept of Monopoly and the Measurement of Monopoly Power. *The Review of Economic Studies*, 1 (3): 157-175

Lopez, R. A. and Z. You (1993). Determinants of Oligopsony Power: The Haitian Coffee Case. *Journal of Development Economics*, 41: 275-284.

Love, A. and E. Murniningtyas (1992). Measuring the Degree of Market Power Exerted by Government Trade Agencies. *American Journal of Agricultural Economics*, 74(3): 546-555.

Muazu, A. U., Mohamed, Z. A., Shamsuddin, M. N. and I. Abdulatif (2015). Measuring Market Power in the Integrated Malaysian Poultry Industry: New Empirical Industrial Organization Approach. *Journal of Food Products Marketing*, 22(4).

Nwachukwu, I. N., Onyenweaku, C. E., Nwaru, J. C. and C. Paveliuc-Olariu (2011). Measuring the Degree of Market Power in the Export Demand for Nigerian Cocoa: An Analysis of Dutch Market. *Journal of Social and Development Sciences*, 2(3): 94-103.

Pall, Z., O. Perekhozhuk, R. Teuber, and T. Glauben (2013). Are Russian Wheat Exporters Able to Price Discriminate? Empirical Evidence from the Last Decade. *Journal of Agricultural Economics*, 64(1): 177–196.

Pall, Z., Perekhozhuk, O., Glauben, T., Prehn, S., and R. Teuber (2014). Residual demand measures of market power of Russian wheat exporters. *Agricultural Economics*, 45(3): 381-91.

Pick, D. H., and C. A. Carter (1994). Pricing to Market with Transactions Denominated in a Common Currency. *American Journal of Agricultural Economics*, 76(1): 55– 60.

Pick, D. H., and T. A. Park (1991). The Competitive Structure of U.S. Agricultural Exports. *American Journal of Agricultural Economics*, 73(1): 133–41.

Pigou, A. C. (1920). The economics of welfare, London Macmillan

Poosiripinyo, R., and M. Reed (2005). Measuring market power in the Japanese chicken meat market. *Journal of International Agricultural Trade and Development*, 1(2): 135-148.

Song, B., Marchant, M. A., Reed, M. R., and S. Xu (2009). Competitive Analysis and Market Power of China's Soybean Import Market. *International Food and Agribusiness Management Review,* 12(1): 21-42.

Steen, F. and K.G. Salvanes (1999). Testing for market power using a dynamic oligopoly model. *International Journal of Industrial Organization*, 17(2): 147-177.

Varian, H. R. (1989). Price discrimination, Chapter 10 in Handbook of Industrial Organization, 1: 597–654.

Yang, S-R., and W-J. Lee (2001). Exporters' Market Power in Agricultural Import Markets in Korea. *Selected Paper for presentation at the Annual Conference of the American Agricultural Economics Association (AAEA), 5-8 August, Chicago, Illinois.*

Yumkella, K. K., L. J. Unnevehr, and P. Garcia (1994). Noncompetitive Pricing and Exchange Rate Pass -Through in Selected U.S. and Thai Rice Markets. *Journal of Agricultural and Applied Economics*, 26(2): 404–16.

Zhang, Q., M. R. Reed, and S. H. Saghaian (2007). Export Market Pricing Decisions and Market Power in World Grain Markets: A Duopoly Model for Soybeans, Annual Meeting, February 4-7, Mobile, Alabama from Southern Agricultural Economics Association.

4 PRICE DISCRIMINATION AND PRICING-TO-MARKET BEHAVIOUR OF BLACK SEA REGION WHEAT EXPORTERS [1]

Abstract. Substantial changes in the world wheat market have resulted in a shift in the market shares of the main wheat exporting countries. Since 2002, Kazakhstan, Russia, and Ukraine (KRU) have become important wheat exporters on the world market, and their pricing behaviour has become a vital issue. By applying the pricing-to-market model to wheat exports, this study analyses the price-discriminating behaviour of KRU wheat exports from 1996 to 2012. The results demonstrate that KRU are able to exercise price discrimination in some importing countries, but in most they either face perfect competition or set common markups in imperfectly competitive markets.

4.1 Introduction

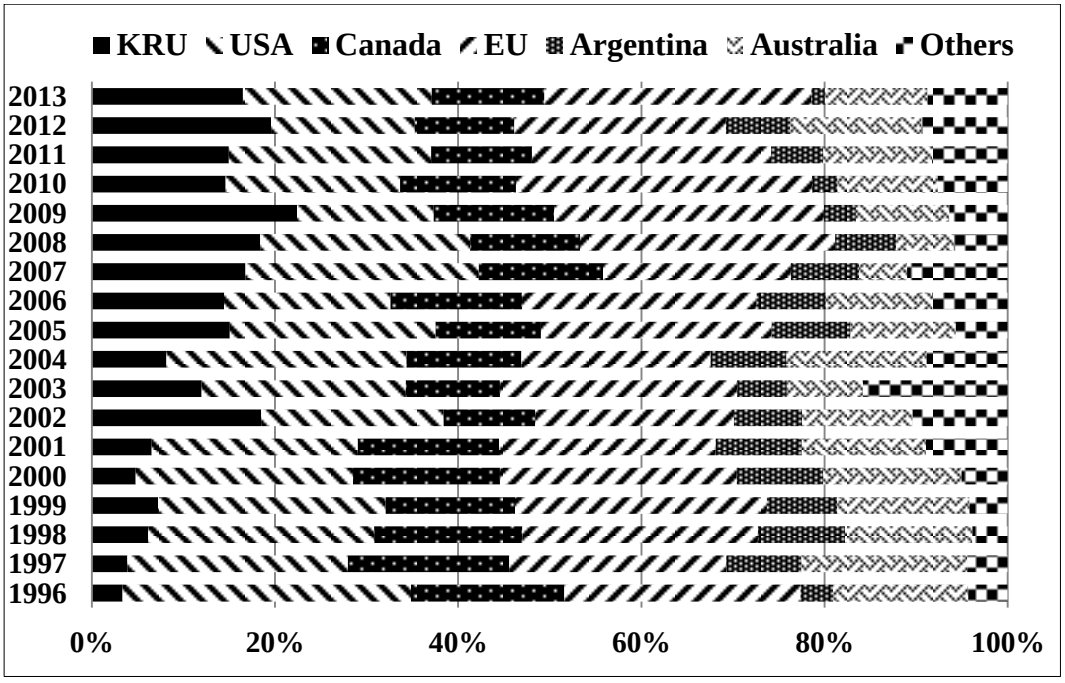
Wheat plays a central role in satisfying the world's growing demand for foodstuffs, as it is one of the most important food staples. Because of natural and climatic conditions, most countries in the world are not able to produce sufficient quantities of wheat to satisfy domestic demand and thus import it from wheat exporting countries. Consequently, decisions by wheat exporting countries concerning export quantities and prices are vital issues for global food security. Historically, Argentina, Australia, Canada, the European Union (EU), and the USA have been major wheat exporters in the world market.

However, the collapse of the Soviet Union led the resulting countries' newly established economies to implement restructuring policies in their agricultural production, consumption, and trade sectors during the 1990s. Because of an increase in yields, some countries achieved a massive increase in grain production, especially in wheat production, during the 2000s. This led to an increase in wheat exports from the former Soviet countries—namely, Kazakhstan, Russia, and Ukraine (KRU). Consequently, since 2002, KRU countries, also known as Black Sea region countries, have participated in the world market as important wheat exporters (Liefert et al., 2013).

[1] The chapter is based on the paper "Price discrimination and pricing-to-market behavior of Black Sea region wheat exporters" by Gafarova, Gulmira., Perekhozhuk, Oleksandr and Glauben, Thomas published in *Journal of Agricultural and Applied Economics*, Vol. 47, No. 3, 2015, pp. 287-316.

The KRU countries were able to increase their market share from 3% in 1996 to 18% in 2002 (see Figure 4.1). This share briefly peaked at 22% in 2009 and later declined to 17% in 2013, but it is still higher than the shares of all other competitors except the EU and the USA. Although KRU countries are gaining rapidly in the world wheat market, their market share is very unstable because of their weather-dependent production and periodically applied export restriction policies. This instability affects their reputation in the world market and has given them the stigma of being unreliable as wheat suppliers. Thus, most importing countries usually have short-term contracts with the KRU countries. The fluctuations in KRU's market share also affect the shares of various wheat exporters in the world market. Although the total share of the traditional wheat exporters was 75% in 2014, it is expected to be 60% in 2023–2024 because of an increase in KRU's export share (USDA, 2014). Hence, the upward trend in KRU's share is expected to continue because these countries have not yet reached their limits of production capacities and still have the potential to expand grain areas and increase wheat yields (Tothova, Meyers, and Goychuk, 2013). It is projected that KRU's market share will reach 26% by 2023 (OECD-FAO, 2014).

Figure 4.1. Market shares of the major wheat exporting countries, 1996-2013.



Source: Own presentation based on the FAOSTAT and UN Comtrade data

Note: "EU" indicates only the main wheat exporting countries in the European Union, including Belgium, Bulgaria, Czech Republic, Denmark, France, Germany, Hungary, Latvia, Lithuania, Poland, Romania, and the United Kingdom; "KRU" indicates Kazakhstan, Russia, and Ukraine).

As KRU countries become larger wheat exporters in the world wheat market, it is expected that their role in decisions concerning wheat prices in various importing markets will become more influential. Exporting countries can charge different prices in different importing countries for a number of reasons, the foremost being changes in bilateral exchange rates, relations with importing countries, geographic locations of importing countries, and the number of competitors in destination markets. Making decisions concerning export prices based on these reasons is called exercising price discrimination. However, there is one special type of price discrimination, called pricing-to-market (PTM), in which the ratio of prices paid by the importer is affected through the changes in bilateral exchange rates between an exporter and its importers (Pall et al., 2013).

The quantities of KRU wheat exports sent to various destinations are not the same. Because of historical relations and geographic locations, some importing countries are important trade partners for KRU. However, most countries buy wheat from various exporting countries to diversify their wheat imports. The bilateral exchange rates between importing and exporting countries are generally volatile. This study aims to examine the effect of bilateral exchange rate fluctuations on the decisions KRU countries make concerning wheat prices. Specifically, the goal of this study is to investigate (1) whether KRU countries were able to price discriminate in selected importing markets during the period 1996–2012, (2) how KRU exporters adjust their prices in response to variations in exchange rates, and (3) how pricing strategies differ among the exporting countries.

The rest of the article is organized as follows. Section 4.2 covers the country background, and Section 4.3 summarizes previous relevant studies. An econometric analysis of the empirical model is presented in Section 4.4. Section 4.5 describes the data analysis and the results of the panel unit root tests. The estimations of the PTM model are presented in Section 4.6. The final section of the article provides general conclusions and policy implications.

4.2 Country Background

There are two main reasons why KRU countries have become large wheat exporters. The first reason is that after the collapse of the Soviet Union, the newly established economies restructured their agricultural sectors, especially regarding agricultural production, consumption, and trade during the 1990s. When they were a part of the Soviet Union, KRU countries were not wheat exporters, but rather wheat importers. Livestock was the prioritized

sector, and the government imported grain from other countries to meet the demand for feed grain. After the breakdown of the Soviet Union, KRU countries did not continue supporting the livestock sector (to do so would have been very costly) but worked to improve the grain sector, in which they had comparative advantages in the world market. Consequently, domestic livestock production decreased, and grain production increased (Liefert et al., 2013).

The second reason KRU countries have become large wheat exporters is that because of higher yields, KRU's wheat production increased substantially during the 2000s. The newly established large companies were interested in investing, especially in the grain sector, and they applied different technologies and better management practices. Consequently, higher yields were achieved in grain production, and this led to an increase in KRU's wheat exports (Liefert et al., 2013).

Kazakhstan is a landlocked country without direct access to the world market. However, it is a leading wheat producer and exporter in Central Asia. According to the UN Comtrade statistics, Kazakhstan was the third-largest wheat exporter among the Commonwealth of Independent States economies, behind only Russia and Ukraine in 2013. Russia was previously a net wheat importer, but in 2002 it became a net wheat exporter and in 2013 was the fifth-largest wheat exporter in the world. Ukraine takes advantage of its geographic proximity to the EU and the Middle East and North African (MENA)[2] countries and in 2013 was the seventh-largest wheat exporter in the world.

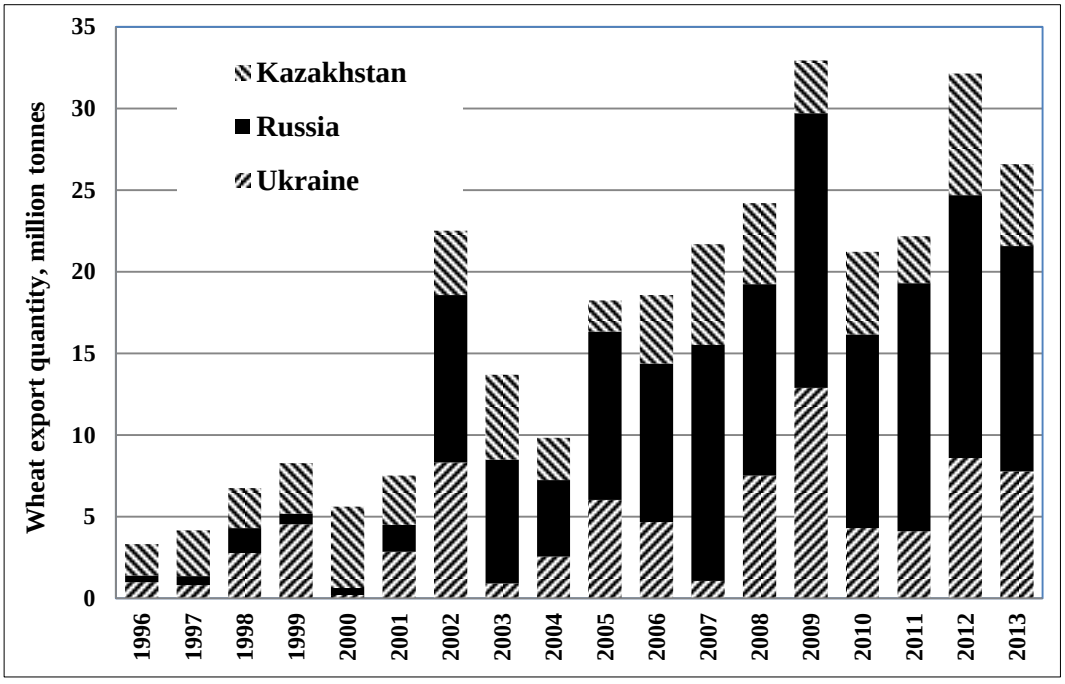
The KRU countries' wheat production is highly dependent on weather conditions, and these countries also occasionally implement export restriction policies. For instance, because of a severe winter in Russia and Ukraine in 2003, and a harsh drought in Kazakhstan in 2004, wheat production and export in these countries declined substantially (see Figure 4.2). However, because of favourable weather after 2003 and new wheat stocks, Ukrainian wheat exports peaked to 12.9 million metric tons in 2009 (FAO-EBRD, 2010). Later, all KRU countries faced severe drought in 2010. Again, after 2 years, the severe drought significantly decreased Kazakh expected wheat production and potential wheat exports.

Similar to weather conditions, export restrictions, which were implemented during the high-price phases in 2007–2008 and 2010–2011, limited wheat trade and led to a decline in KRU's market shares. Specifically, Kazakhstan applied export bans on wheat from April until

[2] The Middle East and North Africa (MENA) region refers to the following countries and territories: Algeria, Bahrain, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, United Arab Emirates, West Bank and Gaza, and Yemen.

September 2008 (Kim, 2010). Russia introduced export taxes on wheat in 2007–2008 and, because of small wheat crops, totally banned wheat exports in 2010–2011. Similarly, during both price peaks, Ukraine set export quotas within a governmental license system (Götz, Glauben, and Bruemmer, 2013). Despite all these issues, KRU countries were able to maintain an increasing trend in wheat production. In fact, KRU countries have a good chance to further their positions as important wheat exporters in the world grain market in the future. According to forecasts, KRU countries will export 52 million metric tons of wheat by 2023–2024, despite an increase in domestic consumption (USDA, 2014).

Figure 4.2. Annual KRU wheat export quantity, 1996-2013.



Source: Own presentation based on the UN Comtrade data

4.3 Related Literature

One of the characteristics of new trade theory is imperfect competition. Under this condition, a profit-maximizing exporter has the chance to exercise price discrimination in an importing market only if the importer's residual demand elasticity is inelastic (because of an absence of other suppliers or an inelastic demand). Otherwise, if residual demand is elastic, price discrimination cannot occur (Pall et al., 2013). Similarly, Carew and Florkowski (2003) argue that an exporter's ability to price discriminate depends both on the elasticity of demand that the exporter faces in different importing countries and on its relationship to the common marginal cost. Moreover, Lavoie and Liu (2007) claim that changes in exchange rate affect

the pricing behaviour of an exporter in an imperfectly competitive market because these changes create large gaps between the prices set by the seller and those paid by the buyer, which consequently causes price discrimination. Price discrimination occurs when an exporter sets different markups across the destination countries to adjust to variations in exchange rates. If the exporting country's currency depreciates, import prices do not necessarily change proportionally, and thus relative world prices can be affected. Against this background, an export price implicitly contains a destination-specific markup over marginal cost; that is, exporters charge the importing countries on an individual basis according to the importers' demand characteristics (Pall et al., 2013).

Krugman (1987) was the first to describe a special type of price discrimination, called PTM. In order to provide an overview of the literature that examines exporters' pricing behaviour in the selected importing countries, Table A4.1 in the Appendix details all relevant studies. Most studies focus their investigation on the pricing strategies of Australian, Canadian, European, and U.S. agricultural food (especially grain) exporters during various time periods and find some evidence of price discrimination exercised in destination countries (Brown, 2001; Carew, 2000; Carew and Florkowski, 2003; Glauben and Loy, 2003; Griffith and Mullen, 2001; Jin, 2008; Knetter, 1989, 1993). More precisely, by applying the PTM framework to quarterly data, Pick and Park (1991) and Pick and Carter (1994) confirm that U.S. and Canadian wheat exporters exercised price discrimination in certain destinations during the 1980s and 1990s. These findings are in line with those reported almost two decades later by Jin and Miljkovic (2008). These authors found that U.S. wheat exporters are still influential enough in the wheat markets to exercise price discrimination. Carew and Florkowski (2003) differentiate the pricing strategies between U.S. and Canadian wheat exporters and argue that in most destination countries the USA stabilizes local currency prices, whereas Canada amplifies the effect of exchange rate changes. Although there are different methods to determine whether the exporting countries exercise price discrimination in the destination countries, most studies prefer a fixed-effects panel method (Carew, 2000; Carew and Florkowski, 2003; Falk and Falk, 2000; Fedoseeva, 2013; Gil-Pareja, 2002; Jin, 2008; Jin and Miljkovic, 2008; Knetter, 1989; Pall et al., 2013; Pick and Carter, 1994; Pick and Park, 1991).

Despite the extensive literature on the PTM model, to our knowledge no other study, except Pall et al. (2013), has analysed the KRU's pricing behaviour in the world wheat market. Pall et al. (2013) consider the PTM model only for Russian wheat exporters and conclude that even though Russia exports wheat to many destinations on a large scale, it can only exercise

price discrimination in a few of them. Russia is unlikely to exert significant market power in the world wheat market because it faces perfect competition in most importing countries.

4.4 Modelling Approach

This study focuses on the application of a testable hypothesis to determine whether KRU countries exercise price discrimination in destination markets by using the PTM model. This model provides a suitable framework for modelling imperfect competition by indicating the competitiveness of an exporter, as it is connected to markup over marginal cost (Jin and Miljkovic, 2008). However, it cannot account for uncertainty and adjustment costs and is not able to distinguish between temporary and permanent exchange rate changes (Carew, 2000).

The PTM model introduced by Krugman (1987) and developed further by Knetter (1989) to determine the presence of price discrimination in international trade is applied in this study:

$$\ln p_{it} = \lambda_i + \theta_t + \beta_i \ln e_{it} + u_{it}, \forall \mathrm{i} = 1, \dots, \mathrm{N} \text{ and } \forall \mathrm{t} = 1, \dots, \mathrm{T} \tag{4.1}$$

where p_{it} is the wheat export price paid by an importing country i measured in the exporting country's currency (Kazakhstani tenge[3], Russian ruble[4], and Ukrainian hryvnia[5] per metric ton) in period t; λ_i and θ_t represent country and time effects, respectively; and e_{it} is the destination-specific exchange rate expressed as the importing country's currency per unit of exporting country's currency. The parameter β_i denotes the elasticity of the export price with respect to exchange rate. The sign of β refers to various policies implemented by an exporter; that is, a significantly negative β means that an exporter stabilizes local currency prices, whereas a significantly positive β indicates that an exporter amplifies the effect of exchange rate changes. Specifically, positive coefficients of the exchange rate variable show that demand for wheat imports becomes more inelastic as export prices increase in response to the depreciation of an importing country's currency relative to an exporting country's currency. On the contrary, negative coefficients of the exchange rate variable indicate that demand for wheat imports becomes more inelastic as export prices decrease because of the depreciation of an importing country's currency relative to an exporting country's currency (Jin and

[3] Kazakhstani tenge: November 15, 1993 - present (1 tenge = 500 Soviet rubles).

[4] Russian new ruble (redenominated): January 1, 1998 - present (1 new ruble = 1,000 old ruble).

[5] Ukrainian hryvnia: September 2, 1996 - present.

Miljkovic, 2008). Finally, u_{it} is the independent and identically distributed (i.i.d.) error term $\mathrm{N}(0, \sigma_u^2)$.

The model described in equation (4.1) differentiates two types of price adjustments: marginal cost (time effect) and price markup over marginal cost (defined by destination-specific exchange rate; Carew and Florkowski, 2003). With respect to model parameters, Knetter (1989) distinguished three alternative model scenarios. First, a competitive market, in which changes in exchange rate do not influence export prices ($\beta = 0$), there is no country effect ($\lambda = 0$), and the export price ($\theta_{\mathrm{t}} \neq 0$) is the same across destinations. The second and third situations explicitly introduce imperfect competition with price discrimination across destination countries. In detail, the second model is called price discrimination with constant elasticity of demand with respect to domestic currency prices. In this model, the shifts in bilateral exchange rates do not affect export prices across destinations ($\beta = 0$), and markup over marginal cost is constant but can change over time and across destinations ($\lambda \neq 0$ and $\theta \neq 0$). Hence, the time effects capture the changes in marginal cost, and the country effect measures the markups in different destinations. The third model is called price discrimination with varying elasticities of demand with respect to domestic currency prices. More precisely, the changes in exchange rate affect a destination specific markup over marginal costs ($\lambda \neq 0$), and thus export prices depend on changes in exchange rate ($\beta \neq 0$). This situation is called PTM. In short, it can be summarized that " . . . how exchange rates affect commodity export prices depends on how changes in currency values are transmitted to foreign currency prices" (Carew and Florkowski, 2003, p. 139). Depending on the elasticity of demand, changes in exchange rates have different effects on export prices. If the elasticity of demand with respect to price is constant, then changes in exchange rates will not have any effect on the optimal markup charged by an exporter but will change the price paid by an importing country. However, if the elasticity of demand with respect to price is not constant, then shifts in exchange rates will change the optimal markup charged by an exporter; that is, the local currency price paid by an importing country will change.

4.5 Data Analysis and Descriptive Statistics

The model in equation (4.1) is applied to the wheat market in order to investigate noncompetitive market structures in Kazakh, Russian, and Ukrainian wheat exports. Three separate panel data sets are used, consisting of the average annual exchange rates and export unit values for Kazakhstan, Russia, and Ukraine for the period 1996–2012. The harmonized

system (HS) code description for wheat is categorized as "wheat and meslin" (HS code[6]: 1001), which includes durum wheat, and wheat (except durum wheat) and meslin.

Unit value data are calculated by dividing export volume (in U.S. dollars) by export quantity (in metric tons), both of which are provided by the United Nations Commodity Trade Statistics Database (UN Comtrade, 2015). This procedure entails a loss of information because the generated unit values usually contain aggregated data concerning products for different uses and thus of different qualities. In other words, by resorting to unit values, the qualities of the products shipped to different destinations are accepted as the same and constant over time (Lavoie and Liu, 2007). More precisely, as the price data used in this study represent export unit values, but not real export prices, it should be clarified that the changes in export prices to different destinations are because of the pricing strategies of the exporters, not because of differences in quality (Fedoseeva, 2013). In contrast, Knetter (1989) argues that as different qualities of wheat are shipped to different countries, country dummies would cover the quality issue. Similarly, time effects would capture the changes in quality over time (Lavoie and Liu, 2007).

All value data are "free on board"; that is, the export prices include the costs of transaction, transportation, and any other services performed to deliver goods to the border of an exporting country[7]. Hence, significant variations in export prices for different destinations cannot be explained by different transportation costs.

The average annual nominal exchange rate data are available from International Monetary Fund (IMF), Online Forex Trading and Currency Services (OANDA), and ROSSTAT (2001, 2007, 2013). The exchange rate data for Tajikistan[8], Turkmenistan[9], and Uzbekistan[10] are calculated by converting old currencies into new ones. Similarly, the exchange rate data for the EU countries that accepted the euro in 1999 are fixed to the euro for the period 1996–1998.

[6] For commodity classifications and quantity measurement, see United Nations, Department of Economic and Social Affairs, Statistic Division (2011), pp. 31-37, 45-46.

[7] For statistical values of exported goods and terms of delivered goods, see United Nations, Department of Economic and Social Affairs, Statistic Division (2011), pp. 39-41, 97-99.

[8] Tajikistani ruble: May 10, 1995-October 29, 2000 (1 Tajikistani ruble = 100 Russian rubles); Tajikistani somoni: October 30, 2000-present (1 Tajikistani somoni = 1,000 Tajikistani rubles).

[9] Turkmen old manat (TMM): November 1, 1993-December 31, 2008 (1 manat = 500 Russian rubles); Turkmen new manat (TMT): January 1, 2009-present (1 TMT = 5000 TMMs).

[10] Uzbekistan old som: November 15, 1993-July 1, 1994; new som: Jul 1, 1994-present (1 new som = 1,000 old soms).

Turning to descriptive statistics, the model comprises $T * N$ observations. To avoid singularity problems, $T - 1$ time dummies (θ_t) and $N - 1$ country dummies (λ_i) are included in a pooled cross-sectional–time-series model. Intercept countries were chosen that have both seaports and highly competitive wheat markets: Turkey for Kazakhstan and Israel for Russia and Ukraine. Importing countries were selected based on data availability, number of observations (more than three observations), geographic location, and relative importance to the exporting country. The number of destination countries for Kazakhstan, Russia, and Ukraine is 48, 71, and 65, respectively. Descriptive statistics for destination specific export prices and bilateral exchange rates are presented in Tables A4.2 – A4.4 in the Appendix. The data are considered to be an unbalanced panel because KRU countries do not trade with all importing countries in every observed year.

4.6 Estimation Results and Discussion

As this study is based on panel data, nonstationarity should be checked, which is particularly necessary in the case of a large number of observations and long time periods (Baltagi, 2005). We perform Augmented Dickey-Fuller and Phillips-Perron panel unit root tests on export prices and nominal exchange rates. Moreover, as the data are unbalanced panels, a Fisher-type panel unit root test is applied in this study. The idea behind a panel unit root test is to check the null hypothesis of nonstationarity [I(1)] against the alternative of stationarity [I(0)]. The results of the tests are presented in Tables 4.1 and 4.2.

Table 4.1. Fisher-Type Augmented Dickey Fuller Panel Unit Root Tests

Test specification	Inverse normal statistics					
	Kazakhstan		Russia		Ukraine	
	Export price	Exchange rate	Export price	Exchange rate	Export price	Exchange rate
Drift	-5.94***	-7.87***	-6.33***	-13.03***	-5.32***	-9.00***
Demean	-9.82***	-4.14***	-10.95***	-3.30***	-11.44***	-3.63***
Demeaned with drift	-11.31***	-8.90***	-14.01***	-10.93***	-13.35***	-9.88***
Trend	-4.43***	-0.45	-0.65	-2.92**	-2.57**	-2.81**
Demeaned with trend	-9.28***	-4.08***	-12.03***	-2.44*	-6.27***	1.57

Notes: The lag length is zero. Asterisks $***$, $**$, and $*$ refer to statistical significance at the 1%, 5%, and 10% levels, respectively.

The test results with drift, demean, and demeaned with drift indicate that the null hypothesis of nonstationarity is rejected; that is, none of the panels contains a unit root. This rejection leads to the conclusion that there exists a linear long-run relationship between export prices and destination-specific exchange rates and confirms the existence of PTM.

Table 4.2. Fisher-Type Phillips-Perron Panel Unit Root Tests

Test specification	Inverse normal statistics					
	Kazakhstan		Russia		Ukraine	
	Export price	Exchange rate	Export price	Exchange rate	Export price	Exchange rate
Demean	-9.82***	-4.14***	-10.95***	-3.30***	-11.44***	-3.63***
Trend	-4.43***	-0.45	-0.65	-2.92**	-2.57**	-2.81**
Demeaned with trend	-9.28***	-4.08***	-12.03***	-2.44*	-6.27***	1.57

Notes: The lag length is zero. Asterisks $***$, $**$, and $*$ refer to statistical significance at the 1%, 5%, and 10% levels, respectively.

Additionally, the Wooldridge test for autocorrelation in panel data (Wooldridge, 2002) was conducted. The results fail to prove the null hypothesis of no serial correlation; that is, it is assumed that there is first-order autocorrelation in the data.

Two types of F-tests are employed to verify the joint significance of both country effects and the exchange rate effects for each exporting country separately (see Table 4.3). The null hypotheses that all country effects are equal and all exchange rate effects are zero (the case of the perfect market) are rejected for all exporting countries; that is, KRU wheat exporters set country-specific markups and use PTM behaviour in at least one of the importing countries.

The PTM model is estimated by using the fixed-effects model for each exporting country separately. Because the unit root process is rejected, we can apply the fixed-effects model to the panel data.

Table 4.3. F-Test Results

Null hypothesis	Kazakhstan	Russia	Ukraine
$H_0: \lambda_1 = \lambda_2 = \cdots = \lambda_i$	4.49**	15.73***	41.33***
$H_0: \beta_1 = \beta_2 = \cdots = \beta_i = 0$	4.75**	20.17***	31.92***

According to Tables 4.4 – 4.6, there is evidence of PTM by KRU countries in the destination markets (i.e., the null hypothesis of a constant elasticity model is rejected). Kazakh wheat exporters use PTM behaviour (significant β) in 7 out of 48 importing countries (see Table 4.4). Specifically, they stabilize the local currency prices (significantly negative β) in Albania, Greece, Lebanon, Tajikistan, and Uzbekistan but amplify the effect of destination-specific exchange rate changes in Lithuania and Sudan.

Table 4.4. Pricing-to-Market Results for Kazakhstan

Destinations	λ	β	**Destinations**	λ	β
Afghanistan	0.11 [0.23]	-0.23 [-0.82]	Lithuania	1.24 [1.72]	**0.40*[1.98]**
Albania	**-2.34**[-2.15]**	**-7.93**[-2.60]**	Malaysia	0.00 [0.00]	-0.08 [-0.40]
Algeria	0.01 [0.01]	-1.84 [-0.93]	Moldova	-2.75 [-1.09]	-1.24 [-1.15]
Azerbaijan	1.92 [1.52]	0.40 [1.56]	Mongolia	0.92 [1.03]	-0.08 [-0.19]
Belarus	0.43 [1.23]	0.09 [1.62]	Morocco	4.71 [0.98]	1.73 [0.97]
Cyprus	1.48 [1.39]	0.28 [1.39]	Netherlands	-2.40 [-0.75]	-0.63 [-0.91]
China	3.25 [0.51]	0.95 [0.47]	Norway	0.68 [0.77]	0.19 [0.65]
Dominica	1.17 [1.33]	0.30 [1.36]	Pakistan	0.17 [0.39]	-0.27 [-0.62]
Egypt	-0.89 [-0.99]	-0.27 [-1.00]	Poland	-1.47 [-1.22]	-0.45 [-1.46]
Estonia	0.49 [0.73]	0.19 [0.70]	Portugal	-2.29 [-0.79]	-0.48 [-0.85]
Finland	1.16 [0.65]	0.21 [0.59]	Romania	0.90 [1.41]	0.20 [1.35]
Georgia	-1.03 [-0.54]	-0.24 [-0.55]	Spain	0.30 [0.31]	0.07 [0.37]
Germany	1.06 [0.78]	0.20 [0.75]	Sudan	**2.64**[2.74]**	**0.66**[2.61]**
Greece	**-1.83*[-1.84]**	**-0.37*[-1.85]**	Sweden	-0.42 [-0.52]	-0.24 [-0.96]
Indonesia	2.55 [1.19]	-0.43 [-0.84]	Switzerland	1.21 [0.76]	0.26 [0.74]
Iran	**1.06**[2.81]**	-0.09 [-1.01]	Tajikistan	**-0.50**[-2.21]**	**-0.12**[-2.29]**
Ireland	-2.40 [-1.05]	-0.49 [-1.04]	Tunisia	-0.20 [-0.06]	-0.04 [-0.05]
Israel	0.07 [0.03]	0.00 [0.00]	Turkey	-	-0.08 [-1.29]
Italy	-0.36 [-0.34]	-0.08 [-0.40]	Turkmenistan	0.34 [0.26]	0.04 [0.14]
Jordan	-9.15 [-1.68]	-1.70 [-1.64]	UAE	-2.38 [-1.01]	-0.68 [-1.05]
Kyrgyz Rep	-0.18 [-1.01]	-0.31 [-1.65]	UK	-11.27 [-1.33]	-2.18 [-1.32]
Latvia	0.17 [0.11]	0.02 [0.07]	USA	-0.39 [-0.24]	-0.10 [-0.29]
Lebanon	**1.97***[4.52]**	**-0.57**[-2.72]**	Uzbekistan	**-0.62**[-2.77]**	**-0.10**[-2.25]**
Libya	-9.86 [-0.76]	-2.08 [-0.76]	Venezuela	-17.62 [-0.85]	-3.54 [-0.87]
Constant	**9.41***[30.82]**				

Notes: Values in parentheses are *t*-statistics. Asterisks ∗∗∗, ∗∗, and ∗ denote statistical significance at the 1%, 5%, and 10% levels, respectively. Values in boldface refer to significant results. Turkey is treated as the intercept country.

Additionally, Kazakh exporters price discriminate with constant markups against Iran (significant λ, insignificant β); that is, they charge higher price markups than Turkey

(intercept country). However, in 40 destinations there is no evidence of price discrimination exercised by Kazakh exporters; that is, they either face perfect competition or set common markups in imperfectly competitive markets. Because Kazakhstan is located far from most of its destinations, transportation costs make Kazakh wheat less competitive. Most countries prefer to import from short-distance exporters, and this restricts Kazakh exporters' ability to exercise price discrimination.

The PTM results listed in Table 4.4 should be carefully explained because there are differences between small and large buyers. Moreover, there are several consistent markets for Kazakhstan where Kazakh exporters export in large quantities—namely, Iran, Tajikistan, and Uzbekistan. However, only in Iran do they enjoy a small price premium[11] (1%), whereas in Tajikistan (−13%) and Uzbekistan (−11%) they garner negative price premiums. There are several export countries—namely, Australia, Canada, Germany, and Russia—that also sell wheat to Iran. However, because of its geographic advantages, Kazakhstan has the chance to strengthen its position in the Iranian wheat market and thus can charge a higher price markup.

Because of its political relations and geographic locations, Kazakhstan has the highest market share in wheat exports to Central Asian markets. Specifically, the average Kazakh market shares for the years 1996–2012 are 91%, 95%, 76%, and 84%, respectively, for the Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan. However, PTM results show that Kazakh wheat exporters are in perfect competition in the Kyrgyz Republic and Turkmenistan but stabilize the export prices in Tajikistan and Uzbekistan in the case of the domestic currencies' depreciation. Additionally, even though Kazakhstan shares the Azerbaijani wheat market only with Russia, it cannot price discriminate in this market.

The quantities that Kazakhstan exports to Albania, Lebanon, Lithuania, and Sudan are very small (i.e., they are small buyers), and they do not trade regularly with Kazakhstan. Additionally, Lithuania is a wheat producing and exporting country. Therefore, the PTM results for those countries might not reflect the reality. Since 2004, Greece has regularly imported wheat from Kazakhstan in small quantities. There are several wheat exporters (mainly EU countries) in the Greek import market; however, Kazakh wheat exporters exercise price discrimination and enjoy a price premium (24%) in Greece.

[11] As Turkey was accepted as an intercept country for Kazakhstan, the average price for Turkey was considered as a benchmark price for calculating the price premium. Similarly, Israel was accepted as an intercept country for Russia and Ukraine. Further, the average price for Israel was used as a benchmark price for calculating the price premiums for Russia and Ukraine.

Table 4.5. Pricing-to-Market Results for Russia

Destinations	λ	β	Destinations	λ	β
Afghanistan	1.15 [1.36]	-1.26 [-1.06]	Malaysia	0.55 [0.44]	0.20 [0.32]
Albania	0.25 [0.51]	-0.14 [-0.33]	Malta	0.44 [1.10]	0.09 [0.81]
Algeria	0.33 [0.29]	-0.40 [-0.34]	Mauritania	3.03 [1.34]	-1.28 [-1.21]
Armenia	-0.79 [-1.65]	**0.37**[2.36]**	Moldova	-0.17 [-0.55]	**-0.98**[-2.20]**
Austria	-0.15 [-0.25]	-0.04 [-0.24]	Mongolia	-0.98 [-0.96]	0.35 [1.36]
Azerbaijan	**0.74**[2.88]**	**0.17*[2.00]**	Morocco	**0.29**[2.45]**	**0.15**[2.71]**
Bangladesh	-0.39 [-1.10]	0.49 [1.45]	Mozambique	0.18 [0.95]	0.28 [0.72]
Br. Virgin Isl.	0.05 [0.37]	-0.03 [-0.30]	Netherlands	-0.68 [-0.44]	-0.18 [-0.39]
Bulgaria	0.20 [0.97]	-0.03 [-0.28]	Nigeria	0.67 [0.57]	-0.47 [-0.66]
Cyprus	**0.65**[2.24]**	**0.16*[1.77]**	North Korea	**0.37*[1.75]**	0.12 [0.94]
Denmark	**0.53***[3.43]**	**0.31***[2.97]**	Norway	-0.58 [-0.55]	-0.37 [-0.56]
DR Congo	**2.67***[10.27]**	**-0.79***[-7.03]**	Oman	**3.57***[3.01]**	**0.78**[2.72]**
Egypt	0.37 [1.12]	0.16 [0.85]	Pakistan	-0.25 [-0.89]	**0.47***[6.03]**
Eritrea	-0.01 [-0.04]	-0.23 [-0.51]	Peru	**1.39***[4.59]**	**0.50***[3.46]**
Estonia	0.02 [0.17]	0.06 [0.56]	Poland	0.13 [0.78]	**-0.22*[-1.86]**
Ethiopia	**0.33*[1.81]**	**0.42***[3.64]**	Rep of Yemen	-0.66 [-0.62]	0.40 [0.76]
Finland	**3.05***[6.37]**	**0.81***[4.55]**	Romania	**4.55*[1.75]**	1.92 [1.66]
Georgia	0.66 [1.46]	0.18 [0.99]	Rwanda	0.75 [0.45]	-0.22 [-0.41]
Germany	**4.07**[2.53]**	**1.11**[2.48]**	Saudi Arabia	**2.59***[3.45]**	**1.29***[3.50]**
Greece	1.05 [1.56]	0.29 [1.42]	South Korea	0.07 [0.15]	-0.00 [-0.01]
Hungary	1.33 [1.61]	-0.49 [-1.67]	Spain	-1.19 [-0.63]	-0.32 [-0.59]
India	**-1.38*[-2.02]**	**3.06**[2.20]**	Sudan	0.49 [0.77]	0.14 [0.49]
Indonesia	1.51 [0.46]	-0.24 [-0.44]	Sweden	**0.78***[5.63]**	**0.58**[2.57]**
Iran	-2.07 [-1.48]	0.36 [1.55]	Switzerland	**0.46*[1.91]**	0.13 [1.14]
Iraq	**-0.74*[-2.00]**	0.26 [1.52]	Syria	-0.48 [-1.26]	-0.59 [-1.47]
Israel	-	-0.00 [-0.02]	Tajikistan	0.87 [0.86]	0.27 [0.66]
Italy	-0.19 [-0.29]	-0.05 [-0.31]	Tanzania	**1.62*[1.96]**	-0.39 [-1.47]
Japan	**-1.32***[-5.79]**	**1.48***[7.80]**	Thailand	-0.02 [-0.12]	0.28 [0.80]
Jordan	1.18 [0.58]	0.28 [0.51]	Tunisia	**2.54***[22.27]**	**0.78***[14.59]**
Kenya	0.40 [0.77]	-0.24 [-0.47]	Turkey	0.34 [0.63]	0.08 [0.39]
Kyrgyz Rep	0.72 [1.31]	-0.32 [-0.54]	Turkmenistan	-1.10 [-1.33]	**-0.82**[-2.83]**
Latvia	-0.30 [-0.41]	-0.13 [-0.66]	UAE	0.43 [0.50]	0.16 [0.38]
Lebanon	-0.30 [-0.84]	0.10 [1.38]	Uganda	1.13 [0.56]	-0.23 [-0.45]
Libya	0.95 [0.61]	0.29 [0.57]	UK	-6.42 [-1.70]	-1.76 [-1.71]
Lithuania	**0.43*[1.81]**	0.16 [1.32]	Uzbekistan	1.12 [1.31]	-0.14 [-0.53]
Constant	**8.07***[50.04]**		Vietnam	-0.53 [-0.16]	0.09 [0.18]

Notes: Values in parentheses are *t*-statistics. Asterisks ∗∗∗, ∗∗, and ∗ denote statistical significance at the 1%, 5%, and 10% levels, respectively. Values in boldface refer to significant results. Israel is treated as the intercept.

The PTM results for Russia show that Russian wheat exporters use PTM in 20 out of 71 destinations (see Table 4.5). In contrast to the results for Kazakhstan, in most importing countries Russian exporters amplify the effect of destination specific exchange rate changes by changing the destination-specific markup (significantly positive β)—namely, Armenia, Azerbaijan, Cyprus, Denmark, Ethiopia, Finland, Germany, India, Japan, Morocco, Oman, Pakistan, Peru, Saudi Arabia, Sweden, and Tunisia.

However, Russian exporters stabilize the local currency prices in the Democratic Republic of the Congo, Moldova, Poland, and Turkmenistan. Russian wheat exporters price discriminate with constant markup in Iraq, Lithuania, North Korea, Romania, Switzerland, and Tanzania; that is, they charge higher price markups than Israel (intercept country) in those destinations.

However, the evidence of price discrimination by Russian exporters is not observed in the 45 other importing countries. The reason is that Russia usually exports an undifferentiated quality of wheat to the world market and thus cannot compete with the traditional wheat exporters in most destinations (Pall et al., 2013).

Just as in the case of Kazakhstan, some PTM results should be carefully interpreted. According to the UN Comtrade statistics, Armenia, Azerbaijan, Iraq, Morocco, and Tunisia are consistent markets for Russian exporters. These countries regularly trade with Russia and usually import wheat in large quantities. Armenia mainly imports wheat from Russia, and Azerbaijan from Kazakhstan and Russia. Therefore, Russian exporters use PTM behaviour in Armenia and Azerbaijan, and enjoy 24% and 14% price premiums, respectively.

Russia competes with Australia, Canada, Turkey, and other wheat exporters in the Iraqi wheat market, and because of its greater potential and geographic advantages, has the chance to improve its position in this market. Perhaps using PTM in the Iraqi wheat market is why Russia enjoys a 35% price premium.

Several countries including Canada, Russia, the USA, and Ukraine, as well as the EU, export wheat to the Moroccan and Tunisian wheat markets. However, Russian wheat exporters exercise price discrimination and garner price premium in these markets (Morocco, 132%; Tunisia, 30%). Similarly, Russian exporters compete with some EU countries in the Cypriot wheat market with 16% average market share for the years 1996–2012. Therefore, they use PTM behavior and enjoy a 16% price premium in this market. In the Omani wheat market, Russia competes with Argentina, Australia, and India. Even though its average market share in this market from 1996–2012 is only 11%, Russia garners an even higher price premium

(85%). According to Table 4.5, Russia does not price discriminate in the Egyptian wheat market. This was expected, because, as the largest wheat buyer in the world, Egypt imports wheat from many different sources, including Australia, Canada, France, Russia, Ukraine, and the USA. Therefore, if there is an increase in wheat export price charged by Russian exporters, Egypt will simply decrease its wheat import quantity from Russia and increase imports from other exporters.

The results for Denmark, Germany, India, Lithuania, Pakistan, Poland, Romania, and Sweden should be carefully interpreted because they are wheat producing and exporting countries. Moreover, the Democratic Republic of the Congo, Ethiopia, Finland, Japan, North Korea, Peru, and Turkmenistan are not consistent markets for Russia, and they do not regularly import wheat from Russia. Therefore, the results that show price discrimination in those countries might not express the reality.

Because of its geographic location, Ukrainian wheat exporters use PTM behaviour in 17 importing countries, primarily the EU and MENA countries (see Table 4.6). Similar to Kazakhstan, in most countries—Djibouti, Egypt, Eritrea, Greece, Libya, Mauritania, Moldova, Myanmar, Poland, and Switzerland—Ukrainian exporters stabilize the local currency prices. However, they amplify the effect of destination-specific exchange rate changes in Algeria, Belgium, Bulgaria, Estonia, Latvia, Thailand, and Uzbekistan. Additionally, Ukrainian wheat exporters price discriminate with constant markup in Indonesia, Lithuania, Morocco, Portugal, Saudi Arabia, and Spain, which means they charge higher markups in these destinations than Israel (intercept country).

Price discrimination is not observed in the other 42 importing countries. The main reason is that Ukraine usually exports feed wheat to the world market (Kobuta, Sikachyna, and Zhygadlo, 2012), and there are many substitutes for it.

Table 4.6. Pricing-to-Market Results for Ukraine

Destinations	λ	β	Destinations	λ	β
Albania	0.78 [1.42]	-0.08 [-0.58]	Lithuania	**0.31*[1.84]**	0.02 [0.12]
Algeria	-0.13 [-0.24]	**0.18*[1.89]**	Malaysia	0.07 [0.88]	-0.10 [-0.99]
Armenia	0.57 [0.84]	0.06 [0.65]	Mauritania	**1.96**[2.17]**	**-0.40**[-2.33]**
Austria	-0.02 [-0.10]	0.05 [0.95]	Moldova	**1.52***[3.54]**	**-0.96*[-1.78]**
Azerbaijan	0.14 [0.50]	0.10 [0.73]	Morocco	**0.19*[1.82]**	-0.02 [-0.52]
Bangladesh	0.61 [1.24]	-0.10 [-0.90]	Myanmar	**0.24***[3.09]**	**-0.54**[-2.21]**
Belarus	-0.35 [-0.78]	0.22 [1.36]	Netherlands	-0.02 [-0.06]	0.01 [0.06]
Belgium	**0.39*[1.91]**	**0.34***[3.00]**	Nigeria	-0.43 [-0.33]	0.24 [0.70]
Bermuda	-0.12 [-0.84]	-0.01 [-0.10]	North Korea	0.06 [0.60]	0.13 [0.78]
Br. Virgin Isl.	-0.11 [-0.53]	-0.02 [-0.15]	Peru	-0.59 [-0.78]	-1.68 [-0.93]
Bulgaria	**0.81***[3.56]**	**0.43*[1.89]**	Philippines	0.01 [0.02]	0.10 [0.87]
Cyprus	-0.22 [-0.85]	0.00 [0.04]	Poland	**0.16**[2.30]**	**-0.14*[-2.03]**
Djibouti	**2.29***[3.20]**	**-0.54**[-2.22]**	Portugal	**-0.46**[-2.26]**	-0.10 [-1.10]
Egypt	**0.09**[2.29]**	**-0.34***[-3.01]**	Rep of Yemen	0.94 [0.68]	-0.10 [-0.35]
Eritrea	**1.06***[3.87]**	**-0.85*[-2.05]**	Saudi Arabia	**0.26*[1.89]**	0.24 [0.81]
Estonia	-0.22 [-0.77]	**0.35*[2.10]**	Slovak Rep	0.24 [0.46]	0.09 [0.49]
France	-0.28 [-1.04]	-0.09 [-0.74]	South Africa	0.19 [1.70]	-0.03 [-0.14]
Georgia	0.20 [1.05]	0.02 [0.16]	South Korea	0.31 [0.35]	0.07 [0.76]
Germany	0.22 [0.70]	0.18 [1.72]	Spain	**-0.42**[-2.18]**	-0.10 [-1.11]
Greece	**-0.45**[-2.27]**	**-0.18**[-2.48]**	Sri Lanka	-1.34 [-0.55]	0.69 [0.75]
Hungary	0.14 [0.23]	0.10 [1.05]	Sudan	-0.07 [-0.38]	-0.16 [-0.83]
India	0.55 [0.92]	-0.08 [-0.50]	Switzerland	-0.29 [-1.55]	**-0.24**[-2.51]**
Indonesia	**2.61*[1.83]**	-0.22 [-1.43]	Syria	0.23 [1.63]	-0.06 [-0.45]
Iraq	0.55 [0.87]	0.04 [0.47]	Tajikistan	0.38 [1.73]	0.09 [0.29]
Ireland	-0.17 [-0.70]	-0.13 [-0.74]	Thailand	**-1.66**[-2.55]**	**1.40**[2.92]**
Israel	-	-0.12 [-0.97]	Tunisia	-0.00 [-0.00]	0.02 [0.20]
Italy	-0.14 [-0.73]	0.05 [0.78]	Turkey	0.77 [1.46]	0.39 [1.12]
Jordan	0.37 [0.66]	0.20 [0.99]	Uganda	2.69 [1.13]	-0.31 [-0.93]
Kenya	1.21 [1.73]	-0.29 [-1.61]	UAE	0.02 [0.23]	-0.06 [-0.37]
Latvia	0.55 [1.33]	**0.36*[2.10]**	UK	-0.17 [-0.58]	-0.00 [-0.11]
Lebanon	0.74 [1.12]	0.03 [0.50]	USA	0.02 [0.05]	0.13 [0.85]
Libya	**-0.64**[-2.57]**	**-0.32**[-2.19]**	Uzbekistan	**1.45***[3.20]**	**0.44*[1.94]**
Constant	**6.44***[182.14]**		Vietnam	2.57 [0.99]	-0.18 [-0.81]

Notes: Values in parentheses are *t*-statistics. Asterisks ∗∗∗, ∗∗, and ∗ denote statistical significance at the 1%, 5%, and 10% levels, respectively. Values in boldface refer to significant results. Israel is treated as an intercept country.

Algeria, Egypt, Greece, Indonesia, Libya, Mauritania, Moldova, Morocco, Spain, and Switzerland are consistent markets for Ukrainian wheat exporters. Except for Indonesia, all countries are either EU or North African countries. North African countries—Algeria, Egypt, Libya, Mauritania, and Morocco— usually import wheat from various sources, such as Canada, the EU, the USA, Russia, and Ukraine. However, because of its geographic location, Ukraine has the chance to price discriminate in these markets and therefore garners positive price premiums (Algeria, 8%; Egypt, 33%; Libya, 42%; Mauritania, 18%; and Morocco, 17%). Moldova is a landlocked country and usually prefers to import from neighbouring countries—namely, Romania and Ukraine, as well as Russia. Recent UN Comtrade statistics show that Moldova has increased its wheat imports from Ukraine. Therefore, Ukrainian exporters do price discriminate and enjoy a 132% price premium in the Moldavian wheat market. Australia, Canada, and the USA are important players in the Indonesian wheat market, and Ukrainian market share is very tiny. However, PTM results demonstrate that Ukrainian exporters exercise price discrimination in the Indonesian wheat market and enjoy a 46% price premium.

Because Belgium, Bulgaria, Greece, Latvia, Lithuania, Poland, and Spain are simultaneously wheat producing and exporting countries, the PTM results for those countries do not demonstrate that Ukrainian wheat exporters use pricing behaviour to price discriminate in these markets. Moreover, Switzerland imports wheat mainly from the EU, but the results show that Ukraine exercises price discrimination in the Swiss wheat market. Djibouti, Eritrea, Myanmar, Portugal, Saudi Arabia, Thailand, and Uzbekistan do not trade with Ukraine regularly, and thus a conclusion cannot be drawn from these results.

Table 4.7. Statistical Inference of Estimated Pricing-to-Market Models

	Kazakhstan	**Russia**	**Ukraine**
Number of observations	451	660	605
Number of time series	17	17	17
Number of cross sections	48	71	65
R-squared	0.30	0.65	0.50
Akaike Information Criterion (AIC)	313.60	-48.93	-352.34
Bayesian Information Criterion (BIC)	379.39	22.94	-281.86

The statistical inferences of the PTM models are listed in Table 4.7. The number of observations is different for each data set. Russian data set contains trade statistics for the

most importing countries (number of cross sections) and logically also has the maximum number of observations.

However, the time series are the same because all data sets cover the period 1996–2012. The R-squared values between observed and predicted values are 0.30, 0.65, and 0.50, respectively, for Kazakhstan, Russia, and Ukraine. Additionally, the results for Akaike information criterion and Bayesian information criterion demonstrate that the PTM model for Russia achieves better performance than the PTM models for Kazakhstan and Ukraine.

4.7 Conclusion and Policy Implications

Because of the restructuring policies in agricultural production, consumption, and trade sectors during the 1990s, as well as a massive increase in wheat production during the 2000s, Black Sea region wheat exporters became important players in the world market during the early 2000s.

We analyse the changes in pricing behaviour of KRU exporters in response to the bilateral exchange rate fluctuations. Specifically, we investigate whether KRU countries are able to price discriminate in selected importing markets during the period 1996–2012. The results of this research indicate that Kazakhstan and Ukraine stabilize local currency prices in most wheat importing countries, whereas Russia amplifies the effect of destination-specific exchange rate changes.

Because of political relations and geographic locations, the main destinations for KRU exporters are South Caucasus, Central Asia, and some EU and MENA countries. Although Kazakhstan is a leading wheat exporting country in Central Asia, it is able to use PTM behaviour only in Tajikistan and Uzbekistan. Moreover, even though all KRU countries are active wheat exporters to the South Caucasian countries, only Russia is able to exercise price discrimination in the Armenian and Azerbaijani wheat markets. Kazakhstan and Ukraine face perfect competition in all three countries in this region. As the Georgian government implements a diversification policy on wheat imports and buys wheat from multiple sources (KRU, Germany, Israel, Italy, Romania, Turkey, and the USA), despite their high market shares, none of the KRU countries can exercise price discrimination in this market. Ukraine is able to export and exercise price discrimination in some EU and MENA countries because of its geographic advantages.

The results of this study contradict the ones by Pall et al. (2013), who investigated the PTM behaviour of Russian exporters in 25 destinations. These authors found that Russia amplifies the effect of destination-specific exchange rate changes in Algeria and India but stabilizes local currency prices in Azerbaijan, Cyprus, and Mongolia over the period 2002–2010. Only the conclusion for India is in line with our results.

Kazakhstan and Russia do not price discriminate in the Egyptian wheat market, whereas Ukraine stabilizes the wheat export prices in Egyptian pounds. These results were expected because Egypt is the largest wheat importer in the world and usually imports from multiple sources (e.g., Argentina, Canada, EU, Russia, Ukraine, and the USA). This situation gives Egypt monopsony power, and in order to maintain their market share, exporters are sensitive to the changes in export prices of wheat in this country.

According to the PTM results, in only 17% of total destinations can Kazakhstan exercise price discrimination, whereas Russia can do so in 37% and Ukraine in 35%; in most destination countries, KRU countries cannot exercise PTM behaviour.

There are three main reasons why KRU countries cannot price discriminate in their export destinations: (1) their production is highly weather dependent; (2) they mainly export an undifferentiated quality of wheat, or feed wheat; and (3) they periodically implement export restriction policies. Because of their weather-dependent production, they are not able to trade regularly with their main partners. Therefore, importing countries switch to buy wheat from more reliable sources. Compared with the traditional wheat exporters, KRU countries usually have short-term relations with their partner countries (mainly developing countries). Moreover, Russia chiefly exports an undifferentiated quality of wheat, whereas Ukraine is specialized in feed wheat exports. This makes the competition tougher for both of them because the demand is highly elastic for their products, and there are many competitors in the market that offer substitutes (Pall et al., 2013). Hence, most importing countries can easily switch to import wheat from other exporters if KRU countries increase wheat export prices. However, despite having higher protein-content wheat than Russia and Ukraine, Kazakhstan is not able to price discriminate in most destinations, as it is geographically distant from most export destinations.

Moreover, several trade restriction policies have been implemented by KRU countries since 2007, with the most recent being implemented by the Russian government on February 1, 2015. These policies disrupt their wheat trade with most export destinations. For example,

when Ukraine set export restrictions in 2007, its main importing countries—Egypt, Israel, Italy, Tunisia, and Yemen— imported more from Kazakhstan and Russia (Dollive, 2008). Export restrictions isolate KRU countries from the global wheat market, which reduces the global wheat supply and affects global food security. These reasons cause KRU countries to be branded as unreliable wheat exporters in the world wheat market. In order to strengthen their reputation in the world market, it would benefit KRU countries to abstain from setting any restriction policies on wheat. This would improve their relations with importing countries and reduce disruptions in wheat exports.

Future research should incorporate the pricing behaviour of the KRU countries using firm-level data. This would render a much clearer picture of the competitive structure of the wheat market.

4.8 References

Baltagi, B. H. (2005). *Econometric Analysis of Panel Data*. 3rd ed. Chichester, UK: Wiley.

Brown, J. (2001). Price Discrimination and Pricing to Market Behavior of Canadian Canola Exporters. *American Journal of Agricultural Economics,* 83(5): 1343–49.

Carew, R. (2000). Pricing to Market Behavior: Evidence from Selected Canadian and U.S. Agri-Food Exports. *Journal of Agricultural and Resource Economics,* 25(2): 578–95.

Carew, R., and W. J. Florkowski (2003). Pricing to Market Behavior by Canadian and U.S. Agri-Food Exporters: Evidence from Wheat, Pulse and Apples. *Canadian Journal of Agricultural Economics,* 51(2): 139–59.

Dollive, K. (2008). The Impact of Export Restraints on Rising Grain Prices. *Working Paper No. 2008-09-A. Washington, DC: U.S. International Trade Commission*

Falk, M., and R. Falk (2000). Pricing to Market of German Exporters: Evidence from Panel Data. *Empirica,* 27: 21–46.

Fedoseeva, S. (2013). (A)symmetry, (Non)linearity and Hysteresis of Pricing-to-Market: Evidence from German Sugar Confectionary Exports. *Journal of Agricultural & Food Industrial Organization,* 11(1): 69–85.

FAO-EBRD. (2010). Ukraine: Grain Sector Review and Public Private Policy Dialogue. Report Series No. 15, Rome, Italy.

Gil-Pareja, S. (2002). Export Price Discrimination in Europe and Exchange Rates. *Review of International Economics,* 10(2): 299–312.

Glauben, T., and J.-P. Loy (2003). Pricing-to-Market versus Residual Demand Elasticity Analysis of Imperfect Competition in Food Exports: Evidence from Germany. *Journal of Agricultural & Food Industrial Organization,* 1 (1): 1–19.

Götz, L., T. Glauben, and B. Bruemmer (2013). Wheat Export Restrictions and Domestic Market Effects in Russia and Ukraine during the Food Crisis. *Food Policy,* 38: 214–26.

Griffith, G., and J. Mullen (2001). Pricing-to-Market in NSW Rice Export Markets. *Australian Journal of Agricultural and Resource Economics,* 45(3): 323–334.

Jin, H. (2008). Competitive Structure of Canadian Wheat Exports in the World Market. *Applied Economics Letters,* 15(13): 1059–64.

Jin, H., and D. Miljkovic (2008). Competitive Structure of U.S. Grain Exporters in the World Market: A Dynamic Panel Approach. *Journal of International Economic Studies,* 12(1): 33–63.

Kim, J. (2010). Recent Trends in Export Restrictions. OECD Trade Policy Papers, No. 101, OECD Publishing, Paris. http://dx.doi.org/10.1787/5kmbjx63sl27-en (accessed July 6, 2014).

Knetter, M. M. (1989). Price Discrimination by U.S. and German Exporters. *American Economic Review,* 79(1): 198–210.

Knetter, M. M. (1993). International Comparisons of Pricing-to-Market Behavior. *American Economic Review,* 83(3): 473–86.

Knetter, M. M. (1995). Pricing to Market in Response to Unobservable and Observable Shocks. *International Economic Journal,* 9(2): 1–25.

Kobuta, I., O. Sikachyna, and V. Zhygadlo (2012). Wheat Export Economy in Ukraine. Policy Studies on Rural Transition No. 2012–4, Budapest.

Krugman, P. (1987). Pricing to Market When Exchange Rate Changes. *Real-Financial Linkages among Open Economies*. S.W. Arndt and J.D. Richardson, eds. Cambridge, MA: MIT Press.

Lavoie, N., and Q. Liu (2007). Pricing-to-Market: Price Discrimination or Product Differentiation? *American Journal of Agricultural Economics*, 89(3): 571–81.

Liefert, O., W. Liefert, and E. Luebehusen (2013). Rising Grain Exports by the Former Soviet Union Region: Causes and Outlook. U.S. Department of Agriculture, Economic Research Service, Outlook WHS-13A-01, Washington, DC.

OECD-FAO (2014). Agricultural Outlook 2014. OECD Publishing. http://dx.doi.org/10.1787/agr_outlook-2014-en (accessed June 11, 2015).

Pall, Z., O. Perekhozhuk, R. Teuber, and T. Glauben (2013). Are Russian Wheat Exporters Able to Price Discriminate? Empirical Evidence from the Last Decade. *Journal of Agricultural Economics*, 64(1): 177–196.

Pick, D. H., and C. A. Carter (1994). Pricing to Market with Transactions Denominated in a Common Currency. *American Journal of Agricultural Economics*, 76(1): 55– 60.

Pick, D. H., and T. A. Park (1991). The Competitive Structure of U.S. Agricultural Exports. *American Journal of Agricultural Economics*, 73(1): 133–41.

ROSSTAT. *Russian Statistical Yearbook*: Statistical Handbook, Moscow: 2001, 2007, 2013.

Russian Government (2014). Government Decisions: Introduction of Grain Export Duty and Setting the Tax Rate. http://government.ru/en/docs/16329/ (accessed March 21, 2015).

Tothova, M., W. H. Meyers, and K. Goychuk (2013). Productivity Growth and Variability in KRU: Evidence and Prospects. *Selected Paper for presentation at the Public Trade Policy Research and Analysis Symposium Productivity and Its impacts on Global Trade, Seville, Spain, June 2–4.*

UN Comtrade Statistics Database. http://comtrade.un.org/ (accessed January 15, 2015).

United Nations (2011). Department of Economic and Social Affairs, Statistics Division. *International Merchandise Trade Statistics: Concepts and Definitions 2010.* Statistical Papers, Series M, No. 52, New York: United Nations.

USDA (2014). *USDA Agricultural Projections to 2023*. Prepared by the Interagency Agricultural Projections Committee. Washington, DC: Office of the Chief Economist, World Agricultural Outlook Board, USDA, Long-term Projections Report OCE-2014–1.

Wooldridge, J. M. (2002). *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT Press.

Yumkella, K. K., L. J. Unnevehr, and P. Garcia (1994). Noncompetitive Pricing and Exchange Rate Pass-Through in Selected U.S. and Thai Rice Markets. *Journal of Agricultural and Applied Economics*, 26(2): 404–16.

Appendix

Table A4.1. Selected Studies applying the Pricing-to-Market models

Authors	Journal[a] (Year)	Exporter	(Number of) importer	(Number of) product	Period	Data[b]	Method/ estimator[c]	Result[d]
Knetter	AER (1989)	United States	14	6	1978-86	Q	FE	AER: 11/46; LCPS: 9/46
		Germany	10	10	1977-85			AER: 10/34; LCPS: 24/34
Pick and Park	AAEA (1991)	United States	8	wheat	1978-88	Q	FE	AER: 2/8; CED: 5/8; LCPS: 1/8
			10	corn				CED: 1/10; LCPS: 1/10
			12	cotton				LCPS: 1/12
			10	soybeans				CED: 1/10; LCPS: 1/10
			6	soybean meal				AER: 2/6; CED: 2/6
Knetter	AER (1993)	United States		11	1973-87	A	n/a	AER: 2/11; LCPS: 1/11
		United Kingdom		9	1974-87			LCPS: 2/9
		Germany		18	1975-87			LCPS: 9/18
		Japan		14	1973-87			LCPS: 8/14
Pick and Carter	AJAE (1994)	United States	8	wheat	1978-88	Q	FE	AER: 2/8; CED: 4/8; LCPS: 3/8
		Canada	3					AER: 1/3; CED: 1/3; LCPS: 2/3
Yumkella, Unnevehr and Garcia	JAAE (1994)	United States	4	parboil rice	1980-87	Q	GLS	AER: 1/4; CED: 3/4
			5	long grain rice				AER: 2/5; CED: 2/5
		Thailand		long grain rice				AER: 1/4; CED: 1/4
Knetter	IEJ (1995)	Germany	6	7	1975-87	A	n/a	AER: United Kingdom; LCPS: Canada, France, Japan, Sweden, United States and United Kingdom
		United States	8	7	1973-87			ARE: Australia, Canada, Italy, Japan and United Kingdom; LCPS: Australia, Canada, Germany, Italy, Japan, Sweden and United Kingdom

Table A4.1. (continued)

Authors	Journal[a] (Year)	Exporter	(Number of) importer	(Number of) product	Period	Data[b]	Method/ estimator[c]	Result[d]
Carew	JARE (2000)	Canada	9	wheat	1980-94	A	FE	AER: 4/9; CED: 4/9
			11	pulse				AER: 3/11; CED: 3/11; LCPS: 1/11
			9	tobacco				AER: 4/9; LCPS: 3/9
		United States	13	wheat	1980-94	A	FE	CED: 6/13; LCPS: 7/13
			9	pulse				CED: 4/9; LCPS: 4/9
			15	tobacco				AER: 2/15; CED: 9/15; LCPS: 1/15
Falk and Falk	E (2000)	Germany	15	70	1990-94	A	GMM	AER: 8/15
			15				FE	LCPS in 6/15
			15				LAD	AER: 1/15; LCPS: 4/15
			15				OLS	AER: 1/15; LCPS: 4/15
			9				RCM	LCPS: 5/15
Brown	AJAE (2001)	Canada	Japan, Mexico	canola	1993-96	Q	GLS	CED in all; LCPS in Japan
			United States		1996-99			CED in Japan and United States; LCPS in all
					1993-99			CED in all; LCPS in Japan
Griffith and Mullen	AJARE (2001)	Australia	4	rice	1982-95	M	OLS	AER: 1/4; CED: 2/4; LCPS: ¼
Gil-Pareja	RIE (2002)	Belgium-Lux.	OECD countries	17	1988-96	Q	FE	AER: 8/17
		France		21				AER: 11/21
		Germany		19				AER: 12/19
		Italy		17				AER: 10/17
		Netherlands		10				AER: 4/10
		Spain		15				AER: 7/15
		United Kingdom		16				AER: 1/16; LCPS: 1/16

Table A4.1. (continued)

Authors	Journal[a] (Year)	Exporter	(Number of) importer	(Number of) product	Period	Data[b]	Method/ estimator[c]	Result[d]
Glauben and Loy	JAFIO (2003)	Germany	Canada, US, France, United Kingdom, Belgium and Italy	Beer Cocoa Chocolate Sugar confect.	1991-98	M	SUR	LCPS in Canada and United States LCPS in Italy LCPS in United Kingdom
Carew and Florkowski	CJAE (2003)	Canada	15	Wheat	1980-98	A	FE	AER: 4/15; CED: 5/15; LCPS: 1/15
			13	Pulse				AER: 4/13; CED: 7/13; LCPS: 1/13
			15	Apple				CED: 3/15; LCPS: 2/15
		United States	15	Wheat				AER: 1/15; CED: 4/15; LCPS: 9/15
			13	Pulse				CED: 3/13; LCPS: 5/13
			15	Apple				CED: 9/15; LCPS: 9/15
Jin	AEL (2008)	Canada	19	wheat	1988-03	A	TWFE	AER: 2/19; CED: 4/19; LCPS: 3/19
Jin and Miljkovic	JIES (2008)	United States	22	wheat	1989-04	Q	TWFE	AER: 3/22; CED: 19/22; LCPS: 6/22
							DTWFE	AER: 3/22; CED: 18/22; LCPS: 6/22
			16	corn			TWFE	AER: 5/16; CED: 7/16; LCPS: 5/16
							DTWFE	AER: 6/16; CED: 13/16; LCPS: 6/16
			14	soybeans			TWFE	AER: 5/14; CED: 4/14
							DTWFE	AER: 5/14; CED: 6/14
Fedoseeva	JAFIO (2013)	Germany	5	sugar confectionary	1991-11	M	FE	LCPS in Canada, Switzerland, United Kingdom and United States
Pall, Perekhozhuk, Teuber and Glauben	JAE (2013)	Russia	25	wheat	2002-07	Q	FE	CED: 3/25; LCPS: 4/25
					2008-10			CED: 3/25; LCPS: 9/25
					2002-10			AER: 2/25; CED: 2/25; LCPS: 3/25

[a] AEL, Applied Economics Letters; AER, American Economic Review; AJAE, American Journal of Agricultural Economics; AJARE, Australian Journal of Agricultural and Resource Economics; CJAE, Canadian Journal of Agricultural Economics; E, Empirica; IEJ, International Economic Journal; JAAE, Journal of Agricultural and Applied Economics; JAE, Journal of Agricultural Economics; JAFIO, Journal of Agricultural & Food Industrial Organization; JARE, Journal of Agricultural and Resource Economics; JIES, Journal of International Economic Studies; RIE, Review of International Economics.

[b] A, annual; M, monthly; Q, quarterly.

[c] DTWFE, dynamic two-way fixed effects; FE, fixed effects; GLS, generalized least squares; GMM, generalized method of moments; LAD, least absolute deviations; OLS, ordinary least squares; RCM, random coefficient model; SUR, seemingly unrelated regressions; TWFE, two-way fixed effects.

[d] AER, evidence of price discrimination via amplification of exchange-rate effects (significant positive exchange rate effect); CED, evidence of price discrimination via constant elasticity of demand (significant country effect); LCPS, evidence of price discrimination via local currency price stability (significant negative exchange rate effect).

Source: Own compilation based on the articles cited.

Table A4.2. Descriptive Statistics for Kazakhstan

Importing countries	N	Exchange rate				Export unit value			
		MEAN	CV	MIN	MAX	MEAN	CV	MIN	MAX
Afghanistan	17	0.41	0.30	0.31	0.71	20512	0.49	6472	42686
Albania	4	0.71	0.03	0.69	0.74	32643	0.41	16593	49577
Algeria	5	0.64	0.22	0.52	0.81	59328	1.58	11374	226726
Azerbaijan	17	0.01	0.28	0.01	0.01	19175	0.43	8085	37084
Belarus	14	15.34	0.99	0.20	56.50	21549	0.53	7757	44677
China	7	0.05	0.20	0.04	0.07	57439	1.49	8728	249397
Cyprus	4	0.01	0.26	0.00	0.01	12664	0.32	8220	18124
Dominica	5	0.030	0.34	0.02	0.04	11109	0.22	7830	14048
Egypt	9	0.04	0.15	0.03	0.05	20944	0.48	6834	35562
Estonia	10	0.13	0.30	0.09	0.18	12966	0.39	7437	21663
Finland	10	0.01	0.29	0.01	0.01	26008	0.49	11784	51387
Georgia	16	0.01	0.14	0.01	0.02	20533	0.47	6052	40177
Germany	8	0.01	0.40	0.01	0.01	25251	0.44	10192	39700
Greece	12	0.01	0.29	0.01	0.01	25097	0.48	6183	41249
Indonesia	4	66.33	0.13	57.34	74.59	18393	0.22	12828	21566
Iran	14	50.16	0.55	11.95	81.98	20567	0.39	10020	36002
Ireland	5	0.01	0.23	0.01	0.01	10028	0.31	5300	13408
Israel	8	0.03	0.10	0.03	0.04	20274	0.57	10768	45714
Italy	17	0.01	0.33	0.01	0.01	22652	0.57	7892	48576
Jordan	4	0.01	0.06	0.01	0.01	20807	0.51	11065	35192
Kyrgyz Rep	17	0.30	0.13	0.19	0.34	18391	0.48	6586	34404
Latvia	13	0.01	0.35	0.01	0.01	23264	0.59	9292	53048
Lebanon	8	12.12	0.26	9.84	19.36	16563	0.46	5571	27325
Libya	4	0.01	0.12	0.01	0.01	25336	0.49	6925	33476
Lithuania	7	0.03	0.55	0.02	0.06	14110	0.45	7407	26636
Malaysia	4	0.03	0.51	0.02	0.05	31813	0.54	8840	45265
Moldova	4	0.09	0.08	0.09	0.10	26083	0.55	16581	47359
Mongolia	14	8.93	0.13	7.24	10.74	22514	0.50	11188	45724
Morocco	5	0.07	0.06	0.06	0.08	18930	0.47	9863	33067
Netherlands	8	0.01	0.39	0.01	0.01	98829	1.89	8090	559241
Norway	13	0.05	0.16	0.04	0.07	20915	0.40	11140	36618
Pakistan	5	0.46	0.18	0.38	0.59	20045	0.48	8973	30831
Poland	15	0.03	0.30	0.02	0.04	24314	0.58	6590	47881
Portugal	5	0.01	0.16	0.01	0.01	21428	0.61	10764	42958
Romania	5	0.02	0.32	0.01	0.02	16688	0.33	10257	21579
Spain	10	0.01	0.25	0.01	0.01	16396	0.46	7987	33458
Sudan	4	0.02	0.20	0.02	0.02	22370	0.43	11344	34802
Sweden	10	0.06	0.28	0.04	0.10	24555	0.46	7607	42211
Switzerland	10	0.01	0.31	0.01	0.02	20295	0.53	8949	37866
Tajikistan	17	0.02	0.43	0.01	0.03	17745	0.43	7791	31293
Tunisia	4	0.01	0.09	0.01	0.01	22233	0.41	10538	32392
Turkey	17	0.01	0.45	0.00	0.01	20311	0.47	7704	37776
Turkmenistan	14	0.01	0.44	0.01	0.02	22179	0.56	8923	50548
UAE	8	0.03	0.09	0.02	0.03	22429	0.40	11392	38263

Table A4.2. (continued)

Importing countries	N	Exchange rate				Export unit value			
		MEAN	CV	MIN	MAX	MEAN	CV	MIN	MAX
UK	12	0.01	0.24	0.00	0.01	250766	3.07	6792	2700000
USA	7	0.01	0.30	0.01	0.01	15969	0.25	10431	21548
Uzbekistan	17	0.01	0.64	0.00	0.01	18036	0.33	9337	31691
Venezuela	4	0.01	0.14	0.01	0.01	38130	1.22	12094	107891

Notes: N denotes the number of observations; Mean, the mean value of the variable; CV, the coefficient of variation defined as the standard deviation/mean; and Min. and Max., the minimum and maximum values of the variable, respectively.

Table A4.3. Descriptive Statistics for Russia

Importing countries	N	Exchange rate				Export unit value			
		MEAN	CV	MIN	MAX	MEAN	CV	MIN	MAX
Afghanistan	4	1.68	0.14	1.51	2.02	6154	0.42	2821	9146
Albania	12	3.69	0.14	2.99	4.92	4568	0.41	2188	8241
Algeria	9	2.56	0.05	2.29	2.71	3270	0.22	2421	4222
Armenia	17	25.88	0.90	11.45	84.85	4261	0.51	650	8272
Austria	12	0.04	0.54	0.02	0.09	3766	0.60	650	7133
Azerbaijan	17	0.05	0.87	0.03	0.17	3925	0.62	650	9790
Bangladesh	7	2.47	0.09	2.18	2.76	4896	0.24	2942	6112
Br. Virgin Isl.	4	0.09	0.78	0.03	0.17	3041	1.25	665	8668
Bulgaria	5	0.10	1.10	0.04	0.29	3523	0.79	589	6779
Cyprus	14	0.03	0.78	0.02	0.09	3981	0.60	631	8985
Denmark	8	0.33	1.01	0.18	1.14	4831	0.71	1151	9759
DR of Congo	5	25.87	0.18	20.20	31.29	5963	0.17	4555	7163
Egypt	12	0.19	0.15	0.14	0.22	4742	0.43	2477	8892
Eritrea	6	0.54	0.12	0.45	0.62	5061	0.26	3407	6288
Estonia	9	1.05	0.78	0.45	2.40	1791	0.52	469	2828
Ethiopia	4	0.44	0.23	0.35	0.58	5344	0.23	4285	7081
Finland	4	0.05	0.61	0.03	0.09	3093	0.54	1640	5455
Georgia	17	0.09	0.66	0.05	0.25	3936	0.57	691	8706
Germany	9	0.03	0.18	0.02	0.04	4582	0.46	1964	7839
Greece	16	0.04	0.79	0.02	0.14	3741	0.58	621	8086
Hungary	5	14.87	0.71	6.93	29.81	3243	1.05	291	8748
India	7	1.63	0.06	1.51	1.75	6178	0.34	3428	8768
Indonesia	8	329.35	0.11	279.46	390.26	5010	0.35	3161	7993
Iran	10	321.82	0.16	220.33	388.58	4630	0.56	2038	9450
Iraq	10	58.26	0.58	21.24	123.65	4636	0.64	753	9326
Israel	17	0.21	0.75	0.12	0.62	3438	0.65	550	7993
Italy	15	0.04	0.84	0.02	0.15	3692	0.66	417	9357
Japan	4	2.78	0.06	2.58	2.95	7161	0.16	6134	8582
Jordan	9	0.03	0.09	0.02	0.03	5541	0.38	2885	8799
Kenya	9	2.66	0.06	2.44	3.02	5630	0.32	3284	8179

Table A4.3. (continued)

Importing countries	N	Exchange rate				Export unit value			
		MEAN	CV	MIN	MAX	MEAN	CV	MIN	MAX
Kyrgyz Rep.	9	1.84	0.32	1.35	3.00	9360	1.10	625	29970
Latvia	10	0.04	0.91	0.02	0.11	4911	0.91	291	14065
Lebanon	15	76.73	0.90	47.50	306.87	3900	0.55	767	8179
Libya	11	0.04	0.09	0.04	0.05	4773	0.46	1944	8520
Lithuania	12	0.23	1.11	0.08	0.78	3936	0.73	764	8844
Malaysia	5	0.12	0.13	0.10	0.13	5514	0.26	3111	6651
Malta	4	0.02	0.51	0.01	0.04	2797	0.72	689	5542
Mauritania	6	9.44	0.07	8.27	10.11	6151	0.38	3140	8706
Moldova	12	0.50	0.34	0.35	0.90	7973	1.07	553	25964
Mongolia	16	50.62	0.51	35.42	136.56	4558	0.45	1064	8599
Morocco	15	0.45	0.84	0.25	1.65	4170	0.63	776	9636
Mozambique	6	0.97	0.09	0.87	1.12	6399	0.24	4459	8489
Netherlands	5	0.03	0.19	0.03	0.04	4119	0.76	1477	8080
Nigeria	6	4.69	0.11	3.80	5.25	4815	0.51	2602	8830
North Korea	7	2.88	0.91	0.07	5.63	6046	0.71	757	12664
Norway	8	0.21	0.10	0.19	0.24	4855	0.44	2363	7746
Oman	8	0.01	0.09	0.01	0.02	6349	0.31	3281	9419
Pakistan	7	3.03	0.60	2.02	7.11	4455	0.54	1221	8186
Peru	6	0.10	0.13	0.08	0.12	6078	0.42	2915	9357
Poland	11	0.23	0.76	0.10	0.57	4029	0.64	743	8198
Rep of Yemen	9	7.12	0.08	6.39	8.04	5505	0.35	3170	8861
Romania	5	0.11	0.06	0.10	0.11	4278	0.33	2659	6498
Rwanda	6	20.04	0.08	17.90	22.00	6274	0.16	5372	7931
Saudi Arabia	7	0.13	0.09	0.12	0.15	4180	0.50	1756	6785
Spain	10	0.03	0.16	0.02	0.04	4169	0.57	1809	8613
South Korea	10	50.18	0.67	35.11	144.40	4217	0.59	650	8117
Sudan	10	0.09	0.13	0.07	0.11	5233	0.40	2790	9264
Sweden	4	0.41	0.65	0.26	0.82	3342	1.00	1145	8314
Switzerland	10	0.09	0.96	0.03	0.25	3728	0.82	691	9636
Syrian AR	11	0.39	0.09	0.35	0.45	4691	0.38	2854	8644
Tajikistan	17	0.11	0.31	0.05	0.16	5323	1.08	968	21843
Tanzania	8	46.84	0.10	39.91	53.51	5698	0.26	3394	7653
Thailand	4	1.04	0.03	1.00	1.08	5915	0.23	4761	7746
Tunisia	14	0.05	0.37	0.04	0.12	4462	0.49	1398	8830
Turkey	17	0.04	0.34	0.02	0.06	3675	0.62	613	8272
Turkmenistan	8	0.08	0.56	0.03	0.14	12071	0.95	592	32531
Uganda	7	72.17	0.11	63.97	85.86	6256	0.20	5139	8179
UAE	8	0.13	0.09	0.12	0.15	5742	0.34	2942	8985
UK	6	0.02	0.10	0.02	0.03	6018	0.98	1600	17362
Uzbekistan	17	0.03	0.58	0.01	0.06	17915	0.48	1510	29487
Vietnam	8	580.52	0.13	487.41	696.03	4304	0.44	2038	8139

Notes: N denotes the number of observations; Mean, the mean value of the variable; CV, the coefficient of variation defined as the standard deviation/mean; and Min. and Max., the minimum and maximum values of the variable, respectively.

Table A4.4. Descriptive Statistics for Ukraine

Importing countries	N	Exchange rate				Export unit value			
		MEAN	CV	MIN	MAX	MEAN	CV	MIN	MAX
Albania	12	19.69	0.34	12.19	33.34	1031	0.65	359	2430
Algeria	13	14.08	0.40	9.15	31.00	812	0.70	218	1976
Armenia	15	97.38	0.56	46.63	226.32	1026	0.70	274	2366
Austria	9	0.14	0.37	0.09	0.23	1099	0.62	335	2159
Azerbaijan	8	0.21	0.58	0.10	0.47	859	0.91	191	2568
Bangladesh	10	12.20	0.25	8.78	19.15	865	0.60	169	1904
Belarus	17	336.56	0.76	7.23	1040.40	938	0.82	86	2518
Belgium	6	0.17	0.30	0.09	0.23	604	0.42	339	1001
Bermuda	4	0.34	0.47	0.19	0.54	295	0.45	171	457
Br. Virgin Isl.	6	0.23	0.38	0.18	0.41	477	0.42	189	788
Bulgaria	4	0.22	0.47	0.10	0.31	1068	0.75	295	2167
Cyprus	10	0.13	0.49	0.07	0.28	641	0.80	169	1930
Djibouti	4	31.61	0.19	22.81	35.19	773	0.36	545	1161
Egypt	13	0.92	0.20	0.71	1.17	997	0.64	355	2201
Eritrea	6	2.71	0.13	2.11	3.05	633	0.13	575	790
Estonia	10	3.90	0.51	1.53	7.46	589	0.97	184	2114
France	8	0.20	0.39	0.09	0.37	686	1.09	198	2510
Georgia	16	0.38	0.41	0.21	0.70	1037	0.77	203	2473
Germany	11	0.17	0.49	0.09	0.37	887	0.69	206	2138
Greece	10	0.15	0.25	0.09	0.21	1020	0.71	451	2382
Hungary	12	46.20	0.34	25.97	87.53	586	0.42	176	1053
India	5	9.64	0.46	5.76	16.84	734	0.66	164	1278
Indonesia	10	1533.52	0.21	1100.77	1893.71	1095	0.61	410	2257
Iraq	5	259.22	0.55	145.12	489.89	834	0.70	203	1667
Ireland	8	0.22	0.50	0.13	0.43	698	0.80	233	1938
Israel	17	0.91	0.47	0.45	1.85	752	0.76	173	1986
Italy	13	0.15	0.31	0.03	0.23	861	0.64	322	1994
Jordan	11	0.12	0.23	0.09	0.17	1093	0.57	388	2257
Kenya	10	12.60	0.16	9.93	14.78	1168	0.56	474	2209
Latvia	6	0.20	0.49	0.09	0.31	428	0.60	216	917
Lebanon	13	331.15	0.57	189.01	826.92	988	0.70	211	2191
Libya	10	0.21	0.22	0.15	0.26	1069	0.67	368	2239
Lithuania	6	1.13	0.74	0.34	2.19	922	0.82	253	2130
Malaysia	9	0.67	0.57	0.38	1.60	1184	0.64	167	2401
Mauritania	11	45.63	0.16	33.68	53.19	883	0.70	410	2130
Moldova	17	2.19	0.20	1.43	2.62	1746	0.91	313	5615
Morocco	13	1.82	0.42	1.02	3.92	882	0.73	191	2313
Myanmar	4	1.01	0.24	0.78	1.22	1299	0.67	589	2433
Netherlands	13	0.17	0.46	0.09	0.37	961	0.68	159	2287
Nigeria	7	22.38	0.12	18.81	25.46	697	0.39	389	1079
North Korea	13	256.42	0.52	140.81	572.12	702	0.81	174	2201

Table A4.4. (continued)

Importing countries	N	Exchange rate				Export unit value			
		MEAN	CV	MIN	MAX	MEAN	CV	MIN	MAX
Peru	4	0.65	0.01	0.64	0.66	622	0.17	501	758
Philippines	9	9.72	0.33	5.68	16.69	613	0.54	191	1222
Poland	9	0.95	0.52	0.37	1.76	810	0.97	194	2590
Portugal	6	0.15	0.34	0.09	0.21	1014	0.73	403	2040
Rep of Yemen	8	33.21	0.18	26.04	39.40	1089	0.56	500	2401
Saudi Arabia	6	0.59	0.22	0.47	0.73	1270	0.47	505	1890
Slovak Rep	5	13.33	0.33	8.46	18.06	350	0.44	203	517
South Africa	6	1.35	0.25	1.03	1.98	964	0.73	480	2289
South Korea	7	9.22	1.19	0.41	26.58	693	0.80	162	1611
Spain	12	0.14	0.29	0.09	0.21	938	0.62	410	2066
Sri Lanka	5	16.81	0.21	13.88	20.58	1348	0.32	948	2088
Sudan	9	0.40	0.20	0.29	0.49	1243	0.57	523	2321
Switzerland	13	0.29	0.61	0.11	0.68	1169	0.98	172	3609
Syrian AR	10	1.93	0.24	1.41	2.72	1101	0.55	355	2010
Tajikistan	5	0.39	0.50	0.16	0.65	712.1	0.71	320	1269
Thailand	4	4.02	0.07	3.83	4.40	1594	0.29	1198	2058
Tunisia	14	0.25	0.29	0.17	0.47	953	0.68	208	2183
Turkey	15	0.19	0.41	0.05	0.28	1053	0.76	166	2521
Uganda	6	312.52	0.13	260.61	362.66	1339	0.40	631	2233
UAE	6	0.62	0.30	0.46	0.89	1208	0.71	343	2465
UK	16	0.13	0.55	0.08	0.35	845	0.69	181	2135
USA	10	0.25	0.49	0.18	0.55	471	0.45	152	955
Uzbekistan	8	0.20	0.39	0.02	0.26	2099	0.78	335	5634
Vietnam	7	2751.77	0.16	2190.29	3375.71	1241	0.51	351	2034

Notes: N denotes the number of observations; Mean, the mean value of the variable; CV, the coefficient of variation defined as the standard deviation/mean; and Min. and Max., the minimum and maximum values of the variable, respectively.

5 ANALYSIS OF OLIGOPOLISTIC BEHAVIOUR OF KAZAKH AND RUSSIAN EXPORTERS IN THE SOUTH CAUCASUS WHEAT MARKET

Abstract. This study explores whether Kazakh and Russian wheat exporters use their privileges of being important players in the South Caucasus countries to exercise market power. We choose a three-stage least squares estimation for systems of simultaneous equations and Zellner's seemingly unrelated regression methods for our residual demand elasticity analysis. The results show that Kazakh exporters are able to exercise market power only in the Georgian wheat market, while Russian exporters are able to do so in both the Armenian and Georgian markets. Neither country is able to exercise market power in the Azerbaijani wheat market. Further, Kazakh and Russian wheat exporters constrain each other's market powers in Azerbaijan and Georgia. Similarly, Ukrainian exporters are able to intervene to Kazakh and Russian exporters' market powers in the Azerbaijani and Georgian wheat markets, but not in Armenian.

5.1 Introduction

At the beginning of the 2000s, KRU became important wheat exporters in the world market, and the shares of the world's traditional wheat exporters were significantly affected (Gafarova et al., 2015). Due to their geographic locations, as well as historical trade relationships, the South Caucasus countries, namely Armenia, Azerbaijan and Georgia, have been key trade partners of KRU. Indeed, KRU possess significant market shares in those countries. Armenia, Azerbaijan and Georgia are middle-income countries, with bread and bakery products being main staple foods that play an important role in providing the population's demand for protein and energy. Annual per capita consumption of wheat in 2013 was 148 kg, 205 kg and 114 kg, respectively, in Armenia, Azerbaijan and Georgia (ARMSTAT, 2015; AZSTAT, 2015 and GEOSTAT, 2015).

Due to limited possibilities for the extension of wheat production, Armenia, Azerbaijan and Georgia are not able to completely meet growing domestic demands for wheat, and therefore import, mainly from Kazakhstan and Russia. From 2010 to 2014, average self-sufficiency rates for wheat were 40%, 55% and 10%, respectively, for Armenia, Azerbaijan and Georgia (ARMSTAT, 2015; AZSTAT, 2015; GEOSTAT, 2015). According to the UN Comtrade database, Kazakh and Russian wheat exporters have higher market shares in Azerbaijan and

Georgia, but Ukrainian wheat exporters possess only small shares, while Russia is the main wheat exporter to Armenia. However, Kazakh and Russian wheat exporters' market shares are frequently disrupted by export restriction policies. Kazakhstan applied export restrictions on wheat from April 2008 till September 2008 (Kim, 2010), Russia implemented a wheat export tax policy from 2007-2008 and a wheat export ban policy from 2010-2011, and Ukraine set export quotas from 2006-2008 and 2010-2011 (Djuric et al., 2015).

Kazakh and Russian wheat export volumes vary across the destination countries. Because of the locational disadvantages, political instability and poor infrastructure, Armenia is able to import wheat almost only from Russia. This makes Russia a leading wheat exporter to this country (AGRICISTRADE, 2015b). Azerbaijan is the largest buyer of wheat in the South Caucasus region, importing twice the amount of Georgia, and almost 6 times more than Armenia. This high rate of purchase is because the Azerbaijani population (9.5 millions) is 3 times more than the Armenian population (3 millions) and 2 times more than the Georgian population (4.5 millions) (ARMSTAT, 2015b; AZSTAT, 2015b; GEOSTAT, 2015b). Georgia enjoys its locational advantages of being closer to Russia and Ukraine, compared to Armenia and Azerbaijan, and mainly imports wheat from Russia.

Obviously, Kazakhstan and Russia are the main wheat exporting countries in the South Caucasus region, so they have the opportunity to affect wheat export prices there. We argue that by using their higher market shares, Kazakh and Russian wheat exporters are able to exercise market power in Armenia, Azerbaijan and Georgia. However, it is expected that this effect will be the strongest in Armenia, since Russia is a leading exporter to this country. Due to the diversified wheat import policy of Georgia it is anticipated that Kazakh and Russian market powers in this country will not be very strong. The objective of this study is to investigate the extent of market power exercised by Kazakh and Russian wheat exporters in the South Caucasus region. Towards this aim, we apply the residual demand elasticity (RDE) approach to examine whether the Armenian, Azerbaijani and Georgian wheat import markets are competitive. To the best of our knowledge, there exists no study investigating the magnitude of Kazakh wheat exporters' market powers in any destination country. Hence, the main contribution of this article is its investigation of Kazakh and Russian wheat exporters' behaviour in their three important destinations by using quarterly time series data for the last 11 years.

The rest of the study is organized as follows. The next section offers an overview of the relevant theoretical and empirical literature. The modelling approach is outlined in Section

5.3. Section 5.4 presents the description of the data and the summary statistics. The regression results are discussed in Section 5.5. The final section of the study summarizes the findings, addresses policy implications and discusses directions for future research.

5.2 Review of Empirical Studies

According to Goldberg and Knetter (1997), some studies focus on the market structure and competition on international markets using econometric approaches that not only analyse the existence of market power and price discrimination, but also quantify its economic significance and explain its sources. It is argued that the RDE approach has some advantages over other trade models, like pricing-to-market (PTM) and exchange rate pass-through (ERPT) since it does not require detailed data on all price elasticities of demand, marginal costs and conduct parameters (Goldberg and Knetter, 1999). The RDE approach not only allows one to identify the extent of market power, but also explains it by the combinations of demand conditions, market conduct and market structure. Instead of dealing with a structural demand system involving all firms in an industry, the RDE approach focuses only on the estimation of a single equation (Poosiripinyo and Reed, 2005). Originally, the RDE approach was introduced by Baker and Bresnahan (1988) and later developed by Goldberg and Knetter (1999). This approach represents the effects of export quantity, cost shifters and demand shifters on export price by taking into account the reactions of competing countries (Glauben and Loy, 2003).

Despite its advantages, few studies have applied the RDE approach to determine the market power of the exporting country in destination countries' agricultural products markets (see Table A5.1. in the Appendix). Rather, most studies analysed a particular market power, especially in beer (Baker and Bresnahan, 1988; Glauben and Loy, 2003; Goldberg and Knetter, 1999) and meat export markets (Felt et al., 2011; Poosiripinyo and Reed, 2005; Reed and Saghaian, 2004; Xie and Zhang, 2014). The literature pertaining to market power analysis in grain markets remains quite limited. Very few studies have focused on an investigation of wheat markets in different destinations (Carter et al., 1999; Cho et al., 2002; Pall et al., 2014; Yang and Lee, 2001). However, except Pall et al. (2014), the majority of these publications have concentrated on an analysis of market power of traditional wheat exporting countries (Argentina, Australia, Canada, the European Union and the USA). For instance, Carter et al. (1999) for 1970-1991, and Yang and Lee (2001) for 1993-1999 analysed if Australia, Canada and the USA have market powers in the Japanese and South Korean wheat markets,

respectively. These authors found that the USA has significant market power in both wheat markets, whereas Australia and Canada have market power only in the South Korean wheat market. Cho et al. (2002) also examined the market power of the USA in the Japanese wheat market, together with five other destinations from 1973-1994. These authors' results argue that the USA can exercise significant market power in the Korean, Malaysian, Philippine and Singapore wheat markets, but not in the Indonesian and Japanese markets. Pall et al. (2014) dealt with the analysis of market power exercised by Russian wheat exporters in selected destinations by using generalized method of moments and instrumental variable Poisson pseudo maximum-likelihood estimators. They used quarterly data from 2002 to 2009 and argued that Russian exporters are able to exercise market power in 5 of 8 destinations, including Azerbaijan and Georgia. Although some studies use multiple-equation (systems of simultaneous equation) methods to analyse the RDE approach (Baker and Bresnahan, 1988; Chang and Inoue, 2013; Cho et al., 2002; Goldberg and Knetter, 1999; Reed and Saghaian, 2004; Song et al., 2009), the majority of them prefer single-equation model (see Table A5.1. in the Appendix).

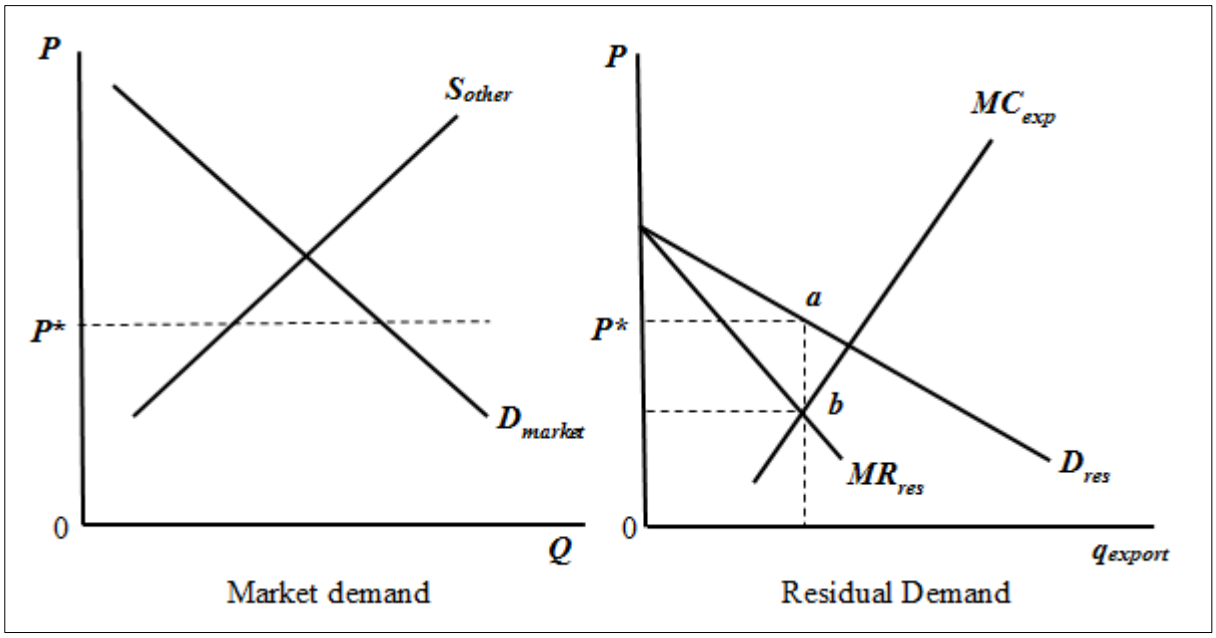
5.3 Modelling Approach

5.3.1 Graphical Analysis

The demand that an exporting country faces in an importing country is the difference between market demand and other competing countries' supply; this is called residual demand. Figure 5.1 describes a residual demand curve for a special case in which an exporting country has a monopolistic position in an importing country while it faces competition from other exporters.

The left side of the graph shows an intersection of market demand curve D_{market} and supply curve of all other competing countries except the exporting country considered S_{other}. The right side graph depicts an intersection of residual demand curve $D_{res.}$ and the considered exporting country's supply curve MC_{exp}. As the exporting country meets residual demand alone, it has a monopolistic power. However, the degree of market power depends on the slope of residual demand curve. If residual demand curve is flat, an exporting country is a price-taker, cannot exercise monopolistic power and faces the price identified by the left side graph. However, if the residual demand curve is steep, an exporting country is a price-maker; in this case it is able to exercise monopolistic market power and makes a profit by equalizing the marginal cost to marginal revenue.

Figure 5.1. The concept of market demand and residual demand.



Source: Goldberg and Knetter (1999).

As the residual demand is the difference between the market demand and the competitors' supply, the demand shifters in the importing countries and the supply shifters in the competing countries are the crucial aspects of identifying the price (Goldberg and Knetter, 1999).

5.3.2 Residual demand elasticity approach

It is often assumed that higher market share is a sign of higher market power, ceteris paribus. However, in some cases this relationship does not hold. For example, in the case of elastic demand, the exporter cannot possess any market power, even if it has a higher market share. On the contrary, in the case of differentiated products, an exporter might achieve higher market power and set higher mark-up over prices, even if it has a small market share (Goldberg and Knetter, 1999).

Consequently, to measure market power indirectly, the relationship between market power and exporting country's inverse RDE should be detected (Baker and Bresnahan, 1988). RDE, which is a measure of market power, represents the relationship between export price and quantity by taking into account the supplies of competitors. In the case of a perfectly competitive market, residual demand is elastic and mark-up is zero. This means that an exporting country does not have any market power, changes in export quantity do not alter

export price, and residual inverse demand function will be horizontal. Export price might be changed only because of variations in competing countries' costs. In the case of an imperfect market, an exporting country has market power and there is a negative relationship between export price and quantity. Degree of market power increases as the slope of residual demand becomes steeper.

In order to build the relationship between export price and quantity, we assume an exporter i sells its product to an importing country and inverse residual demand depends on its own export quantity, Q_i, other competitors' export quantities, Q_j $(i \neq j)$, and demand shifters in an importing country, Z:

$$P = P(Q_i, Q_j, Z) \tag{5.1}$$

The profit maximization problem of an exporter i will be as follows:

$$\max_{Q_i} \pi_i = Q_i P_i\big(Q_i, Q_j, Z\big) - e_i C_i(Q_i, W_i) \tag{5.2}$$

where, e_i is the exchange rate between importing and exporting countries' currency, and C_i denotes an exporting country's cost function, which depends on export quantity and cost shifters, W_i. From the first-order condition for profit maximization, marginal revenue should equal marginal cost:

$$P_i + Q_i\left[\frac{\partial P_i}{\partial Q_i} + \left(\frac{\partial P_i}{\partial Q_j}\right)\left(\frac{\partial Q_j}{\partial Q_i}\right)\right] - e_i MC_i = 0 \tag{5.3}$$

In the case of a perfect competitive market, terms inside the brackets are zero, and an export price equals marginal cost. If the terms are not zero, it is possible to measure the degree of market power through an inverse demand relationship and first-order conditions (Baker and Bresnahan, 1988).

Goldberg and Knetter (1999) introduce a reduced form of the above equation, which allows one to evaluate the degree of market power without having detailed cost shifters of competing countries:

$$\ln P_{mt}^{ex} = \lambda_m + \eta_m \ln \hat{Q}_{mt}^{ex} + \alpha'_{\mathrm{m}} \ln \mathrm{Z_{mt}} + \beta' \ln \mathrm{W}_{\mathrm{mt}}^{\mathrm{N}} + \varepsilon_{t}^{m} \tag{5.4}$$

where, m and t denote importing market and time, respectively, N is a number of competitors in a specific market, $\alpha'$and β' are vectors of parameters, and $\hat{Q}_{mt}^{ex}$ is the instrumented quantity

exported. Further, export prices, P_{mt}^{ex}, and vector of demand shifters of m number of destinations, Z_{mt}, are expressed in the destination country's currency. The real gross domestic product (GDP) of an importing country and time trend are demand shifters and expressed in the importing country's currency. The cost shifters of N competitors, W_{mt}^{N}, can be divided into two parts: first, a part that does not vary by destination and is expressed in the competing country's currency (producer price), and second, a part that is destination-specific (exchange rate). Cost shifters comprise a destination-specific exchange rate and average producer price of wheat of the competitors; both are expressed in the competing country's currency. As the above equation is expressed in double-log form, coefficients are explained as elasticities and ε_{mt}, an error term, is independent and identically distributed (i.i.d.).

The main coefficient in equation (4.4) is η that is inverse of RDE. If $\eta = 0$, it means a market is perfectly competitive and the exporting country faces a perfectly elastic demand curve. In this situation, export price is not affected by a change in quantity exported, but by the costs of competitors. This means that an exporting country does not have any market power and is a price taker. However, if $\eta < 0$, it means that the market is imperfectly competitive and the exporting country is a price maker. In this situation, the exporting country has market power and it increases as the absolute value of η gets larger.

Coefficients of cost shifters, β', define whether competing countries' products are a perfect or imperfect substitute to an exporting country's product. If $\beta' > 0$, a product from a competing country is a perfect substitute to a product of the exporting country. This means the exporting country can raise its export price in the case of an increase in the competing country's costs. In this way, these two countries compete in the importing country and intervene with each other's market powers. On the contrary, if $\beta' < 0$, a product of the competing country is an imperfect substitute to a product of the exporting country.

5.4 Data sources and descriptive statistics

This study covers five country combinations: Kazakhstan-Azerbaijan, Kazakhstan-Georgia, Russia-Armenia, Russia-Azerbaijan and Russian-Georgia. Quarterly time series data for export quantity and value are collected from the Global Trade Information Services (GTIS) database from the first quarter of 2004 to the fourth quarter of 2014. The HS-6 digit codes of the product are 100190 and 100199. Unit-value data are calculated by dividing export value

by export quantity, expressed in the importing country's currency, and used as a proxy for export price.

Consumer price index (CPI) data are collected from the National Statistical Service of the Republic of Armenia (ARMSTAT), the Central Bank of the Republic of Azerbaijan (CBAR) and the National Statistics Office of Georgia (GEOSTAT). Nominal GDP are from ARMSTAT, CBAR and the National Bank of Georgia (NBG) and have been deflated by the overall CPI across the estimated period, taking the first quarter of 2004 as a base period. Quarterly GDP data for Azerbaijan have been interpolated from monthly data. Nominal exchange rate data are taken from ARMSTAT, CBAR, and NBG. Producer price data for Kazakhstan, Russia and Ukraine are collected from the Agency of the Republic of Kazakhstan on Statistics (KAZSTAT), the Russian Federal State Statistics Service (ROSSTAT) and the Food Price Monitoring and Analysis (FPMA) Tool published by the Food and Agriculture Organization of the United Nations, respectively. Summary statistics for Armenia, Azerbaijan and Georgia are presented, respectively, in Tables A5.2. – A5.4. in the Appendix.

5.5 Results and discussion

The majority of the studies that examine market power use a single-equation method to analyse the RDE approach (see Table A5.1. in the Appendix). However, the results of single-equation models are not always precise and efficient. This study uses a system of simultaneous equations method and jointly estimates individual equations in order to increase efficiency and achieve more precise results. Further, the wheat market is interdependent, and making decisions over the export price to one country depends on the decisions made for the other countries.

The three-stage least squares (3SLS) estimation for systems of simultaneous equations method and Zellner's seemingly unrelated regression (SUR) methods have been investigated in this study. The 3SLS method has an advantage over the SUR method since the former corrects for simultaneity bias. The results of the 3SLS and SUR methods are listed below in Tables 5.2 and 5.3, respectively, for Russia and Kazakhstan. All exogenous variables, together with the CPI and total population of an importing country, and total export quantity of an exporting country are treated as instruments. Our primary interest is estimating the coefficients of the export quantity variable (EQ) that corresponds to RDE. If it is negative and significant, then the destination market is imperfectly competitive. The absolute value of RDE

represents the mark-up over marginal cost; the larger its absolute value, the larger the mark-up over marginal cost, and the more market power an exporter has over export price. In this situation an exporting country exercises market power in a destination country. As expected, all export quantity coefficients are negative, meaning that Russian and Kazakh wheat exporters face negatively-sloped demand curves in the South Caucasus region (see Tables 5.2 - 5.3). Besides RDE, the other important factors are the estimates of cost shifters (destination-specific exchange rate and producer price of competing countries) and demand shifters (GDP and time trend of destination countries).

5.5.1 Russian wheat exports

Table 5.1 reports the 3SLS and SUR results for Russian wheat exports that are jointly estimated for all three destinations in the South Caucasus region: Armenia, Azerbaijan and Georgia. Both 3SLS and SUR results demonstrate that Russia achieves its highest market power in the Armenian wheat market. The highly statistically significant results for Armenia provide a clear picture of a market situation in a country where Russian exporters have substantial market powers. Russian exporters achieve higher mark-ups over marginal cost, which is approximated with the RDE, compared to other destination countries in the South Caucasus region. Russian wheat exporters are able to obtain more than 15% (more than 11% with the SUR model) profit over margin in the Armenian market.

This might be explained by several facts: first, Armenia has an unfavourable location in terms of wheat transportation compared to Azerbaijan and Georgia. Second, due to the ongoing political conflict between Armenia and Azerbaijan, the country has closed borders with Azerbaijan and Turkey. Therefore, Armenia is a landlocked country and is able to import wheat only from Russia through the Black Sea and the Georgian area. Third, Armenia still possesses weak infrastructure in terms of wheat transportation, and mainly uses Russian rail wagons, which gives Russia a privilege and allows it to obtain the largest share of the Armenian wheat market and thus exercise market power (AGRICISTRADE, 2015b, p. 25). Fourth, according to APK Inform database the average number of Russian companies, that exporting wheat to Armenia, was only 19 from 2006-2014, whereas 40 and 39 Russian companies exported wheat to Azerbaijan and Georgia, respectively, during the same period. Furthermore, the concentration ratio of top 5 (top 10) Russian wheat companies exporting wheat to Armenia was 77% (91%) from 2006-2014. The concentration ratios of top 5 (top 10) Russian companies exporting wheat to the Azerbaijani and Georgian markets were 65%

(81%) and 65% (79%), respectively. The Herfindahl-Hirschman Indexes (HHIs) are 0.211, 0.154 and 0.146, respectively, for Armenia, Azerbaijan and Georgia from 2006-2014. The HHI indicate a moderate concentration of Russian companies in the Armenian wheat market. This fact might create a non-competitive environment on the Armenian wheat market compared to the other two South Caucasus countries.

Table 5.1. The RDE approach results for Russia

Variables	3SLS			SUR		
	Armenia	**Azerbaijan**	**Georgia**	**Armenia**	**Azerbaijan**	**Georgia**
EQ	-0.1510***	-0.0045	-0.0267*	-0.1056***	-0.0054	-0.0218*
	[-5.362]	[-0.351]	[-1.923]	[-4.553]	[-0.451]	[-1.692]
ER KZT	-0.8345	0.7676*	0.0357*	-0.6045	0.7765*	0.0323
	[-1.372]	[1.927]	[1.760]	[-1.015]	[1.952]	[1.572]
ER RUB	0.7553	0.3308	0.3586	0.8575	0.3236	0.3634
	[1.265]	[1.023]	[1.531]	[1.478]	[1.003]	[1.546]
ER UAH	0.0128	0.0826	0.1766	-0.0294	0.0827	0.1988
	[0.029]	[0.363]	[1.127]	[-0.070]	[0.363]	[1.274]
PP KAZ	0.0647	0.0785	-0.0263	0.0993	0.0801	-0.0225
	[0.328]	[0.842]	[-0.357]	[0.518]	[0.863]	[-0.306]
PP RUS	0.5203**	0.4978***	0.5089***	0.5971**	0.4984***	0.5090***
	[1.980]	[3.847]	[5.026]	[2.342]	[3.854]	[5.033]
PP UKR	0.2983	0.2936***	0.3322***	0.2387	0.2909***	0.3393***
	[1.482]	[2.917]	[4.233]	[1.225]	[2.928]	[4.363]
GDP	0.4328***	0.0467	0.3101***	0.3409***	0.0466	0.3062***
	[4.334]	[0.807]	[3.426]	[3.590]	[0.805]	[3.387]
TIME	-0.0140*	0.0033	-0.0080*	-0.0129*	0.0034	-0.0080*
	[-1.835]	[0.539]	[-1.683]	[-1.743]	[0.548]	[-1.675]
Constant	-5.0993	2.2424	-5.5803***	-4.4884	2.2707	-5.6060***
	[-1.549]	[0.780]	[-2.673]	[-1.387]	[0.788]	[-2.677]
Observations	39	39	39	39	39	39
R-squared	0.7181	0.9280	0.9592	0.7572	0.9280	0.9593
DW statistics	2.1284	1.7237	1.4569	2.1934	1.7298	1.4567
Hausman statistic	15.33	0.78	32.03	-	-	-
(p-value)	0.0823	0.9993	0.0002	-	-	-

Notes: EQ, export quantity in tons; ER, destination-specific exchange rate; KZT, RUB and UAH, the currency codes for Kazakhstani Tenge, Russian Ruble and Ukrainian Hryvnia, respectively; PP, producer price of wheat; GDP, gross domestic product; TIME, time trend. All exogenous variables, together with consumer price index and total population of an importing country, and total export quantity of an exporting country are treated as instruments. All variables except the categorical variables are expressed as natural logs. Values in parentheses are t-statistics. Asterisks ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

The results of 3SLS and SUR methods demonstrate that Russian wheat exporters do not have significant market power in the Azerbaijani wheat market; the RDE coefficient is very small and not significant. That might be explained by several facts; first, self-sufficiency rates for wheat is higher in Azerbaijan (55%) in comparison to Armenia (40%) and Georgia (10%) (ARMSTAT, 2015; AZSTAT, 2015; GEOSTAT, 2015). Second, since 2007 wheat producers in Azerbaijan receive 80 Azerbaijani Manat (around 47 EUR) of direct subsidy per planted hectare, while 50% of their seed costs and 70% of their fertiliser costs are covered by the government (AGRICISTRADE, 2015a, p. 69-70). This stimulates the local wheat producers to expand wheat production. Third, according to APK Inform database, the average number of Russian companies exporting wheat to Azerbaijan was around 40 from 2006-2014 compared to Armenia, which had only 19 such companies. Moreover, the concentration ratio of top 5 (top 10) Russian wheat companies exporting wheat to Azerbaijan was 65% (81%) compared to Armenia, which was 77% (91%) from 2006-2014. The HHI demonstrate that Russian firms are less concentrated in the Azerbaijani wheat market (0.154) than in the Armenian market (0.211). This fact might bring a competitive environment to the Azerbaijani wheat market compared to Armenia.

The 3SLS results suggest that Russian exporters are able to obtain almost 3% (SUR results demonstrate more than 2%) profit over margin in the Georgian wheat market. This result might be explained by the following facts: first, Russia has the highest market share in the Georgian market compared to any other wheat exporter (see Figure 5.1 above). Second, Russia has a land border with Georgia and enjoys locational advantages compared to Kazakhstan; this makes the export process much faster and less costly. Third, even though Russia has implemented export restrictions on wheat several times and because of that is not a reliable wheat exporter for Georgia, Georgia still continues to import wheat from Russia because of their historical relationships. More precisely, speaking Russian language in trade negotiations and long term political ties between two countries makes Russia important trade partner. Fourth, according to APK Inform database, the average number of Russian companies exporting wheat to Georgia (39) was twice as much as the number of Russian companies exporting wheat to Armenia (19) over the period 2006-2014. Moreover, the concentration ratio of top 5 (top 10) Russian wheat companies exporting wheat to Georgia is 65% (79%) compared to Armenia, which was 77% (91%) over the period 2006-2014. The HHI show that Russian firms are less concentrated in the Georgian wheat market (0.146) than

in the Armenian market (0.211). This fact might soften the competitive environment in the Georgian wheat market compared to the Armenian wheat market.

The coefficients of cost shifters determine the factors that constrain the exporting country's market power in the destination market. Destination-specific exchange rates and average producer prices of wheat from competing countries are considered as cost shifters in this study. Table 5.1 shows that neither Kazakh and Ukrainian destination-specific exchange-rates, nor the producer prices of wheat are statistically significant in the Armenian market. This means that the pricing behaviour of Russian exporters does not appear to be restricted in the Armenian wheat market by their two main competitors, Kazakhstan and Ukraine. However, in the Azerbaijani and Georgian wheat markets, Kazakh destination-specific exchange rates and Ukrainian producer prices of wheat are positively significant. This means that Russian exporters' market powers are constrained by Kazakh and Ukrainian wheat exporters in the Azerbaijani and Georgian wheat markets. More specifically, Russian exporters' market powers are constrained more effectively by Kazakh exporters in Azerbaijan, while they are constrained by Ukrainian exporters in Georgia. In the latter case, this might be explained by the geographic locations of exporting country with respect to importing country since Ukraine is relatively closer to Georgia than Kazakhstan and has water borders with Georgia.

The sign of the coefficients of cost shifters define whether competing countries' products are a perfect or imperfect substitute to an exporting country's product. Therefore, it might be concluded that both Kazakh and Ukrainian wheats are perfect substitutes to Russian wheat in the Azerbaijani and Georgian markets. However, this result should be considered with caution since the quality of Russian wheat is considered lower than Kazakh wheat, but higher than Ukrainian wheat (Gafarova et al., 2015).

The real GDP of importing countries and time trend are demand shifters in this analysis. The results show that an increase in Armenian and Georgian GDPs stimulates demand for Russian wheat and consequently causes an upsurge in wheat prices exported from Russia to Armenia and Georgia. However, an increase in Azerbaijani GDP does not stimulate Russian wheat exports to this country. The other demand shifter, time trend, is statistically negative in Armenia and Georgia. This suggests that as time passes there is a tiny decrease in demand for Russian wheat by the Armenian and Georgian populations, which shifts Russian wheat export prices down. Although the time trend is positive, it is not significant in Azerbaijan.

Comparisons between the 3SLS and SUR results based on a Hausman test are quite informative regarding the presence and magnitude of simultaneity bias, and examine the

validity of the used instruments. The Hausman statistic reported in Table 5.1 suggests that the null hypotheses of exogeneity for the quantity variable can be rejected at the 10% significance level, but not at the 5% significance level for Armenia. Thus, the results achieved by 3SLS are more appropriate than those obtained by SUR. However, the magnitude of simultaneity bias looks quite higher since RDE increases from 0.1056 in SUR to 0.1510 in 3SLS. The Hausman statistic does not reject the hypothesis of exogeneity of the quantity variable for Azerbaijan. However it does reject it for Georgia at the 1% significance level. The magnitude of the simultaneity bias seems to be smaller since RDE increases only from 0.0218 in SUR to 0.0267 in 3SLS.

The 3SLS results show that the *R*-squared values are quite high for Azerbaijan and Georgia compared to Armenia. None of the three equations obtained by 3SLS and SUR estimators has a significant serial correlation, according to the Durbin–Watson tests. More precisely, the Durbin–Watson statistics from 3SLS estimation range from 1.4569 for Georgia, 1.7237 for Azerbaijan, and 2.1284 for Armenia (from SUR estimation range from 1.4567 for Georgia, 1.7298 for Azerbaijan, and 2.1934 for Armenia).

5.5.2 Kazakh wheat exports

Table 5.2 reports the 3SLS and SUR results for Kazakh wheat exports that are jointly estimated for two destinations in the South Caucasus region: Azerbaijan and Georgia. Both 3SLS and SUR results demonstrate that Kazakhstan does not have any market power in the Azerbaijani wheat market and it is price-taker. This might be explained by several facts that have already been discussed in sub-section 5.5.1., first, relatively higher self-sufficiency rates for wheat in Azerbaijan (55%) compared to Armenia (40%) and Georgia (10%) plays an important role in building a competitive environment in the Azerbaijani wheat market (ARMSTAT, 2015; AZSTAT, 2015; GEOSTAT, 2015). Second, Azerbaijani wheat producers obtain support from the government through direct subsidy since 2007 (AGRICISTRADE, 2015a, p. 69-70). This increases the number of local wheat producers and contributes to wheat production in Azerbaijan.

Contrary to the results for Azerbaijan, the 3SLS results do not coincide with the SUR results in the case of Georgia. Rather, the 3SLS results suggest that Kazakh exporters are not able to exercise market power in the Georgian wheat market. Again, this result might be explained by some facts that have been discussed in sub-section 5.5.1.: first, Kazakh market share in

Georgia is not as strong as Russian market share. In other words, Russian wheat exports significantly affect the performance of Kazakh wheat exporters in Georgia since dominance of Russian wheat exporters in the South Caucasus region restricts Kazakh wheat exports to this region (Imamverdiyev et al., 2015). Second, Kazakhstan does not share a border with Georgia and usually Kazakh wheat is exported to Georgia through Azerbaijan, which makes the export process slower and more expensive since due to higher transaction costs, an import from Kazakhstan is more costly and takes longer. According to the SUR results, Kazakh exporters obtain more than 2% profit over margin in the Georgian market. The possible explanation of this finding might be that the quality of Kazakh wheat is much higher than Russian wheat; this might bring a privilege to Kazakh exporters to exercise market power in the Georgian wheat market.

Table 5.2 demonstrates that Russian and Ukrainian producer prices of wheat and Ukrainian destination-specific exchange rates are positively significant. This asserts that the profit margins of Kazakh exporters' market powers are constrained by the supply of Russian and Ukrainian wheat exporters in Azerbaijani and Georgian wheat markets. However, Kazakh exporters' market powers are constrained more effectively by Russian exporters in Azerbaijan, while they are constrained by Ukrainian exporters in Georgia. Again, this finding might be explained by the geographic locations of exporting countries with respect to importing countries.

As the sign of the cost shifters might provide a signal about the product type and whether it is a perfect or imperfect substitute for the competing country's product, it might be concluded that both Russian and Ukrainian wheats are perfect substitutes to Kazakh wheat in the Azerbaijani and Georgian markets. However, this result should be explained with caution, since the quality of Kazakh wheat is considered much higher than the quality of Russian and Ukrainian wheats.

The 3SLS and SUR results argue that an increase in Azerbaijani GDP boosts demand for Kazakh wheat, and because of that causes an upward shift in Kazakh wheat export prices. However, an increase in Georgian GDP does not have significant effects on demand for Kazakh wheat. The second demand shifter, time trend, is statistically negative in the case of Azerbaijan, meaning that as time passes the Azerbaijani population decreases its consumption of Kazakh wheat little by little, which in turn shifts Kazakh wheat export prices downward.

Table 5.2. The RDE approach results for Kazakhstan

Variables	3SLS		SUR	
	Azerbaijan	Georgia	Azerbaijan	Georgia
EQ	-0.0122	-0.0131	-0.0131	-0.0219**
	[-0.706]	[-0.846]	[-1.254]	[-2.224]
ER KZT	1.1549***	0.0918***	1.1317***	0.0813***
	[2.800]	[2.928]	[2.884]	[2.968]
ER RUB	-0.2312	-0.2450	-0.2516	-0.2751
	[-0.632]	[-0.783]	[-0.710]	[-0.898]
ER UAH	0.1288	0.6123**	0.1447	0.6664***
	[0.431]	[2.510]	[0.523]	[2.896]
PP KAZ	0.5623***	0.4394***	0.5595***	0.4127***
	[5.630]	[4.402]	[5.775]	[4.506]
PP RUS	0.5167***	0.2588**	0.5170***	0.2486**
	[3.981]	[2.126]	[4.066]	[2.080]
PP UKR	0.1986*	0.2826***	0.2023**	0.3021***
	[1.732]	[2.816]	[1.972]	[3.156]
GDP	0.1261**	0.0785	0.1308**	0.1254
	[2.085]	[0.601]	[2.294]	[1.113]
TIME	-0.0111*	0.0055	-0.0115**	0.0043
	[-1.871]	[0.953]	[-1.980]	[0.779]
Constant	-3.4184	-3.9729	-3.6678	-4.7385*
	[-1.151]	[-1.422]	[-1.302]	[-1.850]
Observations	42	42	42	42
R-squared	0.9237	0.9291	0.9236	0.9302
DW statistics	1.8879	1.9117	1.8892	1.8610
Hausman statistic	0.35	0.54	-	-
(p-value)	1.0000	1.0000	-	-

Notes: EQ, export quantity in tons; ER, destination-specific exchange rate; KZT, RUB and UAH, the currency codes for Kazakhstani Tenge, Russian Ruble and Ukrainian Hryvnia, respectively; PP, producer price of wheat; GDP, gross domestic product; TIME, time trend. All exogenous variables, together with consumer price index and total population of an importing country, and total export quantity of an exporting country are treated as instruments. All variables except the categorical variables are expressed as natural logs. Values in parentheses are t-statistics. Asterisks ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

The Hausman statistic reported in Table 5.2 implies that the null hypotheses of exogeneity of the quantity variable cannot be rejected for both Azerbaijan and Georgia. This leads us to focus on the results achieved by the SUR.

The 3SLS results show that the R-squared values are quite high, ranging from 0.9237 to 0.9291, respectively, for Azerbaijan and Georgia. The sample results of both 3SLS and SUR show that the Durbin Watson statistics are close to 2, indicating that serial correlation is not a

problem. More precisely, the Durbin–Watson statistics from the 3SLS estimation range from 1.8879 for Azerbaijan to 1.9117 for Georgia (SUR results: 1.8892 and 1.8610, respectively).

Table 5.3. Summary of the results

Kazakh exports of wheat			
	RDE coefficient	Russian share	Ukrainian share
Azerbaijan	-0.0122	48.66%	1.13%
Georgia	-0.0131	68.33%	5.50%
Russian exports of wheat			
	RDE coefficient	Kazakh share	Ukrainian share
Armenia	-0.1510***	0.40%	3.72%
Azerbaijan	-0.0045	49.79%	1.13%
Georgia	-0.0267*	23.43%	5.50%

Source: Own compilation based on Tables 1-2 and the UN Comtrade data.

Table 5.3 summarizes the results achieved from the 3SLS estimation for the systems of simultaneous equations method and compares the market situation in Armenia, Azerbaijan and Georgia. The general conclusion is that there is an inverse relationship between the RDE coefficient and market shares of the competitor countries from 2004 - 2014. As the competitor countries achieve a higher market share, the exporting country maintains only small market power. Russian exporters have the highest market share in the Armenian wheat market, and they achieve the strongest market power. Kazakh and Russian exporters almost share the Azerbaijani wheat market; they are not able to exercise market power. In the Georgian wheat market, Russia has 3 times higher market share compared to Kazakhstan; this leads to significant market powers of Russian exporters in Georgia.

The results achieved in this study are partially consistent with a previous study by Pall et al. (2014). The authors argue that Russian wheat exporters are able to exercise market power in the Azerbaijani and Georgian markets. However, they conclude that Russian market power in the Azerbaijani wheat market (-0.17**) is much stronger than the Georgian wheat market (-0.06***). Pall et al. (2014) use single-equation estimation for their analysis, which creates doubt over the efficiency of the results. Our results contradict the results by Glauben et al. (2014), since they argue that Kazakhstan, Russia and Ukraine are not able to exercise market power and they face perfect competition in the South Caucasus region.

5.6 Conclusions and Policy Implications

The results of the 3SLS and SUR methods confirm that the Armenian and Georgian wheat markets are imperfectly competitive, while the Azerbaijani wheat market is perfectly competitive. More precisely, the 3SLS results show that, Russian exporters are able to exercise market power in the Armenian and Georgian wheat markets, but not in the Azerbaijani wheat market. However Kazakh exporters are not able to exercise market power in either the Azerbaijani or Georgian wheat markets. That is explained by dominance of Russian wheat exporters over Kazakh wheat exporters in the South Caucasus region. The SUR results coincide with 3SLS results in the case of Russian exports to all three South Caucasus countries, and Kazakh exports to Azerbaijan. However, in the case of Kazakh exports to Georgia, the SUR results demonstrate that both Kazakh and Russian exporters equally exercise market power in the Georgian wheat market. The most expected result of both methods was that Russia achieves the highest market power in the Armenian wheat market because of its leading position there.

The results of both methods indicate that both exporting countries significantly interfere with each other's market powers in the Azerbaijani and Georgian wheat markets. In the same way, Ukraine constrains Kazakh and Russian exporters' market powers in the Azerbaijani and Georgian markets. However, neither Kazakh nor Ukrainian exporters are able to restrict Russian exporters' market powers in the Armenian market. Kazakh exporters' market powers are constrained more effectively by Russian exporters in Azerbaijan, while they are constrained by Ukrainian exporters in Georgia. Similarly, Russian exporters' market powers are constrained more effectively by Kazakh exporters in Azerbaijan, while they are constrained by Ukrainian exporters in Georgia. In other words, Ukrainian wheat exporters constrain both Kazakh and Russian exporters' market powers more strongly in Georgia than in Azerbaijan.

An increase in Azerbaijani GDP causes an upward shift in wheat exports from Kazakhstan, while an increase in Armenian and Georgian GDPs stimulates wheat exports from Russia. The highest shift in GDP is observed in Armenia, meaning that the Armenian population increase their demand for cheaper Russian wheat as their incomes increase.

This study clarifies that imperfect competition exists in the Armenian and Georgian wheat markets, but not in the Azerbaijani wheat market. These results are plausible and consistent with market structures of the importing countries (number of firms, market concentration, market shares, government intervention and regulation). Therefore, the policy implication of

this study is to address trade negotiations between the South Caucasus countries and non-KRU wheat exporting countries in order to avoid the growing market powers of Kazakh and Russian exporters in the domestic market through diversification policies. Moreover, in order to improve the competitiveness of the domestic market, domestic wheat production should be stimulated in all South Caucasus countries, especially in Armenia since in terms of food security the self-sufficiency of wheat is very crucial.

Further empirical analysis is required to extend this research in terms of the number of importing countries since Kazakhstan and Russia own strong positions not only in the South Caucasus, but also in other destinations, like Central Asian countries, Egypt, Turkey and etc.

5.7 References

AGRICISTRADE (2015a). Country report: Azerbaijan. http://www.agricistrade.eu/wp-content/uploads/2015/06/Agricistrade_Azerbaijan.pdf (accessed June 8, 2015).

AGRICISTRADE (2015b). Agricultural market integration of the Commonwealth of Independent States. http://www.agricistrade.eu/wp-content/uploads/2015/09/Market_integration_D4.2.pdf (accessed August 5, 2015).

ARMSTAT database (2015). http://www.armstat.am/en/ (accessed February 11, 2015).

AZSTAT database (2015). http://www.stat.gov.az/indexen.php (accessed February 12, 2015).

Baker, J. B., and T. F. Bresnahan (1988). Estimating the Residual Demand Curve Facing a Single Firm. *International Journal of Industrial Organization*, 6(3): 283-300.

Carter, C. A., Maclaren, D., and A. Yilmaz (1999). How Competitive is the World Wheat Market? *Working Paper, No.99-002.* Department of Agricultural and Resource Economics, University of California, Davis.

Chang, T. and M. Inoue (2013). Market Power in the Log and Lumber Import Market in Japan. Margin: *The Journal of Applied Economic Research,* 7(2): 131-146.

Cho, G., Jin, H. J., and W. W. Koo (2002). The Competitive Structure of U.S. Grain Exports in Asian Countries. *Selected Paper for presentation at Annual Conference of the American Agricultural Economics Association (AAEA), Long Beach, California.*

Djuric, I., Götz, L., and T. Glauben (2015). Are Export Restrictions an Effective Instrument to Insulate Domestic Prices Against Skyrocketing World Market Prices? The Wheat Export Ban in Serbia. *Agribusiness,* 31(2): 215-228.

Felt, M-H., Gervais, J-P., and B. Larue (2011). Market Power and Import Bans: The case of Japanese Pork Imports. *Agribusiness,* 27(1): 47-61.

Gafarova, G., Perekhozhuk, O., and T. Glauben (2015). Price discrimination and pricing-to-market behaviour of Black Sea region wheat exporters. *Journal of Agricultural and Applied Economic,* 47(3): 287-316.

GEOSTAT (2015). http://www.geostat.ge/index.php?lang=eng (accessed January 10, 2015).

Glauben, T., Imamverdiyev, N., Perekhozhuk, O., and S. Prehn (2014). Competitive Structure of Kazakhstan, Russia and Ukraine in world wheat market: Gravity model approach. *Selected Paper for presentation at the XIV Congress of the European Association of Agricultural Economists, 26-29 August, 2014, Ljubljana Slovenia.*

Glauben, T., and , J-P. Loy (2003). Pricing-to-Market versus Residual Demand Elasticity Analysis of Imperfect Competition in Food Exports: Evidence from Germany. *Journal of Agricultural and Food Industrial Organization,* 1(1): 1–21.

Goldberg, P. K., and M. M. Knetter (1997). Goods Prices and Exchange Rates: What Have We Learned? *Journal of Economic Literature,* 35(3): 1243-1272.

Goldberg, P. K., and M. M. Knetter (1999). Measuring the intensity of Competition in Export Markets. *Journal of International Economics,* 47(1): 27-60.

Imamverdiyev, N., Anders, S., Glauben, T., Perekhozhuk, O., and S. Prehn (2015). Determinants of Trade Duration of Kazakhstan's Wheat Exports. *Selected Paper for presentation at the 29th International Conference of Agricultural Economists, 9-14 August, 2015, Milan, Italy.*

KAZSTAT database (2015). http://www.stat.gov.kz (accessed January 15, 2015).

Kim, J. (2010). Recent Trends in Export Restrictions. OECD Trade Policy Papers, No. 101, OECD Publishing, Paris. http://dx.doi.org/10.1787/5kmbjx63sl27-en (accessed July 6, 2014).

Pall, Z., Perekhozhuk, O., Glauben, T., Prehn, S., and R. Teuber (2014). Residual demand measures of market power of Russian wheat exporters. *Agricultural Economics*, 45(3): 381-91.

Poosiripinyo, R., and M. Reed (2005). Measuring market power in the Japanese chicken meat market. *Journal of International Agricultural Trade and Development*, 1(2): 135-148.

Reed, R., and S. H. Saghaian (2004). Measuring the Intensity of Competition in the Japanese Beef Market. *Journal of Agricultural and Applied Economics*, 36(1): 113-121.

Song, B., Marchant, M. A., Reed, M. R., and S. Xu (2009). Competitive Analysis and Market Power of China's Soybean Import Market. *International Food and Agribusiness Management Review*, 12(1): 21-42.

Tasdogan, C., Tsakiridou, E., and K. Mattas (2005). Country Market power in EU olive oil trade. *South-Eastern Europe Journal of Economics*, 2: 211-219.

Xie, J. and D. Zhang (2014). Imperfect Competition and Structural Changes in the US Salmon Import Market. *Marine Resource Economics*, 29(4): 375-389.

Yang, S-R., and W-J. Lee (2001). Exporters' Market Power in Agricultural Import Markets in Korea. *Selected Paper for presentation at the Annual Conference of the American Agricultural Economics Association (AAEA), 5-8 August, Chicago, Illinois.*

Appendix

Table A5.1. Overview of empirical studies on the Residual Demand Elasticity model

Authors	Journal[a] (year)	Exporter	Importer	Product	Period	Data[b]	Model[c]	Method[d]	Result[e]
Baker and Bresnahan	IJIO (1988)	Anheuser-Busch	n/a	Beer	1962-1982	A	M	3SLS	-0.31***
		Coors							-0.75***
		Pabst							-0.06
Carter, MacLaren and Yilmaz	WP (1999)	Australia	Japan	Wheat	1970-1991	Q	S	2SLS	-0.08
		Canada							-0.49
		United States							-0.93***
Goldberg and Knetter	JIE (1999)	Germany	Canada	Beer	1975-1993	A	S	IV/ SUR/ 3SLS	-0.17/ -0.06***/ -0.14***
			France				M		-0.39***/ -0.33***/ -0.44***
			United Kingdom				M		-0.22***/ -0.08/ -0.21***
			United States						-0.09***/ -0.06***/ -0.07***
		United States	Australia	Kraft linerboard paper	1973-1987		M	SUR/ 3SLS	-0.23***/ -0.31***
			Canada				M		-0.21***/ -0.25*
			Germany						0.12***/ 0.07**
			Japan						-0.06 / -0.10
			Italy						0.02/ 0.01
			United Kingdom						0.28***/ 0.34***
Yang and Lee	CP for AAEA (2001)	Australia	South Korea	Wheat	1993-1999	Q	S	IDM	-0.14**
		Canada							-0.15***
		United States							-0.38**
		China		Corn	1991-1999				-0.05
		United States							-0.03
Cho, Jin and Koo	CP for AAEA (2002)	United States	Indonesia	Wheat	1973-1994	A	M	SUR	-0.01
			Japan						-0.11
			Korea						-0.61***
			Malaysia						-0.12***
			Philippines						-0.84***
			Singapore						-0.16***

Table A5.1. (continued)

Authors	Journal[a] (year)	Exporter	Importer	Product	Period	Data[b]	Model[c]	Method[d]	Result[e]
Glauben and Loy	JAFIO (2003)	Germany	Canada	Beer	1991-1998	M	S	IV	0.28
			France						-0.71**
			United Kingdom						0.58***
			United States						0.19*
			Belgium	Cocoa					1.41
			France						0.02
			Italy						-1.30*
			United States						15.10*
			France	Chocolate					-0.32
			United Kingdom						2.80*
			United States						-0.08
			France	Sugar confectionary					0.52
			United Kingdom						-0.26
			United States						0.29**
Reed and Saghaian	JAAE (2004)	Australia	Japan	Beef Meat: Chilled Chuck	1992-2000	M	M	ISUR	-0.12
		Canada							-0.01
		New Zealand							-0.17***
		United States							0.01
		Australia		Chilled Loin					-0.12*
		Canada							-0.10***
		New Zealand							-0.20***
		United States							-0.03
		Australia		Chilled Ribs					-0.09*
		Canada							0.02
		New Zealand							-0.16***
		United States							0.04

Table A5.1. (continued)

Authors	Journal[a] (year)	Exporter	Importer	Product	Period	Data[b]	Model[c]	Method[d]	Result[e]
		Australia		Frozen Chuck					-0.12***
		Canada							-0.20
		New Zealand							-0.15***
		United States		Frozen Loin					-0.04
		Australia							-1.10***
		Canada							-0.01
		New Zealand							-0.22
		United States		Frozen Ribs					0.01
		Australia							-0.12**
		Canada							-0.17**
		New Zealand							-0.19***
		United States							-0.32***
Poosiripinyo and Reed	JIATD (2005)	Brazil	Japan	Chicken Meat: Whole Birds	1988-2002	M	S	GLS	-0.25***
		China							-0.11
		Thailand							0.10***
		United States							-0.11
		Brazil		Legs with Bone					-0.10***
		China							-0.05
		Thailand							-0.06
		United States							0.02
		Brazil		Other Cuts					-0.02
		China							-0.02
		Thailand							-0.08
		United States							-0.23***
Tasdogan, Tsakiridou and Mattas	SEEJE (2005)	Greece	European Union	Olive Oil	1970-2001	A	S	2SLS	-0.08**
		Italy							-0.36***
		Spain							-0.16***

Table A5.1. (continued)

Authors	Journal[a] (year)	Exporter	Importer	Product	Period	Data[b]	Model[c]	Method[d]	Result[e]
Song, Marchant, Reed and Xu	IFAMR (2009)	United States	China	Soybean	1999-2005	M	M	FIML	-0.04***
Felt, Gervais and Larue	AB (2011)	Canada	Japan	Pork	1994-2006	M	S	GMM	-0.06*
		Denmark							-0.02*
		United States							-0.17*
Chang and Inoue	JAER (2013)	Canada	Japan	Log	1988-2010	A	M	ISUR	-0.08**
		United States							0.14
		Canada		Lumber					-0.21***
		United States							-0.17***
Pall, Perekhozhuk, Glauben, Prehn and Teuber	AE (2014)	Russia	Albania	Wheat	2002-2009	Q	S	IVPPML	-0.09* / -0.06*
			Azerbaijan				S	/ GMM	-0.17 / -0.17**
			Egypt						-0.01 / -0.02*
			Georgia						-0.07* / -0.06***
			Greece						-0.05** / -0.07***
			Lebanon						-0.06 / -0.07
			Mongolia						-0.25 / -0.07
			Syria						-0.05 / -0.03
Xie and Zhang	MRE (2014)	Canada	United States	Whole Salmon	1995-2012	M	S	GMM	-0.15**
		Chile							0.05
		Canada		Salmon Filet					-0.05
		Chile							-0.21***

[a] AAEA, American Agricultural Economics Association; AB, Agribusiness; AE, Agricultural Economics; CP, Conference Paper; IFAMR, International Food and Agribusiness Management Review; IJIO, International Journal of Industrial Organization; JAAE, Journal of Agricultural and Applied Economics; JAER, The Journal of Applied Economic Research; JAFIO, Journal of Agricultural and Food Industrial Organization; JIATD, Journal of International Agricultural Trade and Development; JIE, Journal of International Economics; MRE, Marine Resource Economics; SEEJE, South-Eastern Europe Journal of Economics; WP, Working Paper.

[b] A, annual; M, monthly; Q, quarterly.

[c] M, multiple-equation model; S, single-equation model.

[d] FIML, Full Information Maximum Likelihood; GLS, Generalized Least Squares; GMM, Generalized method of moments; IDM, Inverse Demand model; ISUR, Iterative Seemingly Unrelated Regression; IV, Instrumental variables; IVPPML, Instrumental variable Poisson pseudo maximum-likelihood estimator; SUR, Seemingly Unrelated Regression; 2SLS, Two-stage least squares; 3SLS, Three-stage least squares.

[e] The results are ordered by product type.

Asterisks ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

Source: Own compilation based on the articles cited.

Table A5.2. Summary statistics for Armenia

Variable	Russia			
	Mean	CV	Min	Max
EUV	83524.78	0.36	47020.55	207594.67
EQ	50931.82	0.94	434.00	172675.00
ER KZT	28.23	0.16	22.38	38.54
ER RUB	13.55	0.17	9.12	19.74
ER UAH	61.22	0.34	29.86	106.04
PP KAZ	21791.92	0.33	11560.00	34043.33
PP RUS	4929.89	0.36	2391.44	9158.49
PP UKR	1276.37	0.46	454.67	2591.67
GDP	909366037495.80	0.41	274650600000.00	1722625583398.84
CPI	107.77	0.06	98.01	118.61
Population	3145929.14	0.03	2999053.00	3281257.00
TEQ	3391677.07	0.70	26846.00	9828209.00

Notes: EUV, export unit value, expressed in Armenian Dram (AMD); EQ, export quantity, expressed in tons; ER KZT, ER RUB and ER UAH, destination-specific exchange rates for Kazakhstan, Russia and Ukraine, respectively; PP KAZ, PP RUS and PP UKR, average producer prices of wheat, respectively in Kazakhstan, Russia and Ukraine; GDP, gross domestic product, expressed in AMD; CPI, consumer price index; Population, number of population in Armenia; TEQ, total export quantity.

Table A5.3. Summary statistics for Azerbaijan

Variable	Kazakhstan				Russia			
	Mean	CV	Min	Max	Mean	CV	Min	Max
EUV	167.10	0.30	85.98	308.35	172.11	0.30	93.41	320.07
EQ	153143.32	0.81	1362.00	417549.00	144175.69	0.94	68.00	501834.00
ER KZT	0.01	0.17	0.00	0.01	0.01	0.17	0.00	0.01
ER RUB	0.03	0.16	0.02	0.04	0.03	0.16	0.02	0.04
ER UAH	0.13	0.33	0.05	0.19	0.13	0.33	0.05	0.19
PP KAZ	21791.92	0.33	11560.00	34043.33	21791.92	0.33	11560.00	34043.33
PP RUS	4929.89	0.36	2391.44	9158.49	4929.89	0.36	2391.44	9158.49
PP UKR	1276.37	0.46	454.67	2591.67	1276.37	0.46	454.67	2591.67
GDP	11409372155.91	0.53	1682300000.00	20651469221.24	11409372155.91	0.53	1682300000.00	20651469221.24
CPI	121.76	0.10	99.27	134.74	121.76	0.10	99.27	134.74
Population	8939552.20	0.04	8349100.00	9564325.00	8939552.20	0.04	8349100.00	9564325.00
TEQ	999900.82	0.62	322817.00	2738949.00	3391677.07	0.70	26846.00	9828209.00

Notes: EUV, export unit value, expressed in Azerbaijani Manat (AZN); EQ, export quantity, expressed in tons; ER KZT, ER RUB and ER UAH, destination-specific exchange rates for Kazakhstan, Russia and Ukraine, respectively; PP KAZ, PP RUS and PP UKR, average producer prices of wheat, respectively in Kazakhstan, Russia and Ukraine; GDP, gross domestic product, expressed in AZN; CPI, consumer price index; Population, number of population in Azerbaijan; TEQ, total export quantity.

Table A5.4. Summary statistics for Georgia

Variable	Kazakhstan				Russia			
	Mean	CV	Min	Max	Mean	CV	Min	Max
EUV	370.07	0.28	218.86	638.36	355.14	0.26	192.41	536.24
EQ	41157.19	1.06	418.00	198423.00	120188.18	0.63	5634.00	310033.00
ER KZT	0.07	0.93	0.01	0.15	0.07	0.93	0.01	0.15
ER RUB	0.06	0.12	0.04	0.07	0.06	0.12	0.04	0.07
ER UAH	0.26	0.28	0.13	0.39	0.26	0.28	0.13	0.39
PP KAZ	21791.92	0.33	11560.00	34043.33	21791.92	0.33	11560.00	34043.33
PP RUS	4929.89	0.36	2391.44	9158.49	4929.89	0.36	2391.44	9158.49
PP UKR	1276.37	0.46	454.67	2591.67	1276.37	0.46	454.67	2591.67
GDP	5640141598.05	0.38	2021475779.40	9775022381.95	5640141598.05	0.38	2021475779.40	9775022381.95
CPI	116.70	0.08	98.77	130.32	116.70	0.08	98.77	130.32
Population	4402931.41	0.02	3968502.00	4542000.00	4402931.41	0.02	3968502.00	4542000.00
TEQ	999900.82	0.62	322817.00	2738949.00	3391677.07	0.70	26846.00	9828209.00

Notes: EUV, export unit value, expressed in Georgian Lari (GEL); EQ, export quantity, expressed in tons; ER KZT, ER RUB and ER UAH, destination-specific exchange rates for Kazakhstan, Russia and Ukraine, respectively; PP KAZ, PP RUS and PP UKR, average producer prices of wheat, respectively in Kazakhstan, Russia and Ukraine; GDP, gross domestic product, expressed in GEL; CPI, consumer price index; Population, number of population in Georgia; TEQ, total export quantity.

6 ESTIMATION OF IMPERFECT COMPETITION: A STRUCTURAL ANALYSIS OF THE AZERBAIJANI AND GEORGIAN WHEAT IMPORT MARKETS

Abstract. This study investigates the degree of market imperfection in the Azerbaijani and Georgian wheat import markets using structural model. The new empirical industrial organization (NEIO) approach has been implemented through the nonlinear three-stage least squares (N3SLS) estimator. This approach simultaneously estimates the demand function and the first-order profit maximization condition to measure the degree of market imperfection. The results demonstrate that both Azerbaijani and Georgian wheat markets are competitive, meaning that neither Kazakh, nor Russian wheat exporters are able to exercise market power in the Azerbaijani and Georgian markets over the period 2004-2015.

6.1 Introduction

If the competitors come to an agreement not to compete against each other and charge predatory pricing to the consumers, it means they abuse the pre-existing market power (Digal and Ahmadi-Esfahani, 2002). In this market situation, large competitors usually use their dominant positions in the market and restrict the entry of small rivals to the market. This leads to an inefficient allocation of resources and harming the consumers choices due to the lower-quality products produced (Muazu et al., 2015).

Kazakh and Russian exporters are the main players in both Azerbaijani and Georgian wheat import markets and have significant market shares in compare to the other wheat exporters to the region (Gafarova et al., 2015). According to the UN Comtrade database, Kazakh and Russian total wheat exports to the Azerbaijani and Georgian wheat markets increased significantly from 700 thousand tons in 2000 to more than 2 million tons in 2014, an increase of more than 200%. According to the FAOSTAT database, the average wheat import dependency ratios are accounted as 36% and 86%, respectively for Azerbaijan and Georgia over the period from 1992 to 2013. Based on this market situation, we argue that as Kazakh and Russian exporters possess high market shares in both Azerbaijani and Georgian wheat import markets, they may exercise market power and behave not competitively in the wheat market of this region.

The objective of this study is to examine the degree of market imperfection in both Azerbaijani and Georgian wheat import markets. Specifically, we focus on an analysis of both

Kazakh and Russian exporters' market powers in the region by using the NEIO approach over the period 2004-2015. This approach investigates the degree of imperfect competition by estimating both the demand function and first-order profit maximization condition simultaneously.

The rest of the study is organized as follows. Section 6.2 describes the summary of the relevant theoretical literature. The theoretical framework is presented in Section 6.3. Section 6.4 outlines the source and description of the data. The estimation results of the NEIO model are shown in Section 6.5. The final section of the study provides the main outcomes and conclusions of the regression analysis, and provides ideas for future research.

6.2 Review of Empirical Studies

A wide range of studies are available on market imperfection analysis investigating different countries, markets and industries, and in terms of different database (firm-level, national, regional and world). Most of these investigations have specifically targeted the retail food industry in the USA (Appelbaum, 1982; Schroeter, 1988; Azzam and Pagoulatos, 1990; Schroeter and Azzam, 1990; Wann and Sexton, 1992; Byuhan and Lopez, 1997; Katchova et al., 2005). Appelbaum (1982) investigates the degree of oligopoly power in the U.S. tobacco industries, and concludes that there is oligopolistic behaviour exercised in this sector. Based on data from the U.S. beef packing industry, Schroeter (1988) conclude that there are significant monopoly price distortions in slaughter cattle and significant monopsony price distortions in wholesale beef markets. Similarly, Azzam and Pagoulatos (1990) test the oligopoly and oligopsony market power in the U.S. meat-packing industry. Using the simultaneous-equation model, they find that the degree of market power is higher in livestock (input) market than the meat (output) market. Schroeter and Azzam (1990) analyse the degree of market power in the U.S. meat (beef and pork) industry and find that about half of the farm-to-retail price margin is pertinent to having market power. Based on the simultaneous analyses market power in both input and output markets at the regional level, Wann and Sexton (1992) argue that the market power is exercised in both farm input market and canned pears and fruit cocktail markets in California. Byuhan and Lopez (1997) investigate 40 U.S. food and tobacco industries, and find the existence significant oligopoly market power in 37 industries. Digal and Ahmadi-Esfahani (2002) critically survey different methods used in examining market power in the retail food industry. To test oligopoly and oligopsony price distortions in the U.S. potato chips and frozen fries sectors, Katchova et al. (2005) employed a

linear-quadratic dynamic model. The results reveal that firms behave more competitively than collusively, and oligopsony price distortions are smaller than oligopoly price distortions in both the potato chips and frozen French fries sectors. Perekhozhuk et al. (2015) examine whether dairy processors are able to exercise oligopsony power in the Ukrainian raw milk market. The estimates of a translog production function for the processing sector at the national and regional level suggest the existence of oligopsony power in 3 of 25 regions in Ukraine. To identify the market power parameter, most recently Muazu et al. (2015) apply Bresnahan (1982) and Lau (1982) oligopoly model and estimate the demand and supply equations. The results indicate that the Malaysian poultry market was imperfectly competitive over the period 1980-2010.

Although there is growing body of scientific literature estimating the NEIO approach in the food and agricultural sector, only few of them are related to the agricultural trade markets (see Table A6.1. in the Appendix). Most of the NEIO studies conduct market power analysis at the national level using market-level data (Perekhozhuk, et al. 2017). A number of empirical studies which apply the static models on the agricultural trade surpass the ones which use the dynamic framework. For instance, to estimate the oligopoly power in the Philippine coconut oil export market, Buschena and Perloff (1991) use a dominant firm and competitive fringe model based on an annual data from 1959 to 1987. They treat the Philippines as a dominant exporter, while Malaysia, Indonesia, Sri Lanka, New Guinea and the Ivory Coast as the fringe exporters. The results of the nonlinear three-stage least squares (N3SLS) estimator reveal that prior to the 1970s the Philippine coconut oil export market was rather competitive. However, the legal and institutional changes in the beginning of the 1970s permitted the Philippines to use its dominant position to exercise market power in the coconut oil export market. Love and Murniningtyas (1992) simultaneously test the presence of market power in the Japanese domestic and foreign wheat markets. They conclude that while Japan has high degree of monopsony power in the world wheat market to restrict the wheat import, it does not implement restrictive policies in its wheat resales in the domestic market. Based on a simple two-equation model, Lopez and You (1993) investigate the determinants of oligopsony power exercised by coffee exporters in Haiti. They conclude that the main determinants of oligopsony power are both institutional arrangements and the domestic market conditions. To examine the degree of market imperfection (non-competitiveness) in the German market for banana imports and the world market for soymeal exports, Deodhar and Sheldon (1995, 1997) apply a structural econometric model. They estimate both the demand function and the

industry first-order profit maximization condition. While it is concluded that firms demonstrate Cournot-Nash behaviour (charging the prices above marginal costs) in the German banana import market, perfect competition is present in the world market for soymeal export. Based on national data from 1961-2007, Nwachukwu et al. (2011) examine the degree of market power in the Nigerian cocoa exports to Netherland and conclude that the Dutch cocoa market is relatively competitive.

There are some studies which argue that the static framework would not be appropriate in a repeated game analysis if the firms interact over some time periods (Deodhar and Sheldon, 1996; Steen and Salvanes, 1999). Based on a linear-quadratic dynamic open-loop and feedback oligopoly models, Karp and Perloff (1989) examine the competitiveness of the rice export market of Thailand, Pakistan and China, treating the other rice exporting countries as fringe. To obtain the index of market power, they applied annual data from 1961 to 1985. The results of the estimations of the linear demand curve equation and adjustment equations indicate that rice export market is oligopolistic, but it is closer to competitive than collusive. Later, by using the similar approach Karp and Perloff (1993) analyse the degree of competitiveness in the coffee export markets of Brazil and Colombia, and again treating the other coffee exporters as fringe. The results confirm that Brazil and Colombia compete with each other in the coffee export market. Another empirical application of game theory to estimate the market power in the international agricultural trade is performed by Deodhar and Sheldon (1996). They apply a linear-quadratic dynamic oligopoly model, and test the degree of market imperfection in the German market for banana import using a dynamic conjectural variations parameter. The results suggest that the German market for banana import is not competitive, and the behaviour of firms is close to Cournot-Nash situation. It is also argued that the degree of market imperfection is stronger in case of estimating a dynamic model than a static framework. To analyse the French market for fresh salmon, Steen and Salvanes (1999) introduce a dynamic reformulation of the Bresnahan-Lau model in an error correction framework. The results reveal that Norway has some market power in the short-run, but in the long-run the French salmon market is rather competitive.

6.3 Theoretical Framework

6.3.1 New Empirical Industrial Organization Approach

In general, the market power studies were classified into two groups: the Structure-Conduct-Performance (SCP) paradigm and the new empirical industrial organization (NEIO) approach (Muazu et al., 2015). The former approach was dominant prior to the 1980s, which stated that the higher concentration in the industry together with the barriers to entry leads to collusion among competitors. Beside the SCP collusion hypothesis, the SCP efficiency hypothesis was also developed. According the latter hypothesis, actually the most efficient competitor usually achieves the higher market share through the greater profitability, and it leads to the increased market concentration. However, both the SCP collusion and the SCP efficiency hypotheses were criticized during and after the 1980s because of unclearly prediction of the relationship between industry structure and conduct, and incorrectly implication of high concentration in an industry (Mei and Sun, 2008; Muazu et al., 2015).

To examine the existence of market power more carefully, the research direction turned to the NEIO approach that was introduced by Bresnahan (1989). The advantage of this approach over the SCP paradigm is that, it uses structural models to estimate industry's degree of market power. The NEIO approach is applied through different models, mainly by directly estimating marginal costs, conjectural variations models/conduct parameter models and comparative statics models (Muazu et al., 2015). The most important component of the NEIO approach is to estimate the conjectural elasticity (market conduct parameter) that measures the overall market reaction to a firm's change in input demand, and output supply (Mei and Sun, 2008; Muazu et al., 2015). It is calculated as the conjectural variation of a firm multiplied by its market share (Azzam and Pagoulatos, 1990). The NEIO approach investigates the presence of market power based on demand and cost functions and hypothesis relating to the firms' strategies (Deodhar and Sheldon, 1997). In other words, the NEIO approach concentrates more on market conduct aspects, such as an individual firm's behaviour and strategic reactions in the industry (Digal and Ahmadi-Esfahani, 2002). The disadvantages of the NEIO models are the following: they are not able to define the sources of market power and have limited practical contributions in competition policy settings (Bresnahan, 1989; Connor, 1998). Moreover, they are usually used to examine a single market and due to the data requirements and sensitivity to specification errors it is difficult to apply them (Hyde and Perloff, 1995).

The aim of using the NEIO approach is to estimate an individual firm's supply relation instead of supply function, since monopoly firm does not have a supply curve (Appelbaum, 1982). Firm's cost function, demand and its pricing behaviour are not known for estimation. Moreover, the firm's product price and quantity are endogenous variables, whereas input prices, demand and supply shifters are exogenous variables (Muazu et al. 2015).

As both quantity and price are endogenous, demand and supply equations should be simultaneously estimated. However, as mentioned by Steen and Salvanes (1999), it would be difficult to define λ, which is measured as the degree of market power, by solving the demand and supply equations in system equations. It is not possible to differentiate perfectly competitive market and monopoly situations from each other unless demand function meets some necessary conditions.

To identify λ, Bresnahan (1982) introduced a new demand-side exogenous variable that included interactively with price. By this way, changes in the exogenous variables in the demand-side not only shift the intercept, but also rotate it. That means the exogenous variable that is able to change the slope of the demand curve may also help to determine the market power parameter (Muazu et al. 2015).

We use a structural econometric model that was introduced by Bresnahan (1982). Specifically, we suppose an importing country's demand function is a relationship between import quantity and import price, as well as vector of exogenous variables (such as price of substitute goods and income).

$$Q_t = Q(P_t, Z_t) \tag{6.1}$$

As Q_t and P_t are defined simultaneously, the inverse demand function will be:

$$P_t = P(Q_t, Z_t) \tag{6.2}$$

The revenue function is defined as $R_t = P_t Q_t$. Then perceived marginal revenue will be:

$$MR_t(\lambda) = P(Q_t, Z_t) + \lambda \frac{dP_t}{dQ_t}(Q_t, Z_t)Q_t \tag{6.3}$$

where λ is a parameter indexing the degree of market power. In case $\lambda = 1$, the market is monopolistic, or the exporters act as a perfect cartel. In case λ lies between 0 and 1, it reveals an intermediate degree of oligopoly market power. The exporters operate competitively and face horizontal demand curve, if $\lambda = 0$, (price equals marginal cost). In the Cournot model,

where $\lambda = \frac{1}{n}$, each exporter equally exports. We assume that, the total cost function is a function of export quantity and the vector of exogenous cost shifters (such as input costs):

$$C_t = C(Q_t, W_t) \tag{6.4}$$

We also predict that the exporting country will exercise market power. Then the perceived marginal revenue should equal marginal cost

$$MR_t(\lambda) = \left[P(Q_t, Z_t) + \lambda \frac{dP_t}{dQ_t}(Q_t, Z_t)Q_t\right] = \frac{dC}{dQ_t}(Q_t, W_t) = MC(Q_t, W_t) \tag{6.5}$$

It is equivalent to

$$P(Q_t, Z_t) = \frac{dC}{dQ_t}(Q_t, W_t) - \lambda \frac{dP_t}{dQ_t}(Q_t, Z_t)Q_t \tag{6.6}$$

The equation (6.6) is called the general supply relation. After estimating equation (6.2) the slope of the demand curve will be $\frac{dP_t}{dQ_t}(Q_t, Z_t)$. Based on the estimates of the demand equation (6.2) and optimality equation (6.6), it is possible to achieve the estimates of λ and MC, where marginal cost is considered constant with respect to output. Once the equation (6.6) is estimated, the estimator will be the product of λ and the slope of the demand curve. The parameter of market power can be obtained through dividing this estimator by the slope of the demand curve.

Bresnahan (1989) and Perloff (1992) describe two interpretations of the parameter of market power λ. First, general interpretation of λ is that it is a difference between price and marginal cost $P(Q_t, Z_t) - \frac{dC}{dQ_t}(Q_t, W_t) = -\lambda \frac{dP}{dQ_t}(Q_t, Z_t)Q_t$. According to Lerner's (1934) index of monopoly power the results might be demonstrated this way:

$$L = \frac{P - MC}{P} = -\frac{\lambda \frac{dP}{dQ_t}(Q_t, Z_t)Q_t}{P} = \frac{\lambda}{\varepsilon} \tag{6.7}$$

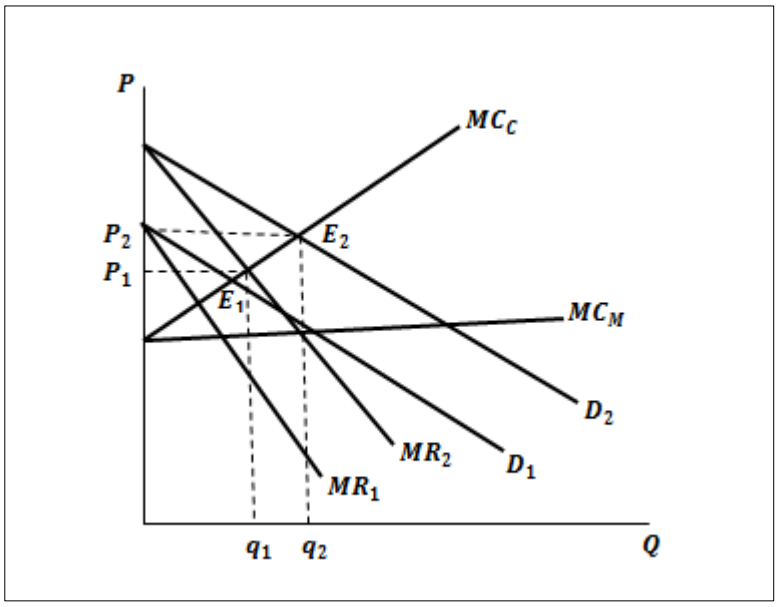
where ε is the market demand elasticity, and λ can be explained as an index of market power.

Second, λ might also be interpreted as a conjectural variation, It means that an exporter does not only consider how its own export affects export price directly, but also concerns how changes in its own export will affect the export price through its effects on other exporters' export decisions.

6.3.2 Graphical Analysis

According to the theory, the coefficient of market power can be obtained from the supply relation, but it is not clearly identified in the practice. As already mentioned above, the estimation of the equation (6.6) will be the product of the parameter of market power and the slope of the demand curve, which we can call this composition as μ. If the marginal cost is constant with respect to output, λ might be separated from μ. However, in case of non-constant marginal cost λ might not be separated (Perloff, 1992; Deodhar and Sheldon, 1995). As the level of output changes marginal cost usually is not constant, and in that case the parameter of market power would not be defined. Graphically this might be illustrated as in Figure 6.1.

Figure 6.1. Identification of Monopoly Power: not identified



Source: Bresnahan (1982)

We suppose that demand (D_1 and D_2) and marginal revenue curves MR_1 and MR_2 are linear. MC_C and MC_M represent the marginal cost curves for perfect competition and monopoly cases, respectively. The first equilibrium point is E_1. This point might be an equilibrium either for competitive market (where $P = MC_C$), or monopoly or oligopoly market (where $MR_1 = MC_M$). An exogenous change in demand curve will shift the equilibrium from E_1 to E_2. Similarly, E_2 might also be the equilibrium either for perfect competitive market, or monopoly or oligopoly market. However, as long as marginal costs are unknown, competition case cannot be differentiated from the non-competitive case (monopoly or oligopoly) Susanto (2006).

Susanto (2006) suggests very clear explanation of this problem mathematically. He follows the Bresnahan (1982) and Lau (1982) and takes the linear demand and marginal cost functions (equation (6.8) and equation (6.9), respectively), where Y and W are vector of exogenous variables in the demand and marginal cost functions, respectively.

$$Q = \alpha_0 + \alpha_1 P + \alpha_2 Y + \varepsilon \tag{6.8}$$

$$MC = \beta_0 + \beta_1 Q + \beta_2 W \tag{6.9}$$

Since the NEIO model assumes the marginal cost is not observable, Susanto (2006) derives the supply relation through finding the marginal revenue from the equation (6.8), $MR = P + Q/\alpha_1$. He uses $MR = MC$ equilibrium and inserts λ, and finds the following supply relation:

$$P = \frac{-\lambda}{\alpha_1} Q + \beta_0 + \beta_1 Q + \beta_2 W + \eta \tag{6.10}$$

After substituting $\gamma = \beta_1 - \frac{\lambda}{\alpha_1}$, equation (6.10) might be written as follows:

$$P = \beta_0 + \gamma Q + \beta_2 W + \eta \tag{6.11}$$

However, it is still unclear whether it is competitive ($P = MC$) or non-competitive ($MR = MC$) case. In order to find λ, the estimates of β_1, α_1 and γ should be identified. However, λ cannot be identified, since the demand (equation (6.8)) and supply relation (equation (6.11)) can provide only the estimates of α_1 and γ.

By following up Bresnahan (1982) idea about this problem, Susanto (2006) suggests to add the interaction term (between price and demand shifter) in order to consider both the rotation (the nature of the competition) and vertical shifts (equivalent supply relation) in the demand curve. Therefore, the included exogenous variables should be able not only shift the intercept but also change the slope.

After adding the interaction, the demand equation and supply relation will be follows:

$$Q = \alpha_0 + \alpha_1 P + \alpha_2 Y + \alpha_3 PZ + \alpha_4 Z + \varepsilon \tag{6.12}$$

where, Z is new demand-side exogenous variables (price of a substitute good).

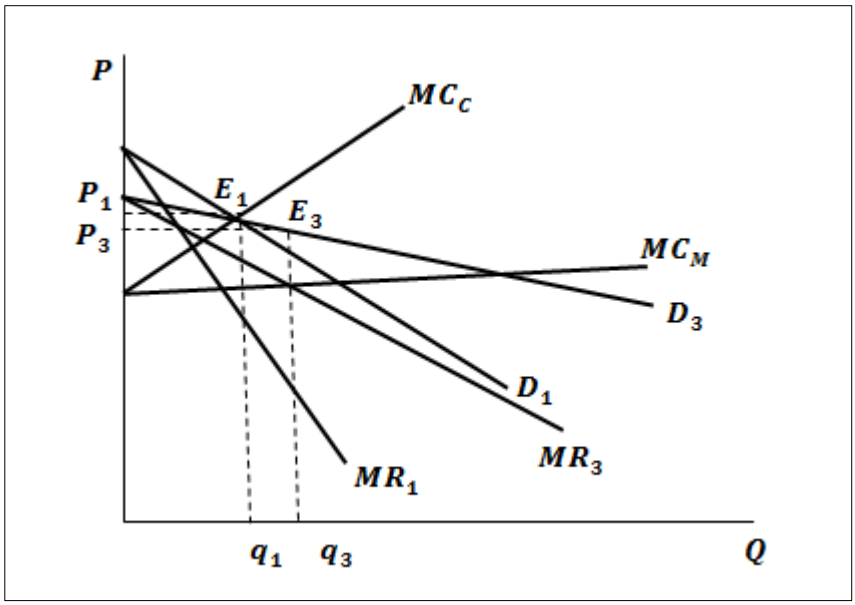
$$P = \frac{-\lambda}{\alpha_1 + \alpha_3 Z} Q + \beta_0 + \beta_1 Q + \beta_2 W + \eta \tag{6.13}$$

After substituting $Q^* = \frac{-Q}{\alpha_1 + \alpha_3 Z}$, equation (6.13) might be written as:

$$P = \lambda Q^* + \beta_0 + \beta_1 Q + \beta_2 W + \eta \quad (6.14)$$

To disentangle λ and β_1 in equation (6.13), the demand function is estimated first to have the parameters α_1 and α_3. And, λ is estimated as a coefficient of Q^*. The graphical illustration of this is described in Figure 6.2.

Figure 6.2. Identification of Monopoly Power: identified



Source: Bresnahan (1982)

The initial equilibrium is E_1. In order to get the new demand (D_3) and marginal revenue (MR_3) curves, the demand curve is rotated around the equilibrium point E_1. Bresnahan (1982) argues that if the supply relation is a supply curve, then this rotation will not have any effect on the equilibrium, meaning that in case of competitive market marginal cost will be MC_C and E_1 will be equilibrium under D_1 and D_3. However, in case of non-competitive market the marginal cost will be MC_M and the new equilibrium will be E_3. Therefore, adding interaction term will rotate the demand curve, and identify the parameter of market power, λ.

6.4 Data Source

Although most of the studies which conduct NEIO approach on export/import market of agricultural products apply annual data for the investigation (see Table A6.1 in the Appendix), this study uses more frequent data. Quarterly time series data on wheat import quantity and unit value are collected for the period Q1:2004 - Q4:2015 from the State Statistical Committee of the Republic of Azerbaijan (AZSTAT), the National Statistics Office of

Georgia (GEOSTAT) and the Global Trade Information Services (GTIS) database. The HS-4 digit code of 1001 is used in the estimations. Import unit values of Russian and Ukrainian wheat flour data (HS 1001) are also collected from the same sources. Average producer price of wheat data are taken from the Agency of the Republic of Kazakhstan on Statistics (KAZSTAT) and the Russian Federal State Statistics Service (ROSSTAT). Nominal gross domestic price (GDP) data are collected from the Central Bank of the Republic of Azerbaijan (CBAR) and the National Bank of Georgia (NBG) and have been deflated by the consumer price index (CPI, Q1:2004=100) across the estimated period. Population data for Azerbaijan and Georgia are from AZSTAT and GEOSTAT, respectively. Retail price data of bread for both countries are collected from the Food Price Monitoring and Analysis (FPMA) Tool published by the Food and Agriculture Organization of the United Nations. Bilateral exchange rate data are taken from CBAR and NBG. Rail cargo transportation tariff index data (Q1:2004=100) are from ROSSTAT.

This study covers four separate datasets for Kazakhstan-Azerbaijan, Russia-Azerbaijan, Kazakhstan-Georgia and Russia-Georgia combinations. N3SLS estimation results for different country combinations are obtained by using the statistical software package SAS. Due to the different country backgrounds, the list of the instrumental variables varies accordingly. Summary statistics of the variables used in the estimations for Azerbaijan and Georgia are presented, respectively, in Tables A6.2 – A6.3 in the Appendix.

6.5 Results and Discussion

Most employed estimators on market imperfection studies through simultaneous estimation methods are N3SLS, generalized method of moments (GMM), full information maximum likelihood (FIML) and iterative three-stage least squares (I3SLS). FIML is asymptotically efficient estimator under the assumption of normally distributed residuals. Using different instruments usually makes changes in the results of GMM, which makes N3SLS most preferred one. However, using different instruments does not make many changes in the results of 3SLS. As the equations (6.12) and (6.14) indicate a nonlinear simultaneous equation system, they have been estimated using N3SLS.

Using a structural econometric model, we first estimate demand elasticities, which include own price elasticities and technological change. Table 6.1 below depicts that own-price elasticities are significantly elastic, meaning that demand for both Kazakh and Russian wheats

is elastic in both Azerbaijani and Georgian import markets. Additionally, the demand for Kazakh wheat is much more elastic in both countries in compare to Russian wheat. The other interesting finding is estimates of technological changes. This estimate shows how the technological change affects the demand for Kazakh and Russian wheat in different destinations. Although, the technological changes positively affect the demand for Kazakh wheat in both markets, these results are not statistically significant. On the other hand, the results demonstrate that the technological changes negatively affect the demand for Russian wheat in Azerbaijani import market, while positively in the Georgian import market.

Table 6.1. N3SLS Estimates

Estimates	Kazakhstan Azerbaijan	Russia Azerbaijan	Kazakhstan Georgia	Russia Georgia
Own-price elasticity	-2.896**	-2.348**	-4.309*	-3.379**
	[-2.54]	[-3.33]	[-1.69]	[-2.52]
Technological change	1.394	-2.268**	2.271	0.493**
	[1.16]	[-2.22]	[1.57]	[2.20]

Note: Values in parentheses are t-statistics. Asterisk ** and * denote statistical significance at the 5% and 10% levels, respectively.

As already mentioned above, in order to analyse the competitiveness in the Azerbaijani and Georgian wheat import markets, the demand function and F.O.C. equation are simultaneously estimated. Dependent variable of the demand function is import quantity of wheat, expressed in ton. Import unit value of wheat, import unit value of substitute goods, gross domestic product and number of population of the importing country, the product of import unit value and time trend, time trend, time trend squared and quarter dummies are exogenous variables (see Tables 6.2 - 6.5). In order to have non-linear demand function, the product of import unit value and time trend is included as interim term into the demand function. In other words, the product of import unit value and time trend indicates the rotation of the demand curve (Buschena and Perloff, 1991). According to the theory, import unit price of substitute goods are supposed to be included into the estimation. We believe that import unit value of wheat and wheat flour of the competing countries would fit as substitute goods in the demand function. Dependent variable of the F.O.C. equation is import unit price of wheat, measured in importing country's currency. The list of exogenous variables includes import quantity, producer price of wheat in exporting country, rail cargo transportation tariff index, bilateral exchange-rate between importing and exporting countries, market power parameter, time trend and quarter dummies (see Tables 6.2 - 6.5).

6.5.1 Azerbaijani wheat market

The estimation results for the Kazakhstan-Azerbaijan combination are presented in Table 6.2. All the exogenous variables together with import quantity of substitute good ($P_{RUS,WHEAT}$), producer prices of wheat of competing countries (PP_{RUS} and PP_{UKR}), and retail price of bread in importing country ($P_{AZE,BREAD}$) are used as instrumental variables.

In the demand equation, import unit value (P_t) shows an unexpected sign, meaning that an increase in import unit value of Kazakh wheat will not cut the import demand down. However, the negative coefficient of the variable $P_t * T$ slightly offsets the positive coefficient of the import unit value variable. Although, the import unit value of substitute goods ($Z_{1t}$and Z_{2t}) have expected signs, only import unit value of Russian wheat flour is statistically significant at the 10% level. The gross domestic product variable (Y_{1t}) has an unexpected sign, while the population variable (Y_{2t}) has an expected sign, but both results are statistically insignificant. The estimates of time trend (T) and time trend squared (T^2) are not expected, but they are not statistically significant. The estimates of the quarterly dummies (QD_2, QD_3 and QD_4) are statistically insignificant.

In the first-order condition (F.O.C.) equation, the import quantity variable (Q_t) has an expected sign and it is statistically significant at the 10% level, meaning that an increase in the demand for Kazakh wheat will stimulate the import unit value of it. Producer price of Kazakh wheat (W_{1t}) also shows an expected sign and it is statistically significant at the 1% level, meaning that as the cost of wheat production increases, import unit value of wheat will increase as well. The rail cargo tariff index variable (W_{2t}) also has an expected sign, but it is statistically insignificant. Bilateral exchange rate variable (W_{3t}) shows also an expected sign and it is statistically significant at the 10% level, meaning that depreciation of Kazakhstani tenge will improve the wheat import from Kazakhstan to Azerbaijan. Although the estimate of time trend (T) is expected, it is very close to zero and statistically insignificant. The estimates of the quarterly dummies (QD_2, QD_3 and QD_4) are also statistically insignificant. The main coefficient of F.O.C. equation is the market power parameter, λ. Although it has an expected sign, it is close to zero and statistically insignificant, meaning that the Azerbaijani wheat import market is performing competitively.

The *R*-squared values range from 0.4203 to 0.7441. The sample results of N3SLS show that the Durbin Watson statistics is less than 2 for both demand equation and F.O.C. equation, indicating that serial correlation might be a problem.

Table 6.2. N3SLS results for Kazakhstan-Azerbaijan

Demand function		F.O.C.	
Variables	Estimates	Variables	Estimates
Import unit value of Kazakh wheat, P_t	**3.118**[2.54]**	Market power parameter, λ	0.001 [0.13]
Import unit value of Russian wheat, Z_{1t}	0.398 [0.44]	Import quantity of Kazakh wheat, Q_t	**0.056*[2.12]**
Import unit value of Russian wheat flour, Z_{2t}	**1.789*[1.94]**	Producer price of Kazakh wheat, W_{1t}	**0.818***[5.97]**
Price times time trend, $P_t * T$	**-0.241**[-2.55]**	Rail cargo tariff index, W_{2t}	0.044 [0.10]
Real GDP, Y_{1t}	-1.290 [-0.81]	Bilateral exchange rate, W_{3t}	**0.731*[2.52]**
Population, Y_{2t}	6.599 [0.02]	Time trend, T	-0.002 [-0.93]
Time trend, T	1.465 [1.23]	Quarter dummy, QD_2	0.009 [0.13]
Time trend squared, T^2	-0.003 [-1.05]	Quarter dummy, QD_3	0.056 [0.88]
Quarter dummy, QD_2	-0.161 [-0.32]	Quarter dummy, QD_4	-0.051 [-0.82]
Quarter dummy, QD_3	-0.401 [-0.75]		
Quarter dummy, QD_4	0.264 [0.50]		
Constant	-95.566 [-0.02]		
R-squared	0.4203	*R*-squared	0.7441
DW statistics	1.4210	DW statistics	1.3983

Notes: Values in parentheses are t-statistics. Asterisks ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

The estimation results for the Russia-Azerbaijan combination are presented in Table 6.3. All the exogenous variables together with import quantity of substitute goods ($P_{KAZ,WHEAT}$ and $P_{RUS,WHEAT\ FLOUR}$), retail price of bread in importing country ($P_{AZE,BREAD}$), bilateral exchange rates of competing countries ($ER_{AZN/KZT}$ and $ER_{AZN/UAH}$), the products of both demand shifters and time trend ($Y_{1t} * T$ and $Y_{2t} * T$), the product of import unit value and demand shifter ($P * Y_{1t}$) are used as instrumental variables.

In the demand equation, import unit value (P_t) is significantly negative, which is expected. However, the positive coefficient of the variable $P_t * T$ dampens the strong negative magnitude of wheat import unit value. Kazakh wheat and Russian wheat flour are considered as substitute goods for Russian wheat in the Azerbaijan-Russian case. Import unit value of Kazakh wheat ($P_{KAZ,WHEAT}$) is positively significant at the 5% level, but import unit value of Russian wheat flour ($P_{RUS,WHEAT\ FLOUR}$) is negative and insignificant. Although GDP (Y_{1t})

has an unexpected sign, while the population variable (Y_{2t}) has an expected sign, both results are not statistically significant. The estimate of time trend (T) is expected and negatively significant. Although the estimate of time trend squared (T^2) is not expected, it is very close to zero.

Table 6.3. N3SLS results for Russia-Azerbaijan

Demand function		**F.O.C.**	
Variables	Estimates	Variables	Estimates
Import unit value of Russian wheat, P_t	**-8.833**[-3.34]**	Market power parameter, λ	0.001 [0.10]
Import unit value of Kazakh wheat, Z_{1t}	**3.289**[2.32]**	Import quantity of Russian wheat, Q_t	**-0.107**[-2.05]**
Import unit value of Russian wheat flour, Z_{2t}	-0.783 [-1.11]	Producer price of Russian wheat, W_{1t}	**0.693***[4.04]**
Price times time trend, $P_t * T$	**0.260**[3.34]**	Rail cargo tariff index, W_{2t}	0.279 [0.71]
Real GDP, Y_{1t}	-0.413 [-0.32]	Bilateral exchange rate, W_{3t}	0.204 [0.57]
Population, Y_{2t}	303.446 [1.02]	Time trend, T	-0.005 [-1.09]
Time trend, T	**-2.250**[-2.19]**	Quarter dummy, QD_2	0.081 [0.95]
Time trend squared, T^2	-0.001 [-0.36]	Quarter dummy, QD_3	0.076 [0.86]
Quarter dummy, QD_2	-0.253 [-0.67]	Quarter dummy, QD_4	0.123 [1.36]
Quarter dummy, QD_3	0.440 [1.02]		
Quarter dummy, QD_4	**0.877**[2.05]**		
Constant	-4782.56 [-1.01]		
R-squared	0.5478	*R*-squared	0.6233
DW statistics	1.4972	DW statistics	2.0623

Notes: Values in parentheses are t-statistics. Asterisks ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

In the F.O.C. equation, the import quantity variable (Q_t) has an unexpected sign. The producer price of wheat variable (W_{1t}) also has an expected sign and statistically significant at the 1% level. Although the sign of the rail cargo tariff index (W_{2t}) and bilateral exchange rate variables (W_{3t}) are also expected, they are not statistically significant. The estimate of time trend (T) is expected, but it is very close to zero and statistically insignificant. The estimates of the quarterly dummies (QD_2, QD_3 and QD_4) are statistically insignificant as well. The main coefficient of F.O.C. is the market power parameter, λ. Although it has expected sign, it is

close to zero and statistically insignificant, meaning that Azerbaijani wheat import market is performing competitively.

The *R*-squared values range from 0.5478 to 0.6233. The sample results of N3SLS show that even though the Durbin Watson statistics is less than 2 for the demand equation, it is above 2 for the F.O.C. equation, indicating that serial correlation is not a problem.

6.5.2 Georgian wheat market

The estimation results for the Kazakhstan-Georgia combination are presented in Table 6.4. All the exogenous variables together with import quantity of substitute goods ($Q_{RUS,WHEAT}$, $Q_{RUS,WHEAT\ FLOUR}$ and $Q_{UKR,WHEAT\ FLOUR}$), producer prices of wheat in competing country (PP_{UKR}), the product of demand shifter and time trend ($Y_{1t} * T$), the product of import unit value and demand shifter ($P * Y_{1t}$) are used as instrumental variables.

In the demand equation, the import unit value (P_t) shows an unexpected sign, meaning that despite an increase in import unit value there will not be a decrease in the demand for imported wheat from Kazakhstan. However, the negative coefficient of the variable $P_t * T$ slightly offsets the positive coefficient of import unit value variable. Russian wheat, Russian wheat flour and Ukrainian wheat flour are considered as substitute goods. The sign of import unit value of Russian wheat (Z_{1t}) is expected, while the sign of import unit values of Russian wheat flour (Z_{2t}) and Ukrainian wheat flour (Z_{3t}) are unexpected, but all three results are insignificant. Although the demand shifters (Y_{1t} and Y_{2t}) have expected signs, both are statistically insignificant. The estimate of time trend (T) is unexpected, while the estimate of time trend squared (T^2) is expected, but both are statistically insignificant.

In the F.O.C. equation, the import quantity variable (Q_t) has an expected sign and it is statistically significant at the 5% level. Producer price of wheat variable (W_{1t}) and bilateral exchange rate (W_{3t}) have expected signs and both are statistically significant at the 1% level. However, the sign of the rail cargo tariff index variable (W_{2t}) is not expected. The estimate of time trend is statistically significant but it is unexpected result. The last quarter of the F.O.C. equation is negatively significant. The main coefficient of F.O.C. is the market power parameter, λ. It has expected sign, but it is very close to zero. That indicates that the Georgian wheat import market is competitive.

The *R*-squared values are quite high, ranging from 0.5367 to 0.9225. The sample results of N3SLS show that the Durbin Watson statistics is more than 2 in the demand function, and quite close to 2 in the F.O.C. equation, indicating that serial correlation is not a problem.

Table 6.4. N3SLS results for Kazakhstan-Georgia

Demand function		**F.O.C.**	
Variables	Estimates	Variables	Estimates
Import unit value of Kazakh wheat, P_t	**5.144*[1.68]**	Market power parameter, λ	0.004 [1.22]
Import unit value of Russian wheat, Z_{1t}	2.484 **[**1.14**]**	Import quantity of Kazakh wheat, Q_t	**0.041**[2.41]**
Price times time trend, $P_t * T$	**-0.414*[-1.69]**	Producer price of Kazakh wheat, W_{1t}	**0.966***[9.10]**
Real GDP, Y_{1t}	5.226 [0.97]	Rail cargo tariff index, W_{2t}	**-0.763**[-3.47]**
Population, Y_{2t}	10.472 **[**1.65**]**	Bilateral exchange rate, W_{3t}	**0.173***[4.49]**
Import unit value of Russian wheat flour, Z_{2t}	-0.961 [-0.75]	Time trend, T	**0.010**[3.24]**
Import unit value of Ukrainian wheat flour, Z_{3t}	-2.388 [-0.80]	Quarter dummy, QD_2	-0.011 [-0.22]
Time trend, T	2.171 [1.54]	Quarter dummy, QD_3	-0.072 [-1.33]
Time trend squared, T^2	0.004 [0.92]	Quarter dummy, QD_4	**-0.114**[-2.12]**
Quarter dummy, QD_2	**-1.440*[-1.82]**		
Quarter dummy, QD_3	-1.446 [-1.27]		
Quarter dummy, QD_4	-1.150 [-0.85]		
Constant	-285.76 [-1.51]		
R-squared	0.5367	*R*-squared	0.9225
DW statistics	2.8514	DW statistics	1.8925

Notes: Values in parentheses are t-statistics. Asterisks ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

The estimation results for the Russia-Georgia combination are presented in Table 6.5. All the exogenous variables together with import quantity of substitute goods ($Q_{KAZ,WHEAT}$, $Q_{RUS,WHEAT\ FLOUR}$ and $Q_{UKR,WHEAT\ FLOUR}$), and bilateral exchange rates of competing country ($ER_{GEL/KZT}$) are used as instrumental variables.

In the demand equation, the import unit value (P_t) is significantly negative, which is expected. Although the coefficient of the variable $P_t * T$ is negative, it cannot affect the strong negative magnitude of import unit value of Russian wheat. Kazakh wheat, Russian wheat flour and Ukrainian wheat flour are substitute goods for Russian wheat in the Georgia-Russian case.

The sign of import unit value of Kazakh wheat (Z_{1t}) and import unit value of Ukrainian wheat flour (Z_{3t}) are negative, while import unit value of Russian wheat flour (Z_{2t}) is positive, but all three variables are not statistically significant. Although the sign of GDP variable (Y_{1t}) is expected, while the sign of the population variable (Y_{2t}) is unexpected, both results are not statistically significant. The estimate of time trend (T) is not expected despite the fact that it is statistically significant. Although the estimate of time trend squared (T^2) is not expected, it is close to zero.

Table 6.5. N3SLS results for Russia-Georgia

Demand function		**F.O.C.**	
Variables	Estimates	Variables	Estimates
Import unit value of Russian wheat, P_t	**-1.834**[-2.05]**	Market power parameter, λ	0.232 [0.97]
Import unit value of Kazakh wheat, Z_{1t}	-0.776 [-0.94]	Import quantity of Russian wheat, Q_t	-0.084 [-0.78]
Price times time trend, $P_t * T$	-0.068 [-1.61]	Producer price of Russian wheat, W_{1t}	**0.478**[3.03]**
Real GDP, Y_{1t}	0.280 [0.12]	Rail cargo tariff index, W_{2t}	**0.935**[2.49]**
Population, Y_{2t}	-1.647 [-0.57]	Bilateral exchange rate, W_{3t}	0.127 [0.71]
Import unit value of Russian wheat flour, Z_{2t}	0.555 [1.08]	Time trend, T	**-0.018*[-1.82]**
Import unit value of Ukrainian wheat flour, Z_{3t}	-0.193 [-0.18]	Quarter dummy, QD_2	-0.057 [-1.49]
Time trend, T	**0.515**[2.33]**	Quarter dummy, QD_3	**0.157**[2.07]**
Time trend squared, T^2	-0.001 [-0.48]	Quarter dummy, QD_4	**0.117**[2.09]**
Quarter dummy, QD_2	-0.217 [-0.67]		
Quarter dummy, QD_3	0.751 **[**1.54**]**		
Quarter dummy, QD_4	0.489 [0.86]		
Constant	41.680 [0.50]		
R-squared	0.8492	*R*-squared	0.9409
DW statistics	1.9412	DW statistics	1.6329

Notes: Values in parentheses are t-statistics. Asterisks ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

In the F.O.C. equation, the import quantity variable (Q_t) has an unexpected sign, but it is statistically insignificant. The signs of the producer price of wheat variable (W_{1t}) and the rail cargo tariff index variable (W_{2t}) are expected and both are statistically significant at the 5% level. Although the sign of and bilateral exchange rate variable (W_{3t}) is also expected, it is statistically insignificant. The estimate of time trend (T) is expected, and it is significant at the

10% level. The second and third quarter dummies are also significant at the 5% level. The main coefficient of F.O.C. is the market power parameter, λ. The sign of this parameter is expected and the magnitude is higher than the other combinations, but it is also statistically insignificant. Than proves that the Georgian wheat import market is competitive.

The *R*-squared values are quite high, ranging from 0.8492 to 0.9409. The sample results of N3SLS show that the Durbin Watson statistics are close to 2, which indicates that serial correlation is not a problem.

Table 6.6. Summary Statistics

	Kazakhstan Azerbaijan	Russia Azerbaijan	Kazakhstan Georgia	Russia Georgia
Parameters estimated	21	21	22	22
Objective value	0.8147	0.6537	0.7527	0.4848
Observation	47	47	28	28

The number of observation used in N3SLS analysis is different across the country combinations. As the estimation is implemented simultaneously, the missing value in any dataset drops out the observations from the sample. Therefore, we have 47 observations for Kazakhstan-Azerbaijan and Russia-Azerbaijan, while only 28 for Kazakhstan-Georgia and Russia-Georgia (see Table 6.6).

6.6 Conclusion and Policy Implications

In order to determine the degree of market imperfection in the Azerbaijani and Georgian wheat markets the N3SLS estimator is used in this study. As own-price elasticities are significantly elastic, it is concluded that demand for Kazakh and Russian wheats is elastic in both Azerbaijani and Georgian import markets. However, the demand for Kazakh wheat is much more elastic in both countries in compare to Russian wheat. Additionally, the technological changes positively affect the demand for Kazakh wheat in both markets, but these results are insignificant. The technological changes negatively affect the demand for Russian wheat in the Azerbaijani import market, while positively in the Georgian import market.

Further, the results show that the GDP and total population variables do not significantly affect demand for wheat imports both from Kazakhstan and Russia in Azerbaijani and

Georgian markets. Russian wheat flour is a substitute product for Kazakh wheat in Azerbaijani market. Similarly, Kazakh wheat is a substitute product for Russian wheat in Georgian market. However, Ukrainian wheat flour cannot be a substitute good both for Kazakh and Russian wheats in Azerbaijani and Georgian markets. Additionally, producer price of wheat significantly affects the supply of Kazakh and Russian wheats to both markets. Appreciation of Azerbaijani manat and Georgian Lari with respect to Kazakhstani tenge considerably affects the supply of Kazakh wheat to both markets. On the contrary, appreciation of Azerbaijani manat and Georgian Lari with respect to Russian ruble does not affect the supply of Russian wheat to both markets. The estimates of market power parameter are quite low and insignificant in all combinations, meaning that both Azerbaijani and Georgian wheat import markets are performing competitively.

The *R*-squared values are quite high, especially for the F.O.C. equations in all combinations. As this study applies nonlinear estimation method, the serial correlation of the error terms is difficult to evaluate, and it should be highlighted that the Durbin-Watson test statistic might only be approximately interpreted (White, 1992).

Due to lack of some data, the investigation of the imperfect competition in the Armenian wheat market is ignored in this study. The future research should consider this, and the existence of imperfect competition could be analysed for different time periods for the Armenian market.

6.7 References

Appelbaum, E. (1982). The Estimation of the Degree of Oligopoly Power. *Journal of Econometrics*, 19(2-3): 287-299.

Azzam, A. M. and E. Pagoulatos (1990). Testing oligopolistic and oligopsonistic behaviour: An application to the US meat-packing industry. *Journal of Agricultural Economics*, 41(3): 362-370.

Bresnahan, T. F. (1982). The oligopoly solution concept is identified. *Economics Letters*, 10: 87-92.

Bresnahan, T. F. (1989). Empirical studies of industries with market power. In *Handbook of industrial organisation*, edited by R. Schmalensee and R.D. Willig, vol. 2, Chapter 17, Amsterdam, North Holland.

Buschena, D. E. and J. M. Perloff (1991). The creation of dominant firm market power in the coconut oil export market. *American Journal of Agricultural Economics*, 73(4): 1000-1008.

Byuhan, S. and R. Lopez (1997). Oligopoly power in the food and tobacco industries. *American Journal of Agricultural Economics*, 79(3): 1035-1043.

Connor, J. M. (1998). What can we learn from ADM global price conspiracies? Department of Agricultural Economics, Purdue University, West Lafayette.

Deodhar, S. Y. and I. M. Sheldon (1995). Is Foreign Trade (Im)perfectly Competitive?: An Analysis of the German Market for Banana Imports. *Journal of Agricultural Economics*, 46(3): 336-348.

Deodhar, S. Y. and I. M. Sheldon (1996). Estimation of imperfect competition in food marketing: A dynamic analysis of the German banana market. *Journal of Food Distribution Research*, 27(3): 1-10.

Deodhar, S. Y. and I. M. Sheldon (1997). Market Power in the World Market for Soymeal Exports. *Journal of Agricultural and Resource Economics*, 22(1): 78-86.

Digal, L. N. and F. Z. Ahmadi-Esfahani (2002). Market power analysis in the retail food industry: a survey of methods. *Australian Journal of Agricultural and Resource Economics*, 46(4): 559-584.

Gafarova, G., Perekhozhuk, O. and T. Glauben (2015). Price discrimination and pricing-to-market behaviour of Black Sea region wheat exporters. *Journal of Agricultural and Applied Economics*, 47(3): 287-316.

Hyde, C.E. and J. M. Perloff (1995). Can market power be estimated? *Review of Industrial Organisation*, 10: 465-485.

Katchova, A. L., I. M. Sheldon and M. L. Miranda (2005). A dynamic model of oligopoly and oligopsony in the U.S. potato-processing industry. *Agribusiness*, 21(3): 409-428.

Karp, L. S. and J. M. Perloff (1989). Dynamic Oligopoly in the Rice Export Market. *The Review of Economics and Statistics*, 71(3): 462-470.

Karp, L. S. and J. M. Perloff (1993). A Dynamic Model of Oligopoly in the Coffee Export Market. *American Journal of Agricultural Economics*, 75: 448-457.

Lau, L. J. (1982). On Identifying the degree of competitiveness from industry price and output data. *Economics Letters*, 10 (1-2): 93-99.

Lerner, A. P. (1934). Economic theory and socialist economy. *Review of Economic Studies*, 2(1): 51–61.

Lopez, R. A. and Z. You (1993). Determinants of Oligopsony Power: The Haitian Coffee Case. *Journal of Development Economics*, 41: 275-284.

Love, A. and E. Murniningtyas (1992). Measuring the Degree of Market Power Exerted by Government Trade Agencies. *American Journal of Agricultural Economics*, 74(3): 546-555.

Mei, B. and C. Sun (2008). Assessing Time-Varying Oligopoly and Oligopsony Power in the U.S. Paper Industry. *Journal of Agricultural and Applied Economics*, 40(3): 927-939.

Muazu, A. U., Mohamed, Z. A., Shamsuddin, M. N. and I. Abdulatif (2015). Measuring Market Power in the Integrated Malaysian Poultry Industry: New Empirical Industrial Organization Approach. *Journal of Food Products Marketing*, 22(4).

Nwachukwu, I. N., Onyenweaku, C. E., Nwaru, J. C. and C. Paveliuc-Olariu (2011). Measuring the Degree of Market Power in the Export Demand for Nigerian Cocoa: An Analysis of Dutch Market. *Journal of Social and Development Sciences*, 2(3): 94-103.

Perekhozhuk, O., T. Glauben, R. Teuber and M. Grings (2015). Regional-level Analysis of Oligopsony Power in the Ukrainian Dairy Industry. *Canadian Journal of Agricultural Economics*, 63(1): 43-76.

Perekhozhuk, O., T. Glauben, M. Grings and R. Teuber (2017). Approaches and methods for the econometric analysis of market power: A survey and empirical comparison. *Journal of Economic Surveys*, 31(1): 303-325.

Perloff, J. M. (1992). Econometric Analysis of Imperfect Competition and Implications for Trade Research. In Proceedings of a Workshop on Industrial Organization and International Trade edited by I.M. Sheldon and D.R. Henderson, NC-194 Research Monograph Number 1, Ohio State University, Columbus.

Schroeter, J. R. (1988). Estimating the Degree of Market Power in the Beef Packing Industry. *The Review of Economics and Statistics*, 70(1): 158-162.

Schroeter, J. R. and A. Azzam (1990). Measuring Market Power in Multi-Product Oligopolies: The U.S. Meat Industry. *Applied Economics*, 22(10): 1365-1376.

Steen, F. and K.G. Salvanes (1999). Testing for market power using a dynamic oligopoly model. *International Journal of Industrial Organization*, 17(2): 147-177.

Susanto, D. (2006). Measuring the Degree of Market Power in the Export Demand for Soybean Complex. Unpublished Ph.D Thesis, Department of Agricultural Economics and Agribusiness, The Louisiana State University, USA.

Wann, J. J. and R. J. Sexton (1992). Imperfect Competition in Multiproduct Food Industries with Application to Pear Processing. *American Journal of Agricultural Economics*, 74(4): 980-990.

White, K. J. (1992). Durbin-Watson test for autocorrelation in nonlinear models. *The Review of Economics and Statistics*, 74(2): 370-373.

Appendix

Table A6.1. Selected studies applying the New Empirical Industrial Organization approach.

Authors	Journal[a] (year)	Exporter	Importer	Product	Period	Data[b]	Method/ Estimator[c]	Analysis	Result
Karp and Perloff	RES (1989)	China Pakistan Thailand	World	Rice	1961-1985	A	3SLS SUR	Dynamic	All exporters are price-takers All exporters are price-takers
Buschena and Perloff	AJAE (1991)	The Philippine	World	Coconut Oil	1959-1987	A	N3SLS	Static	Prior to the 1970s there was competition in the Philippine coconut oil export market. After 1970 the Philippines exercised its potential dominant firm market power.
Love and Murniningtyas	JAE (1992)	Japan ROW	ROW Japan	wheat	1964-1985	A	N3SLS	Static	Monopsony power in the world wheat market. No monopoly power in the domestic wheat market.
Karp and Perloff	AJAE (1993)	Brazil Columbia	World	Coffee	1961-1983	A	EF EOL	Dynamic	Both are price-takers. Both are price-takers.
Lopez and You	JDE (1993)	World	Haiti	Coffee	1954-1984	A	Lerner index Export supply	Static	Haitian coffee market is far from being a monopsony.
Deodhar and Sheldon	JAE (1995)	World	Germany	Banana	1970-1992	A	2SLS Bootstrap	Static	λ=0.29: German banana import market is less than competitive. Cournot-Nash behaviour is not rejected

Table A6.1. (continued)

Authors	Journal[a] (year)	Exporter	Importer	Product	Period	Data[b]	Method/ Estimator[c]	Analysis	Result
Deodhar and Sheldon	JFDR (1996)	World	Germany	Banana	1970-1992	A	Taylor expansion	Dynamic	In both open-loop and feedback cases collusive behaviour is rejected, but Cournot-Nash is not rejected. Perfect competition is rejected in feedback case, but not in open-loop case.
							Bootstrap		In both open-loop and feedback cases perfect competition and collusive behaviour are rejected, but the Cournot-Nash is not rejected.
Deodhar and Sheldon	JARE (1997)	Argentina Brazil United States	World	Soymeal	1966-1993	A	N3SLS	Static	The world market for soymeal exports is perfectly competitive.
Steen and Salvanes	IJIO (1999)	Norway	France	Fresh salmon	1981-1992	Q	ECM	Dynamic	There is some market power in the short-run, but in the long-run the fresh salmon market is competitive.
Nwachukwu et al.	JSDS (2011)	Nigeria	Netherland	Cocoa	1961-2007	A	2SLS	Static	Relative competitiveness in the Dutch market

Notes: [a] AJAE, American Journal of Agricultural Economics; IJIO, International Journal of Industrial Organization; JAE, Journal of Agricultural Economics; JARE, Journal of Agricultural and Resource Economics; JDE, Journal of Development Economics; JFDR, Journal of Food Distribution Research; JSDS, Journal of Social and Development Sciences; RES, The Review of Economics and Statistics. [b] A, annual; Q, quarterly. [c] 2SLS, Two-stage least squares; 3SLS, Three-stage least squares; ECM, Error correcting framework; EF, Estimated Feedback; EOL, Estimated open-loop; N3SLS, Nonlinear Three-stage least squares; SUR, Seemingly Unrelated Equations.

Source: Own compilation based on the articles cited.

Table A6.2. Summary Statistics for Azerbaijan.

Variable	Kazakhstan			Russia		
	Mean	Min	Max	Mean	Min	Max
Import unit value of wheat	186	114	313	186	117	368
Import quantity of wheat	144596	3981	375446	149777	4471	453677
Import unit value of wheat flour	-	-	-	287	175	482
Import quantity of wheat flour	-	-	-	6777	0	111497
Producer price index	22752	11560	34043	5256	2391	9240
Gross domestic product	11639055080	1609760000	19903900448	11639055080	1609760000	19903900448
Population	8997542	8349100	9677576	8997542	8349100	9677576
Bilateral exchange rate	0.0059	0.0037	0.0075	0.0278	0.0142	0.0351
Retail price of bread	525	350	727	525	350	727
Rail cargo transportation tariff index	-	-	-	100.8	99.9	104.2

Notes: Import unit value of wheat, import unit value of wheat flour, gross domestic product, and retail price of bread are expressed in Azerbaijani manat. Import quantity of wheat and import quantity of wheat flour are expressed in tons. Producer price index and rail cargo transportation tariff index are expressed in percentage (%). Population is the total population at the beginning of the year. Bilateral exchange rate is the rate of Azerbaijani manat in Kazakhstani tenge and Russian ruble.

Table A6.3. Summary Statistics for Georgia.

Variable	Kazakhstan			Russia		
	Mean	Min	Max	Mean	Min	Max
Import unit value of wheat	419	253	634	419	233	611
Import quantity of wheat	43314	1422	231151	93301	3455	229664
Import unit value of wheat flour	-	-	-	618	398	1317
Import quantity of wheat flour	-	-	-	9678	1	34618
Producer price index	22752	11560	34043	5256	2391	9240
Gross domestic product	5973775144	2021475779	10743653491	5973775144	2021475779	10743653491
Population	4337122	3616997	4562092	4337122	3616997	4562092
Bilateral exchange rate	0.0629	0.0080	0.1466	0.0567	0.0332	0.0719
Retail price of bread	1300	943	1607	1300	943	1607
Rail cargo transportation tariff index	-	-	-	100.8	99.9	104.2

Notes: Import unit value of wheat, import unit value of wheat flour, gross domestic product, and retail price of bread are expressed in Georgian Lari. Import quantity of wheat and import quantity of wheat flour are expressed in tons. Producer price index and rail cargo transportation tariff index are expressed in percentage (%). Population is the total population at the beginning of the year. Bilateral exchange rate is the rate of Georgian Lari in Kazakhstani tenge and Russian ruble.

7 CONCLUSIONS

7.1 Background on the theoretical framework

In general, price discrimination and market power issues are well analysed in the international trade theory. Due to some substantial changes, the international wheat market has become less concentrated in recent years. Therefore, the investigation of pricing behaviour becomes a vital issue. Further, except Russian wheat market, the other non-traditional export markets – Kazakhstan and Ukraine, are not well investigated. This thesis aims to close this gap and presents a broad picture of KRU wheat market, and its role in the South Caucasus wheat import market. This thesis is based on three empirical studies and analysis. The results of the first study give an answer to the main research question, whether the KRU exporters are able to price discriminate in the destinations countries in response to changes in bilateral exchange rates. Second study focuses on the investigation of market power of Kazakh and Russian exporters in the South Caucasus (Armenia, Azerbaijan and Georgia) wheat markets. Third study examines whether there is imperfect competition in the Azerbaijani and Georgian wheat import markets.

The PTM and RDE models are widely used to analyse the investigation of market power. The results of these two models complete each other. The PTM model only indicates the existence of market power in the destination country, but it is not able to detect the magnitude of it. This model can conclude whether the exporting country is able to price discriminate in the destination country, or not. The PTM model is applied through the fixed-effects method. However, the RDE approach is able to measure the extent of market power, that exporting country might exercise. This approach represents the effects of export quantity, cost shifters and demand shifters on export price by taking into account the reactions of competing countries. Instead of dealing with a structural demand system involving all firms in an industry, the RDE approach focuses only on the estimation of a single equation. This approach is employed through 3SLS estimation for systems of simultaneous equation and SUR methods.

Except price discrimination and market power issues, it is also important to investigate the market structure of the importing country. The NEIO model is implemented to detect the imperfect competition in the importing country's market. This approach investigates the presence of market power based on demand and cost functions and hypothesis relating to the firms' strategies. In other words, it concentrates more on market conduct aspects, such as an

individual firm's behaviour and strategic reactions in the industry. The disadvantage of the NEIO model is that it is not able to define the sources of market power. The NEIO approach is applied through different models. Most employed estimator on market imperfection studies are FIML, GMM, I3SLS and N3SLS. Yet the most preferred one is N3SLS, as using different instruments does not make many changes in the results of 3SLS.

The comparison of three above stated models are presented in Table 7.1. As already mentioned, PTM investigates whether the exporter is able to price discriminate in the importing country; RDE analyses if the exporter is able to exercise market power; and NEIO examines whether there is an imperfect competition in the importing country's market. Both PTM and RDE are examined through non-structural models of market power, while NEIO is analysed through a structural model. Further, both PTM and RDE are based on static methods, while NEIO is based on both static and dynamic methods. The PTM approach is simple to use and it is investigated by estimation of a single equation. However, both the RDE and NEIO approaches might be investigated by estimations of both single and multi-equations. Further, PTM requires panel data and it is easy to implement, whereas both RDE and NEIO use time series data and demand more detailed data for the investigation market power.

Table 7.1. Comparisons of the PTM, RDE and NEIO approaches

	PTM	**RDE**	**NEIO**
Object	price discrimination	market power	market imperfection
Model	non-structural	non-structural	structural
Method	static	static	static/dynamic
Equation	single	single/multi	single/multi
Type of data	panel	time series	time series
Easiness of implementation	less data	more specific data	more specific data

Note: Own compilation based on information on Chapter 4 – Chapter 6.

7.2 Main outcomes, conclusions and recommendations

The international wheat market has become less concentrated in recent years. In the background of this situation, it is quite important to investigate the pricing behaviour of newly joining wheat exporting countries into the world wheat market. As the non-traditional wheat exporters – Kazakhstan, Russia and Ukraine, have enough potentials in terms of area and yield, it is forecasted that they will grow further to stimulate their wheat production and exports.

The study on the PTM model examined the pricing behaviour of KRU exporters in their all possible destinations. The results reveal that Kazakhstan and Ukraine stabilize local currency prices in most wheat importing countries, whereas Russia amplifies the effect of destination-specific exchange rate changes. More precisely, Kazakhstan only in 8 out of 48 destinations, Russia in 26 out of 71 destinations and Ukraine in 23 out of 65 destinations are able to exercise price discrimination. In most destination countries, KRU countries cannot exercise PTM behaviour. Because of political relations and geographic locations, the main destinations for KRU exporters are South Caucasus, Central Asia, and some EU and MENA countries. Although the KRU countries are active wheat exporters in the South Caucasian region, only Russia price discriminates in the Armenian and Azerbaijani wheat markets. Kazakhstan and Ukraine face perfect competition in all three countries in this region. As the Georgian government implements a diversification policy on its wheat imports and buys wheat from multiple sources, despite their high market shares, none of the KRU countries are able to exercise price discrimination in Georgian wheat market. Because of its geographic advantages Ukraine is able to price discriminate in some EU and MENA countries.

There are three main reasons why KRU countries cannot price discriminate in their export destinations. First, their wheat production is highly dependent on weather and due to this reason KRU cannot trade regularly with their main partners. In order to secure their wheat imports, importing countries switch to buy wheat from more reliable sources. Second, mostly they export low quality wheat. Russia mainly exports an undifferentiated quality of wheat, whereas Ukraine is specialized in feed wheat exports. This makes the competition tougher for both of them because the demand is highly elastic for their products, and there are many competitors in the market that offer substitutes. Hence, most importing countries can easily switch to import wheat from other exporters if KRU countries increase wheat export prices. Kazakh wheat has higher protein-content than Russian and Ukrainian wheats, but due to geographical location, Kazakhstan is not able to price discriminate in most destinations.

Third, they periodically implement export restriction policies. Since 2007, KRU have applied several trade restriction policies, which have disrupted their wheat trade with most export destinations. Export restrictions isolate KRU countries from the global wheat market, which reduces the global wheat supply and affects global food security. These reasons cause KRU countries to be branded as unreliable wheat exporters in the world wheat market.

The results of RDE approach indicate that the Armenian and Georgian wheat markets are imperfectly competitive, while the Azerbaijani wheat market is perfectly competitive. More precisely, the 3SLS results show that, Russian exporters are able to exercise market power in the Armenian and Georgian wheat markets, but not in the Azerbaijani wheat market. However Kazakh exporters are not able to exercise market power in either the Azerbaijani or Georgian wheat markets. That is explained by dominance of Russian wheat exporters over Kazakh wheat exporters in the South Caucasus region. The SUR results coincide with the 3SLS results in the case of Russian exports to all three South Caucasus countries, and Kazakh exports to Azerbaijan. However, in the case of Kazakh exports to Georgia, the SUR results demonstrate that both Kazakh and Russian exporters equally exercise market power in the Georgian wheat market. The most expected result of both methods was that Russia achieves the highest market power in the Armenian wheat market because of its leading position in this market. Additionally, it is concluded that both exporting countries significantly interfere with each other's market powers in the Azerbaijani and Georgian wheat markets. In the same way, Ukraine constrains Kazakh and Russian exporters' market powers in the Azerbaijani and Georgian markets. However, neither Kazakh nor Ukrainian exporters are able to restrict Russian exporters' market powers in the Armenian market. This study clarifies that imperfect competition exists in the Armenian and Georgian wheat markets, but not in the Azerbaijani wheat market. These results are plausible and consistent with market structures of the importing countries (number of firms, market concentration, market shares, government intervention and regulation).

In order to determine the degree of market imperfection from the importing countries' perspective, the NEIO model has been implemented for Azerbaijani and Georgian wheat import markets. On the contrary to the RDE approach, the NEIO model concludes that both Azerbaijani and Georgian wheat import markets are performing competitively. Further, the results show that GDP and the total population do not significantly affect demand for wheat imports both from Kazakhstan and Russia. Russian wheat flour is better substitute good for Kazakh wheat in Azerbaijani market, while Kazakh wheat is better substitute good for

Russian wheat in Georgian market. Producer price of wheat significantly affects the supply of Kazakh and Russian wheats to both markets. Appreciation of Azerbaijani manat and Georgian Lari with respect to Kazakhstani tenge considerable affects the supply of Kazakh wheat to both markets. Further, own-price elasticities are significantly elastic, meaning that demand for Kazakh and Russian wheats is elastic in both Azerbaijani and Georgian import markets. The technological changes positively affect the demand for Kazakh wheat in both markets, but these results are insignificant. The technological changes negatively affect the demand for Russian wheat in the Azerbaijani import market, while positively in the Georgian import market.

Future research could consider extending the price discrimination and market power analysis in terms of other important destinations of KRU, since Kazakhstan and Russia own strong positions not only in the South Caucasus, but also in other destinations, like Central Asian countries, Egypt, Turkey and etc. Further, due to lack of some data, the investigation of the imperfect competition in the Armenian wheat market is ignored in this thesis. By applying the NEIO model, the existence of imperfect competition in the Armenian wheat import market could be analysed for different time period.