Studies on the Agricultural and Food Sector
in Transition Economies

Zsombor Páll

Three essays on the Russian wheat export

Leibniz Institute of Agricultural Development
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SUMMARY IN ENGLISH

Traditionally, the international wheat market has been considered as one of the best examples of a market with perfect competition. Accordingly, the law of one price would hold and all players would behave as price takers without any influence on the market price. However, the results from several empirical studies indicate that this assumption does not hold for all exporters and importers. Imperfect competition and price discrimination and thus market power seem to be present at least in certain segments of the international wheat market. While previous empirical articles examine the competitive structure of traditional wheat exporting countries, which export large quantities of high-quality wheat to developed countries, and have established market share, no analysis has been carried out so far on Russia, a country which supplies mainly wheat of undifferentiated quality to developing and transition countries.

Furthermore the exchange rate and its volatility can have a strong impact on the wheat export. The theoretical studies are inconclusive thus, the issue is rather empirical. Empirical works are mainly based on the gravity model and indicate that the impact of the exchange rate level and volatility on the export volume is dependent on the specific commodity.

This thesis is based on three empirical studies ("three essays") on the Russian wheat market. The first employs the pricing to market (PTM) model to investigate whether the Russian wheat exporters are able to price discriminate and investigates the impact of the 2007/2008 export tax on the pricing behaviour of the Russian wheat exporters. The second essay intends to quantify the market power of the Russian wheat exporters using the residual demand elasticity (RDE) model. The third essay focuses on the impact of the exchange rate level and volatility on the Russian wheat export volume using a gravity model. To complement this three empirical works and give a sound basis for the discussion other chapters of the thesis provide descriptive analysis of the international and Russian wheat market and describe the theory of market power and price discrimination.

The descriptive analysis indicates that significant changes have taken place in the world wheat market in the last decade. Russia, a former net wheat importer, became one of the biggest wheat exporters of the world, increasing wheat exports more than tenfold. While in 2000 Russia's market share was only 0.5 %, it increased by 10.7 percentage points to 11.2 % by 2009. At the same time, the

market share of both the top-five and the top-10 wheat exporters declined from 79 % (2000) to 62 % (2009) and from 93 % to 84 %, respectively.

The pricing to market model was estimated using quarterly Russian wheat export data, covering the period from 2002 to 2010 and 25 export destinations. The results of the PTM approach suggest that Russia exercises pricing to market in some wheat-importing countries. However, this does not imply that Russia exerts market power in the world wheat market. Generally, the structure of the Russian wheat export was found to be more competitive than U.S. or Canadian wheat exports in previous studies. Estimates provide evidence for the existence of pricing to market behaviour of Russian exporters, first, in wheat importing countries where Russia has a large share in total imports and/or in countries in which there are few competitors. Second, our results suggest that Russia exercised pricing to market in more countries after the export tax of 2007 and 2008 than before. The more pronounced PTM effects can be due to the fact that wheat demand far exceeded supply in this period making the wheat market a seller's market, and therefore Russia was able to exercise market power in more countries than before. Alternatively, these results may reflect Russia's need to re-establish confidence amongst their buyers following disruption of Russian supplies, and/or the need to justify the substantial investment in export infrastructure.

The residual demand elasticity approach is employed on eight countries, which are significant market for the Russian wheat using quarterly data for the time period 2002 to 2009. The RDE model is estimated for the first time using a non-linear estimator, the instrumental variable Poisson pseudo maximum likelihood estimator. This is important because the double logarithmic functional form can provide biased results in the presence of heteroskedasticity. The results of the RDE model indicate that Russia has a small market power in three countries, while behaves competitively in five countries. This confirms previous findings that imperfect competition is present in the international wheat trade. However, Russia has market power in only three. Consequently these results are consistent with the findings of the PTM model that Russian wheat exporters behave more competitively than American, Canadian, and Australian wheat exporters.

To investigate the impact of the exchange rate and its volatility on the Russian wheat export volume a gravity model is employed using annual data for the time period 2002-2010. To account for the third country effects, 10 major wheat exporting and 24 major wheat importing countries are considered. The gravity model is estimated using the Poisson pseudo maximum likelihood (PPML) estimator and two different long term exchange rate volatility measures.

The results indicate that the exchange rate has significant impact on the export in only two countries (Canada and United Kingdom). In contrast, the

exchange rate volatility has a significant effect in eight out of ten countries. However, the impact of volatility is insignificant in Russia. This suggests that the volatility does not have a high impact on the profitability of the Russian wheat export. Other factors, such as input prices, weather, and world market prices determine the Russian wheat export volume.

Regarding the contribution of Russia to the food security of the world this thesis might suggest the followings. Russia does not use price discrimination in many countries and its markup is small in other importing countries. Therefore the growth of the Russian wheat export contributes clearly to the food security. Thus the expansion of the Russian wheat export would increase the competition in the world wheat market and reduce the market power of other exporters. However the development of the Russian wheat export cannot be achieved by stabilizing the rouble, rather other policy tools could be considered.

ZUSAMMENFASSUNG

Gewöhnlich wurde der internationale Weizenmarkt als einer der besten Beispiele für perfekten Wettbewerb betrachtet. Dementsprechend gilt das Gesetz des einheitlichen Preises und alle Akteure agieren als Preisnehmer ohne jeglichen Einfluss auf den Marktpreis. Allerdings deuten die Ergebnisse verschiedener empirischer Studien darauf hin, dass diese Annahme nicht für alle Exporteure und Importeure zutrifft. Unvollständiger Wettbewerb, Preisdiskriminierung und folglich auch Marktmacht zeigen sich zumindest in einigen Segmenten des internationalen Weizenmarktes. Während vorangegangene empirische Artikel zwar die Wettbewerbsstruktur der traditionellen Weizenexportländer untersuchten, welche große Mengen an qualitativ hochwertigen Weizen in entwickelte Länder exportierten und sich dort Marktanteile sicherten, wurden bisher keine Analysen für Russland durchgeführt – ein Land, welches hauptsächlich Weizen undifferenzierter Qualität an Entwicklungs- und Schwellenländer liefert.

Des Weiteren können der Wechselkurs und seine Volatilität einen starken Einfluss auf den Weizenexport ausüben. Die theoretischen Studien sind nicht eindeutig, demzufolge ist dieser Sachverhalt eher empirisch. Empirische Arbeiten beruhen meist auf dem Gravitationsmodell und verweisen darauf, dass der Einfluss von Höhe und Volatilität des Wechselkurses auf das Exportvolumen vom einzelnen Handelsgut abhängt.

Diese Arbeit basiert auf drei empirischen Studien ("drei Essays") für den russischen Weizenmarkt. Das erste beschäftigt sich mit dem der "pricing to market" (PTM) Ansatz, welches herausfinden will, ob die russischen Weizenexporteure in der Lage sind, Preisdiskriminierung durchzuführen und ermittelt den Einfluss der Exportsteuer von 2007/2008 auf das Preissetzungsverhalten der russischen Weizenexporteure. Der zweite Ansatz beabsichtigt, die Marktmacht der russischen Weizenexporteure zu quantifizieren mit Hilfe des Residual Demand Elasticity (RDE) Ansatz. Das dritte Essay fokussiert sich auf den Einfluss von Höhe und Volatilität des Wechselkurses auf das russische Weizenexportvolumen unter Nutzung eines Gravitationsmodells. Um diese drei empirischen Ansätze (Essays) zu ergänzen und um eine tragfähige Grundlage für die Diskussion zu schaffen, liefern andere Kapitel dieser Arbeit deskriptive Analysen des internationalen und russischen Weizenmarktes und beschreiben die Theorie von Marktmacht und Preisdiskriminierung.

Die deskriptive Analyse zeigt, dass signifikante Änderungen auf dem Weltmarkt für Weizen in den letzten zehn Jahren stattfanden. Russland, ein früherer Nettoimporteur von Weizen, wurde zu einem der größten Weizenexporteure der Welt, mit einem Weizenexportanstieg von mehr als dem Zehnfachen. Während Russlands Marktanteil im Jahr 2000 gerade mal 0,5 % betrug, stieg er bis 2009 um 10,7 Prozentpunkte auf 11,2 % an. Zur gleichen Zeit sanken die Marktanteile der besten fünf und zehn Weizenexporteure jeweils von 79 % (2000) auf 62 % (2009) und von 93 % auf 84 %.

Das PTM-Modell wurde mit Quartalsdaten des russischen Weizenexports von 25 Exportzielen über den Zeitraum von 2002 bis 2010 geschätzt. Die Ergebnisse des PTM-Ansatzes weisen darauf hin, dass Russland Preisgestaltung auf den Märkten in einigen Weizenimportländern ausübt. Dies bedeutet jedoch nicht, dass Russland Marktmacht auf dem Weltmarkt für Weizen innehat. Generell wurde die russische Exportstruktur von Weizen als konkurrenzfähiger eingeschätzt als die der US-amerikanischen oder kanadischen Weizenexporteure in vorangegangenen Studien. Die Schätzungen liefern Hinweise für die Existenz von Preissetzungsverhalten der russischen Exporteure, erstens in Weizenimportländern, wo Russland einen großen Anteil der Gesamtimporte besitzt und/oder in Ländern, wo wenig Konkurrenten auftreten. Zweitens, unsere Ergebnisse lassen vermuten, dass Russland nach der Exportsteuer 2007 und 2008 Marktmacht in mehr Ländern ausübt als zuvor. Die deutlich ausgeprägten PTM Effekte können auf Grund der Tatsache, dass die Weizennachfrage das Angebot in dieser Periode weit überstieg, den Weizenmarkt zu einem Verkäufermarkt gemacht haben und demzufolge hatte Russland in mehr Ländern als zuvor Marktmacht inne. Andererseits könnten die Resultate auch Russlands Erfordernis widerspiegeln, das Vertrauen unter den Käufern wieder herzustellen, nachdem die russischen Lieferungen unterbrochen wurden und/oder das Erfordernis die beträchtlichen Investitionen in die Exportinfrastruktur zu rechtfertigen.

Der RDE-Ansatz betrachtet acht Länder, die bedeutende Märkte für russischen Weizen sind und nutzt Quartalsdaten für den Zeitraum von 2002 bis 2009. Das RDE-Modell wird erstmals mit einem nicht-linearen Schätzer geschätzt, die instrumentelle Variable ist der Poisson-Pseudo-Maximum-Likelihood-(PPML)-Schätzer. Dieser ist wichtig, da die doppelt-logarithmische funktionelle Form verzerrte Ergebnisse unter Vorliegen von Heteroskedastizität liefern kann. Die Ergebnisse des RDE-Modells zeigen, dass Russland in drei Ländern geringe Marktmacht besitzt, unter konkurrierendem Verhalten sind es fünf Länder. Dies bestätigt vorherige Modellergebnisse, dass imperfekter Wettbewerb im internationalen Weizenhandel vorhanden ist. Für Russland gilt dies jedoch nur für drei Länder. Demzufolge stimmen diese Resultate mit denen des PTM-Modells

überein, dass sich russische Exporteure wettbewerbsfähiger verhalten als US-amerikanische, kanadische und australische Weizenexporteure.

Um den Einfluss des Wechselkurses und seine Volatilität auf das russische Weizenexportvolumen zu prüfen, wird ein Gravitationsmodell angewendet. Dieses nutzt Jahresdaten für die Zeitspanne von 2002 bis 2010. Um den Drittstaaten-Effekt zu berücksichtigen, wurden zehn große Weizen exportierende und 24 große Weizen importierende Länder betrachtet. Das Gravitationsmodell wird mit dem PPML-Schätzer und zwei unterschiedlichen langfristigen Wechselkursschwankungs-Maßen geschätzt.

Die Ergebnisse zeigen, dass der Wechselkurs nur in zwei Ländern einen maßgeblichen Einfluss auf den Export hat (Kanada und Großbritannien). Im Gegensatz dazu hat die Wechselkursschwankung einen erheblichen Effekt in acht von zehn Ländern. Jedoch ist der Einfluss der Volatilität unwesentlich in Russland. Das lässt vermuten, dass die Volatilität keine große Rolle bei der Profitabilität des russischen Weizenexportes spielt. Andere Faktoren, wie Inputpreise, Wetter und Weltmarktpreise bestimmen das Weizenexportvolumen in Russland.

Hinsichtlich Russlands Beitrag an der weltweiten Ernährungssicherung könnte diese Arbeit das Folgende empfehlen. Russland nutzt keine Preisdiskriminierung in vielen Ländern und der Preisaufschlag ist in andere Importländer gering. Folglich trägt das Wachstum des russischen Weizenexports eindeutig zur Ernährungssicherheit bei, erhöht den Wettbewerb auf den Weltmarkt für Weizen und reduziert die Marktmacht der anderen Exporteure. Die Entwicklung des russischen Weizenexports kann jedoch nicht durch die Stabilisierung des Rubels erreicht werden, vielmehr sollten andere politische Instrumente in Erwägung gezogen werden.

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LIST OF ABBREVIATIONS

Comtrade	United Nations Commodity Trade Statistics Database
CPI	Consumer Price Index
CWB	Canadian Wheat Board
ERPT	Exchange rate pass trough
FAO	Food and Agricultural Organizatiom of the United Nations
FAOSTAT	Statistics Division of the Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GMM	Generalized method of moments
HHI	Herfindahl-Hirschman index
IVPPML	Instrumental variable Poisson pseudo maximum likelihood estimator
LCPS	Local-currency price stability
OECD	Organization for Economic Cooperation and Development
PPML	Poisson pseudo maximum likelihood estimator
PTM	Pricing to market
RDE	Residual Demand Elasticity
ROSSTAT	Russian Federation Federal State Statistics Service
STE	State trading enterprise
UGC	United Grain Company
USDA	United States Department of Agriculture

1 General introduction

1.1 Problem statement and motivation

Traditionally, the international wheat market has been considered as one of the best examples of a market with perfect competition. Accordingly, the law of one price would hold and all players would behave as price takers without any influence on the market price. However, the results from several empirical studies indicate that this assumption does not hold for all exporters and importers. Imperfect competition and price discrimination and thus market power seem to be present at least in certain segments of the international wheat market.

Two main approaches are employed to study the competitive structure of the wheat market in the agricultural economics literature: the pricing to market (PTM), and the residual demand elasticity (RDE). While previous empirical articles examine the competitive structure of traditional wheat exporting countries, which export large quantities of high-quality wheat to developed countries, and have established market share, no analysis has been carried out so far on Russia, a country which supplies mainly wheat of undifferentiated quality to developing and transition countries.

Furthermore the exchange rate and its volatility can have a strong impact on the wheat export. The theoretical articles are inconclusive thus, the issue is rather empirical. Empirical works are mainly based on the gravity model and indicate that the impact of the exchange rate level and volatility on the export volume is dependent on the specific commodity.

Thus the thesis is based on three empirical studies ("three essays") on the Russian wheat market. The first employs the pricing to market model to investigate whether the Russian wheat exporters are able to price discriminate. The second intends to quantify the market power of the Russian wheat exporters. The third essay focuses on the impact of the exchange rate level and volatility on the Russian wheat export volume. To complement this three empirical works and give a sound basis for the discussion other chapters of the thesis provide descriptive analyses of the international and Russian wheat market and describe the theory of market power and price discrimination.

Significant changes have taken place on the world wheat market during the last decade. Russia, a former net-importer of wheat has become the fourth-largest exporter in the end of the 2000s, whereby wheat exports increased more than

tenfold. While in 2000 Russia's market share was only 0.5 %, it increased by 10.7 percentage points to 11.2 % in 2009. This was driven by the dramatic decline of livestock which made large quantities of wheat available for export and by the emergence of modern integrated companies. Furthermore, the government investment in transport and storage infrastructure stimulated the growth of the Russian wheat export (USDA, 2010).

It is expected that the market share of Russia in the world trade will increase further, since there is still significant production potential in terms of both area and yield (FAO, 2009, p. 19; USDA, 2010). USDA expects that the country will be the biggest wheat exporter in 2019 (USDA, 2010). Furthermore, Russia has high market share in some importing countries. Its share of the import market was above 60 % in Albania, Georgia and Syria and above 50 % in Armenia, Azerbaijan and Mongolia (based on Comtrade). Some of this countries are landlocked, thus there might be few alternative sources. Thus Russia has a growing influence on the international wheat market.

On the other hand the world wheat trade has increased powerfully in the last decade and many importing countries are increasingly dependent on the wheat import. While the total wheat import in 2000 was 117 million tonnes, it increased to 140 million tonnes by 2009 (20 % increase) (FAOSTAT). The growing population and the increasing demand for meat in the developing countries drive this growth. The geographic location of wheat production and consumption diverge increasingly which induce increasing international trade. Furthermore, the import dependency ratio for wheat, i.e. the share of imports in total wheat consumption, is rather high among others in Algeria (71.5 %), Cyprus (94 %), Israel (90 %) and Jordan (96 %).

At the same time both wheat export and import became less concentrated in the 2000s. The market share of both the top-five and the top-ten wheat exporters declined from 79 % (2000) to 62 % (2009) and from 93 % to 84 %, respecttively. The share of the top five and top ten importers also dropped from 27 % (2000) to 20 % (2009) and from 44 % to 37 %.

These developments raise questions about the competitiveness of the world wheat trade. On the one hand the decrease of the concentration of the wheat export and import would suggest that the wheat trade became more competetive. However, the growing share of Russia in the world wheat market, its high share in some countries (especially in the landlocked countries), and the growing dependence of some countries on the wheat import might indicate the existence of market power and price discrimination.

Furthermore, world wheat prices were unusually high in 2007/2008. In order to secure domestic supply and protect Russian consumers from high bread

prices the Russian government introduced an export tax in November 2007 which was lifted in May 2008. This tax had a great impact on the quantity of wheat exported. However, there is no evidence whether it also influenced the pricing strategies of the Russian exporters.

The competitive structure of the international trade has been investigated previously using the pricing to market (PTM) concept of KRUGMAN (1986). PTM is third degree price discrimination and refers to the situation where the change in the exchange rates between an exporter and its buyers induces changes in the international relative prices. This is evidence of imperfect competition and price discrimination since if the exchange rate changes the relative prices than the exporter does not export always at marginal costs and the buyers pay different prices. Numerous articles tested the PTM concept based on (1989). Also the wheat market was examined and pronounced evidence of price discrimination was found (PICK and PARK, 1991; PICK and CARTER, 1994; CAREW and FLORKOWSKI, 2003; JIN, 2008 and JIN and MILIJKOVIC, 2008). However, these articles investigate only traditional wheat exporting countries (e.g. US and Canada) and no study was found about the competitive structure of a non-traditional wheat exporter. This might be important since non-traditional exporters could have different aims such as the increase of market share and building up long term trading relationships and not short term profit maximization.

The pricing to market models are able to detect if there is price discrimination considering a large number of importing countries. However, they do not show the extent of it. A complement methodology to investigate the existence of imperfect competition in international trade is the residual demand elasticity model developed by GOLDBERG and KNETTER (1999). This model is able to quantify the market power of the exporter. More specifically it investigates whether the exporter is a price maker in the importing country or its prices are defined by the competitors and the demand conditions of the respective country. On the other hand it should be estimated for each country separately and have more sophisticated data needs. Articles using the residual demand elasticity model report on different results regarding the existence of market power in the international trade. While GOLDBERG and KNETTER (1999), TASDOGAN et al. (2005), and FELT et al. (2011) find pronounced evidence of market power in the beer, olive oil and pork meat export respectively, GLAUBEN and LOY (2003) investigating the beer market conclude that exporters do not have market power. However, strong market power was observed in the international wheat market by CARTER et al. (1999), CHO et al. (2002a) and YANG and LEE (2005).

The previous studies use double log form to estimate the residual demand elasticity model, because of its easy applicability (i.e. its coefficients can be interpreted as elasticites.) However, SANTOS SILVA and TENREYRO (2006) and

TENREYRO (2007) argue that in the presence of heteroskedasticity any non-linear transformation and thus also log linearization produce biased results by constant elasticity models. Consequently, the constant elasticity models should be estimated in their original (i.e. multiplicative form). Thus, they suggest using the Poisson pseudo maximum likelihood estimator (PPML). This has two main advantages. First it estimates the model in its multiplicative form and thus it does not require taking logarithm. Second, it produces semi elasticities, which can be transformed to elasticities by multiplying with the mean of the variables. Following their arguments, the PPML estimator is employed for the first time to estimate the residual demand elasticity model.

Articles using the pricing to market and residual demand elasticity models investigate the pricing behaviour of traditional wheat exporting countries, while no article was found on a non-traditional wheat exporter. However, non-traditional wheat exporters are increasingly important in the world wheat market. For instance, Russia, Kazakhstan and Ukraine are expected to give the half of the growth of the world wheat trade in this decade (USDA, 2010).

Beside price discrimination and market power, the impact of the exchange rate and its volatility is a central question in the international economics literature. The theoretical articles conclude that positive, negative and neutral impact is possible since the competitive structure, nature of contracting and size of firms is different in the different sectors. Thus, the issue is rather empirical. Some empirical studies found that it has a significant and negative impact (e.g. ABRAHMS, 1980; THURSBY and THURSBY, 1987; FRANKEL and WEI, 1993; DELL'ARICCIA, 1998), while other reported rather positive effects (e.g. LANGLEY et al., 2000; AWOKUSE and YUAN, 2006). A third group did not see any link between exchange rate volatility and export volumes (e.g. TENREYRO, 2007). These inconsistent results may induced by the aggregation. Thus, later works focus on industry and product level. Most articles found that the exchange rate volatility has the biggest negative impact on agriculture, while both positive and negative impacts were indicated on commodities.

Furthermore, it is important to distinguish between short and long term volatility. While exporters can easily hedge against short term volatility, the impact of the long term volatility is more difficult to offset (WANG and BARRETT, 2007; CHO et al., 2002b; FERTŐ and FOGARASI, 2011). Indeed, some articles for example PERÉE and STEINHERR (1989), OBSTFELD (1995) and CHO et al. (2002b) found that longer term currency fluctuations have rather impact on trade than short term changes. However, short term volatility can still impact foreign trade due to its effect on the risk premium in the forward market (VIANNE and DE VRIES, 1992).

In the international wheat trade the short term exchange rate volatility can be mitigated by hedging, however, the long term volatility is more difficult to offset. Thus, strong long term volatility could decrease the profitability of the wheat export.

Beyond this, the level of the exchange rate could impact the export volume. For instance, a depreciation of the exporter's currency increases the competitiveness of the exporter. Thus, it is expected that depreciation stimulates the volume of the export. However, it is not clear, how important the exchange rate is in the wheat export and to what extent does it impact the export volume.

1.2 Objectives of thesis

In this context the aim of this thesis is to investigate four research questions: (1) whether the Russian wheat exporters exercise price discrimination across the importing countries (2) whether the export tax of 2007/2008 had a significant impact on their pricing 3) whether the Russian wheat exporters have market power or they are price takers in selected importing countries and (4) whether the exchange rate and its volatility impact the Russian wheat export quantity.

The thesis has the following scientific and policy contributions. First it can show the pricing strategies of an emerging, non-traditional exporter and compare it with the pricing behaviour of the traditional exporters. Second, it employs two complement methodologies thus it can give a precise picture about the competitive structure of the Russian wheat export. Third, it can indicate whether the Russian wheat exporters behave competitively and export at marginal costs or Russian exporters charge significant profit over marginal costs. This latter has implications on the food security. If the Russian wheat exporters do not use market power, their prices are at the competitive equilibrium and thus contribute to the food security. In contrast, if the Russian wheat export is characterized by high market power and thus high markups, it increases rather the poverty and hunger in developing countries. Furthermore, the thesis investigates the impact of the exchange rate on the wheat export. This signals whether the policy should mitigate the impact of exchange rate changes to develop the wheat export.

1.3 Structure of the thesis

The thesis is organized as follows. Chapter two describes the structure and main tendencies of the world and Russian wheat market respectively. Chapter three provides the theoretical background of price discrimination and market power. Afterwards, three empirical studies follow. Chapter four investigates whether the Russian wheat exporters exercise price discrimination and whether the imposed export in tax in 2007/2008 had a significant impact on their

pricing strategies using the pricing to market approach. Chapter five examines whether the Russian wheat exporters are price takers or have market power in selected importing countries employing the residual demand elasticity model. Chapter six focuses on the impact of exchange rate level and its volatility on the Russian wheat export quantity based on the gravity model. Chapter seven compares and discusses the descriptive and empirical results. The final chapter provides a summary and conclusion.

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2 DESCRIPTIVE ANALYSIS OF THE INTERNATIONAL MARKET FOR WHEAT

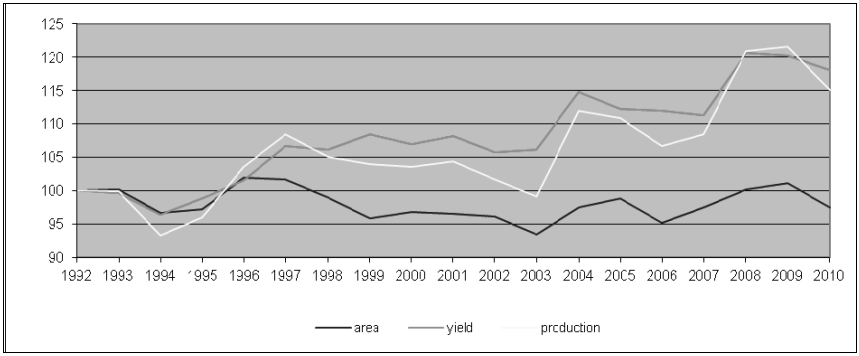
2.1 Descriptive analysis of the world wheat market

This chapter aims to describe the world wheat market to highlight the place of Russia in the international wheat trade and to show its competitive environment. The chapter is divided into three parts: production, consumption and trade; and in each part the trends of the world and the top 5 countries are discussed. Furthermore, the time period of 1992-2009 is considered because of three reasons. First, the Soviet Union collapsed in 1992. Second, Russia introduced a wheat export ban in 2010. Third, most of the data are available up to 2009. However, in some cases the analysis is finished with 2007 because of data availability.

2.1.1 Wheat production

Wheat is one of the most important agricultural products of the world and its production is growing. It was the third product in quantity and sixth in value in the world in 2009 (FAOSTAT). The world wheat production shows a significant increase since 1992, whereby the biggest growth was observed in the 2000s (Figure 2.1.). While in 1992 the wheat production was 562 million tonnes in 2002 it was 575 million tonnes, and in 2009 the world production grew to 682 million tonnes (FAOSTAT). It is a 20 % growth since 1992 and 15 % growth since 2002. The growth is a result of the increased yield, since the production area was quite stable in the last decades. The harvested area shows only 1 % increase, while the yields increased 20 % since 1992 (FAOSTAT).

Figure 2.1: Development of the world wheat production, yield and area, 1992=100



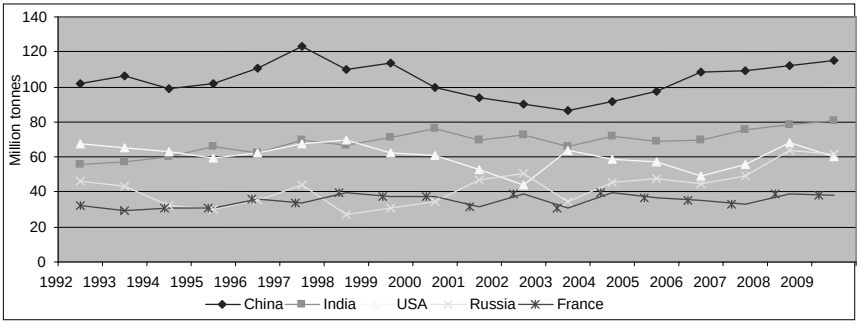
Source: Own compilation based on FAOSTAT.

The wheat is produced mainly as winter wheat in the northern hemisphere but the US, Canada, Kazakhstan and Russia have significant spring wheat production and in the Southern Hemisphere countries plant after Northern Hemisphere spring wheat. This gives the opportunity to adapt quickly to the world market conditions (USDA, 2009).

The wheat production is quite concentrated, however its extent has decreased since 1992. While in 1992 the top 5 countries produced 54 % and the top 10 countries 72 % of the total wheat quantity, these changed to 52 % and 67 % respectively by 2009.

The top wheat producer countries showed different development in the considered period (Figure 2.2). The main wheat producing countries were in the end of 2000s China, India, USA Russia, and France. Their share from the world production was 17 %, 12 %, 9 %, 9 % and 6 % respectively in 2009. The production showed a high but volatile increase in China (13 %), India (44 %) and Russia (33 %) while it decreased in the United States (-10 %) and stagnated in France since 1992 (cf. Figure 2.2).

Figure 2.2: Development of the wheat production of the top 5 countries

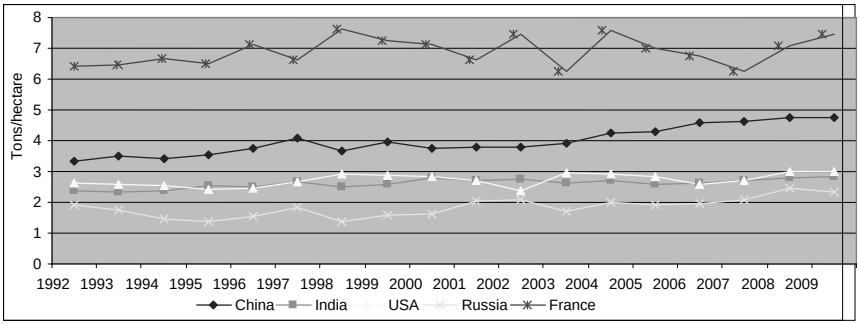


Source: Own compilation based on FAOSTAT.

The harvested area changed differently in the biggest producer countries since 1992. It decreased in China and in the USA by 20 % and it increased in India (22 %) and Russia (9 %), and was quite stable in France. In China it decreased from 31 million to 24 million hectares, in the US from 25 million to 20 million hectares, while it increased in India from 23 million to 28 million hectares and in Russia from 24 million to 26 million hectares. In France the harvested area was stable, approximately 5 million hectares.

The yields increased in all big wheat producer countries. China shows the most spectacular change (42 %), but India (18 %), Russia (21 %) and France (16 %) achieved also high yield increase (Figure 2.3). This growth of the yield is a result of the more intensive production, and use of fertilizer and pesticides. The yields are the biggest among the major producer countries in Germany (7.8 t/ha) and France (7.4 t/ha). In India, USA and Russia the production is rather extensive with 2.8, 2.9 and 2.3 tonnes/ha respectively, while in China it is in between with 4.7 tonnes/ha.

Figure 2.3: Development of the wheat yields of the top 5 producer countries

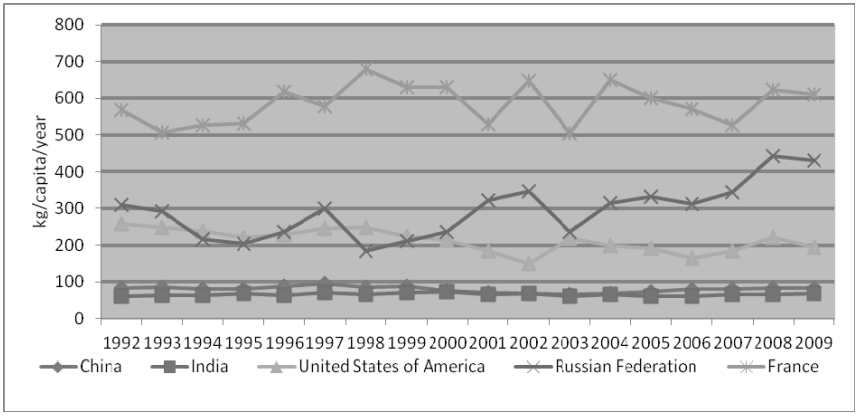


Source: Own compilation based on FAOSTAT.

However these absolute numbers do not show important details. If we take a look at the relative numbers, the per capita production, consumption and use we get a more informative picture about the wheat market.

In the wheat production per capita important differences in both the changes and the volumes can be observed (Figure 2.4). France produces the most compared to the population. The second is Russia, followed by the USA, China and India. The development in France was very volatile since 1992, there is no clear tendency. In Russia the production per capita increased significantly, while it decreased in the USA (Figure 2.4).

Figure 2.4: Wheat production per capita



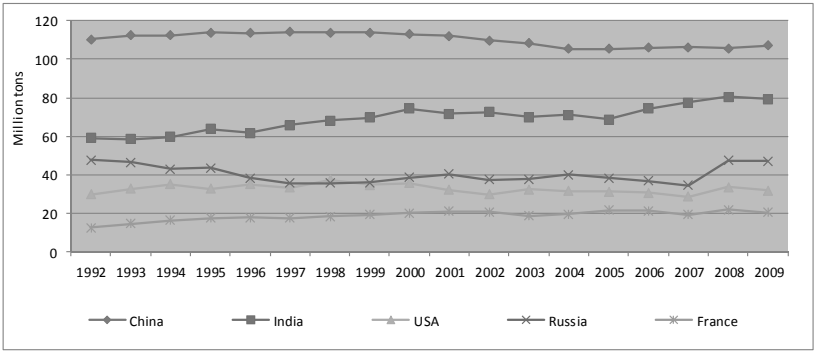
Source: Own compilation based on FAOSTAT.

2.1.2 Wheat consumption

The production growth is stimulated by the growing demand for wheat. The factors behind this are mainly the population growth and increasing affluence of people in developing countries (FAO, 2009). The world population grew by 29 % between 1992 and 2009. Beyond this, as the economy develops people have more purchasing power and demand more meat and dairy products. Thus, the demand for human consumption and feed has grown.

The wheat utilization is classified by the FAO as human consumption, feed, seed utilization, processing, waste (loss in storage and distribution) and other utilization (non-food use and food consumed by tourists). The total wheat utilization increased in the last years even more and sometimes exceeded production (Figure 2.5). In 1992 the total utilization of wheat was 532 million tonnes, by 2007 it became 602 million tonnes. This growth is mostly driven by the growth in human consumption and feed use. The former increased from 388 to 434 million tonnes between 1992 and 2007 (14 % growth). The population is growing and people with more income prefer to eat more meat, therefore the feed use increased as well (Figure 2.5). While in 1992 the feed wheat use was 83 million tonnes, in 2007 it was more than 102 million tonnes, which is a 22 % increase.

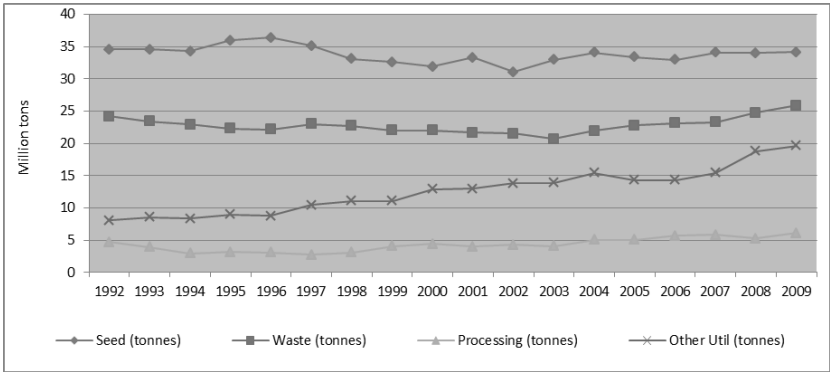
Figure 2.5: World wheat utilization and production I



Source: Own compilation based on FAOSTAT.

The seed utilization decreased slightly from 35 million to 33.5 million tonnes, while the waste decreased from 23.5 to 20 million tonnes in 15 years (Figure 2.6). The processing of wheat shows a spectacular growth from 4.1 to 9.6 million tonnes. The other utilization also increased dramatically in the period of 1992-2007 from 6 million to 13 million tonnes. However these last two are still small proportion of the total utilization.

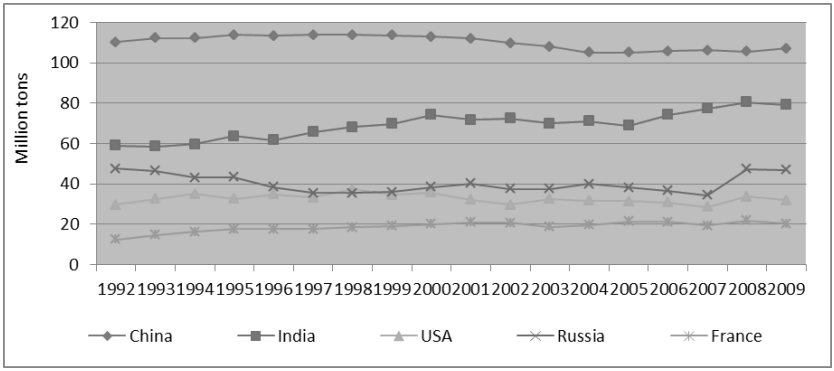
Figure 2.6: World wheat utilization II



Source: Own compilation based on FAOSTAT.

The total utilization of wheat shows different development in the first five wheat producer countries, with very different backgrounds (Figure 2.7). It decreased in China from 110 to 106 million tonnes since 1992. In contrast, the total wheat use increased in India from 59 to 76 million tonnes and France from 12 to 21 million tonnes and in the United States from 30 to 33 million tonnes. In Russia the total utilization decreased strongly in 15 years from 47 to 35 million tonnes. In China the decrease is caused by the reduced human consumption from 96 to 90 million tonnes and waste of wheat from 8 to 2.5 million tonnes, while the feed (from 300 thousand to 6.8 million tonnes) and other utilization (from 1.4 to 2.5 million tonnes) increased powerfully. This mirrors the change in the diet habits in China, growing meat consumption. In India the increase is stimulated by the human consumption mostly (from 54 to 70 million tonnes), but feed (from 688 thousands to 910 thousands), seed use (2.4 and 2.8 million tonnes) and waste (from 1.7 to 2.3 million tonnes) also increased. In Russia the huge reduction of feed use (from 18.5 to 8.5 million tonnes 54 %) resulted in the decrease of total use, while the human consumption and all the other utilizations are stable. Thus, huge quantities of wheat have become available for export, which induced dramatic expansion of the Russian wheat export as it will be shown below. In the USA the human consumption increased strongly (from 21 to 26 million tonnes), while the feed utilization decreased (from 5 to 4 million tonnes). In France the most dramatically the feed use increased (from 5.5 to 8.5 million tonnes, 54 %), but also the human consumption (from 5 to 6 million tonnes, 22 %) and the processing contributed to the increased utilization of wheat.

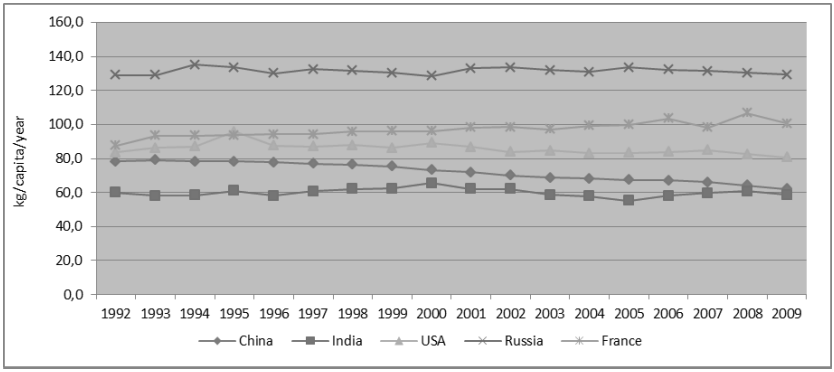
Figure 2.7: Total utilization of wheat in the major producing countries



Source: Own compilation based on FAOSTAT.

The human consumption per capita and its development is very different in the top 5 producer countries (Figure 2.8). It is by far the highest in Russia, followed by France. In the United States, India and China much less wheat is consumed per capita. The countries also show different development since 1992. In Russia the per capita wheat consumption is stable, 129 kg per capita. This mirrors the large bread consumption in the national diet. In India and the United States wheat consumption was also stable, however in the former it was volatile. In France it increased, while in China per capita wheat consumption decreased powerfully since 1992. This shows the different dietary habits of the countries and therefore the different importance of wheat.

Figure 2.8: Wheat consumption per capita



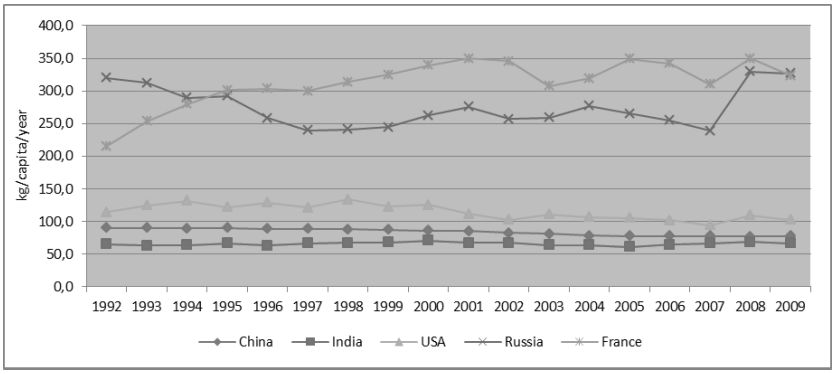
Source: Own compilation based on FAOSTAT.

The total use of wheat per capita provides a surprisingly different picture (Figure 2.9). The total use increased even more in France than the human

consumption from 216 to 323 kg/capita/year between 1992 and 2009. In Russia the total use decreased sharply from 320 to 239 kg/capita/year between 1992 and 2007, and developed to 327 kg/capita/year in 2009 as a result of a large increase of feed use. In the United States and China the decrease was smaller, while in India it did not change. In France the processing and the feed use are the cause of the large increase. In Russia the reduction of the feed utilization resulted in the huge decrease of the total use, while the human consumption was stable. In the USA the feed use decreased, however the decrease of the total use per capita is caused by the increasing population.

Furthermore, this also shows why countries with modest per capita production but also modest utilization like China are net exporters and other countries with high per capita production where the demand is also high e.g. Russia in the 1990s are net importers despite much higher per capita production.

Figure 2.9: Total utilization of wheat per capita



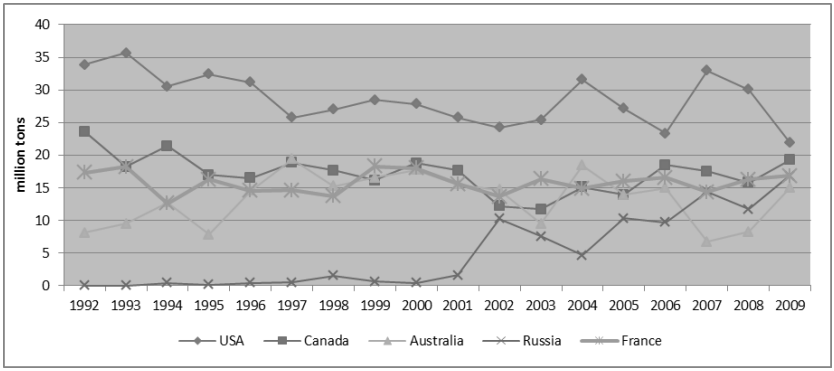
Source: Own compilation based on FAOSTAT.

2.1.3 Wheat trade

Wheat is the most traded agricultural commodity of the world in quantity (FAOSTAT). The trade of wheat is increasing, while in 2000 117 million tonnes with $14 billion value, in 2009 140 million tonnes of wheat with more than $32 billion value was sold in the world market.

The wheat export is even more concentrated than the production, however with a decreasing tendency since 2000. While the share of the top 5 from the total export was 80 % and the share of the top 10 countries was 93 % in 2000, they have decreased to the 61 % and 84 % respectively in 2009 (FAOSTAT).

Figure 2.10: Development of the wheat export

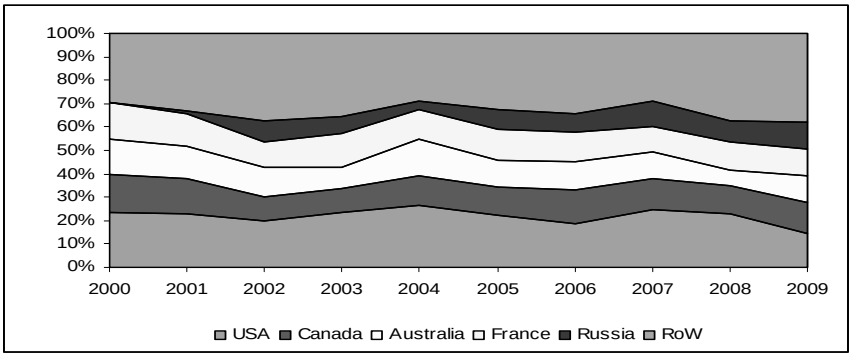


Source: Own compilation based on FAOSTAT.

The biggest wheat exporting countries were in the end of the 2000s the USA, Canada, Australia, Russia and France. The export of the top 5 countries developed differently (Figure 2.10). Russia showed a spectacular growth and the country is expected to become the main wheat exporting country of the world (USDA, 2010). The high investment inflow in the production, which induced growth parallel with the decrease of the livestock, and as a result the reduced feed wheat demand, made possible the growing export. The export quantities of the traditional exporters, the USA, France and Canada were quite volatile but decreased significantly. Australia developed its export since 1992. (Figure 2.10).

However the total export quantity has grown as well, thus the market shares developed slightly differently. The market shares of the top five countries decreased except Russia since 2000 (Figure 2.11). The USDA projects that the three non-traditional exporters: Russia, Ukraine and Kazakhstan will provide the half of the growth of the world wheat export between 2010 and 2019. The US, Canada and Argentina will decrease, while Australia will maintain their export share (USDA, 2010).

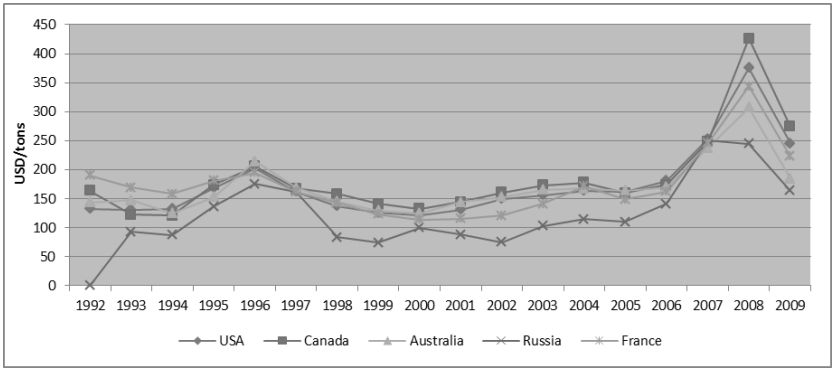
Figure 2.11: Development of the market shares of the top 5 exporters of 2009



Source: Own compilation based on FAOSTAT, Row means rest of the world.

The unit values of the exports of the top 5 exporters are quite close correlated, only Russia had a price advantage, which explains its observed dramatic export development (Figure 2.12). However, these values are aggregated and important differences can be between the unit values of exporters to different countries.

Figure 2.12: Wheat export unit value



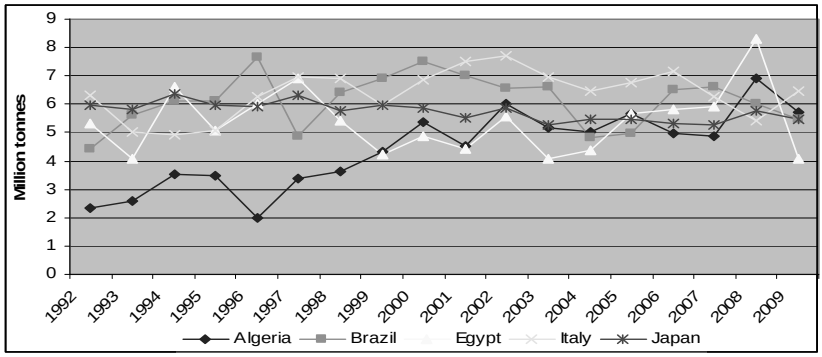
Source: Own compilation based on FAOSTAT.

Similarly to the export, important changes can be observed in the structure of the world wheat import. China and Russia were the biggest wheat importers in the 1990s, but as a result of their production growth they became net exporters in the 2000s. The major wheat importers were in the end of 2000s Italy, Japan, Egypt, Brazil, Algeria and Indonesia (Figure 2.13). The import of Italy fluctuated around 6.4 million tonnes, Japan imports less wheat (5.5 million tonnes in 2009

compared to 6 million tonnes in 1992). Egypt imports around 5-6 million tonnes wheat since 1992. Its production increased significantly, thus the import grew less powerfully despite the growing population. In contrast, the import of Brazil is growing, however with high fluctuations, it increased from 4,1 million tonnes in 1992 to more than 6 million tonnes in 2008 and 5,4 million tonnes in 2009. Algeria reached the most spectacular growth, while in 1992 the country imported 2 million tonnes in 2008 its import was almost 7 million tonnes. In the future Egypt, Algeria, Sub Saharan Africa, Middle East region, Pakistan and Indonesia are expected to experience the largest growth in import (USDA, 2010b).

The wheat import is much less concentrated than the export and this concentration is decreasing. The exporters face many counties with smaller share. While in 2000 the share of the top 5 and top 10 importing countries from the total wheat import was 27 % and 44 % respectively, it has become 20 % and 37 % in 2009.

Figure 2.13: Development of wheat import

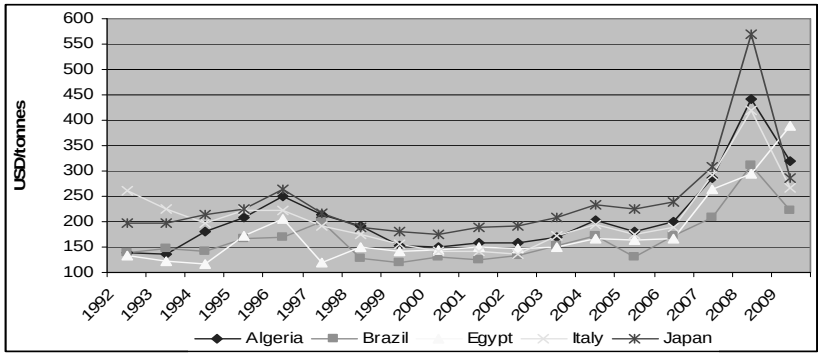


Source: Own compilation based on FAOSTAT.

In the geographic distribution of the wheat export changes are expected. In the recent years Russia is becoming the dominant exporter in Europe, Africa and the Middle East. The Russian companies are more price competitive than the other exporters. Therefore the US is looking for new export markets in South America. The production is going back in the other four big exporter countries (USDA, 2010b).

The import unit values of the biggest 5 importers show significant differences (Figure 2.14). The highest unit value has Italy and Japan. This suggests that they buy higher quality wheat than the other importer countries. Egypt and Brazil import cheaper wheat, which is assumingly not that high quality. These later two countries are developing economies and their aim is to be able to feed their population, quality is not the most important concern for them.

Figure 2.14: Wheat import unit values



Source: Own compilation based on FAOSTAT.

2.1.4 Summary of the descriptive analysis of the international market for wheat

The wheat production increased powerfully in the last two decades. The drivers of this growth are the growing demand for human consumption and feed induced by the increasing population and affluence. The main wheat producer countries in the end of the 2000s were China, India, United States, Russia and France. However, the geographic distribution of the growth of production and consumption diverges, thus the wheat trade has grown. The main exporters in the end of the 2000s were the US, Canada, Australia, Russia and France. The development of the Russian export was spectacular throughout the 2000s, which was mainly driven by the investment in production and the dramatic decrease of the livestock, which latter made large quantities available for export. The world wheat export has become less concentrated in the 2000s, which might suggest that the competition among the exporting countries increased. The main importers were in the end of the 2000s Egypt, Japan, Italy, Algeria and Brazil. The growth markets for import are Egypt, Algeria, Middle East, Indonesia and Brazil.

This descriptive analysis raises a number of questions regarding the competitive structure of the wheat market. The emergence of non-traditional exporters and the decreasing concentration of the wheat export indicate that the international market for wheat might have become more competitive and exporters are not likely to have market power. On the other hand it is still highly concentrated faces constantly growing demand, and several countries are dependent on wheat import. Thus the exporters might have market power and potentially exercise price discrimination. Furthermore the competitive behaviour of the Russian exporters is questionable since the country has established itself as a major player in the wheat market in the last decade.

2.2 Descriptive analysis of the Russian market for wheat

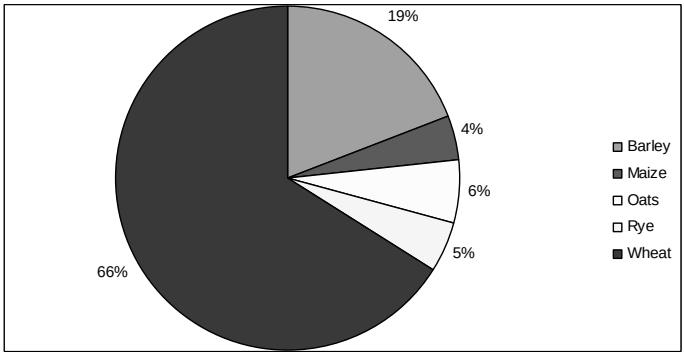
This chapter takes a closer look at the Russian wheat market. This helps to understand better the drivers and background of the development of the Russian wheat export and thus the pricing behaviour of the wheat exporters. The chapter consists of three subchapters: production, consumption and trade. In the production part also other grain products are included to show the importance of wheat in the Russian grain production. Afterwards, the patterns of wheat consumption over time are presented, which highlights why the Russian wheat export has developed in the last years. This is followed by a discussion of the development of the Russian wheat trade. As it will be indicated this three parts are highly related.

As in the world market section, the time period of 1992-2009 is considered. However in the case of the wheat trade mainly the period of 2002-2009 is discussed, since Russia emerged as a main wheat exporter in 2002. A future outlook is also discussed in order to indicate important changes which can impact the current decisions.

2.2.1 Wheat production

Wheat is the most important agricultural commodity in Russia. The wheat production was the first in quantity and the second in value after the dairy production in 2009 (FAOSTAT). Furthermore, wheat is by far the most important grain (Figure 2.15). In 2009 61 million tonnes of wheat, while only 18 million tonnes barley, 4 million tonnes maize, 5.4 million tonnes oat and 4 million tonnes rye were produced. Since 1992 only the wheat and maize production increased, while the barley, rye and oat production decreased powerfully (Figure 2.16). However, the wheat production did not show a stable growth, while it decreesed between 1992 and 1998 it increased powerfully between 1999 and 2009 but with high fluctuations.

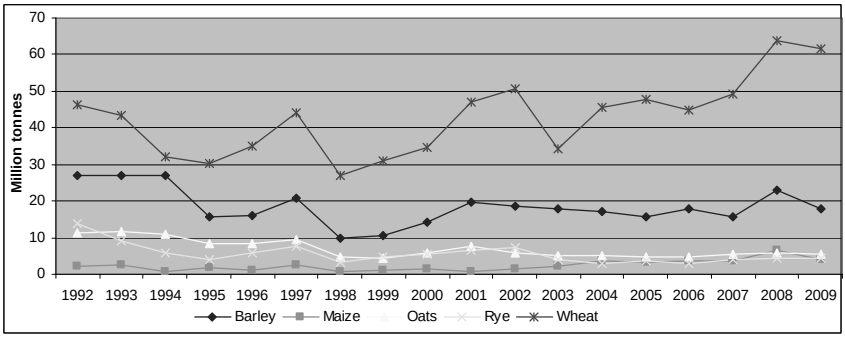
Figure 2.15: Structure of the grain production by quantity in 2009



Source: Own compilation based on FAOSTAT.

These fluctuations are caused by the climate of Russia, which is characterized by variable rainfall and temperature and severe droughts (LIEFERT et al., 2009; USDA, 2009). As it will be shown later this has a great impact on the Russian wheat export.

Figure 2.16: Development of the Russian grain production



Source: Own compilation based on FAOSTAT.

The wheat production was stimulated by the private sector investment inflow, which was attracted largely by the good export opportunities (USDA, 2010a). The investment in the agricultural in general rose by 275 % in real terms from 2004 to 2007 (ROSSTAT; LIEFERT et al., 2009). Beside the high world market prices the government investment in export infrastructure made more profitable the wheat export. The government aims Russia to become the biggest wheat exporter of the world. Therefore, it invested in domestic transport and export infrastructure. Furthermore it established the United Grain Company in 2009 to coordinate the grain export and infrastructural development (USDA, 2010a).

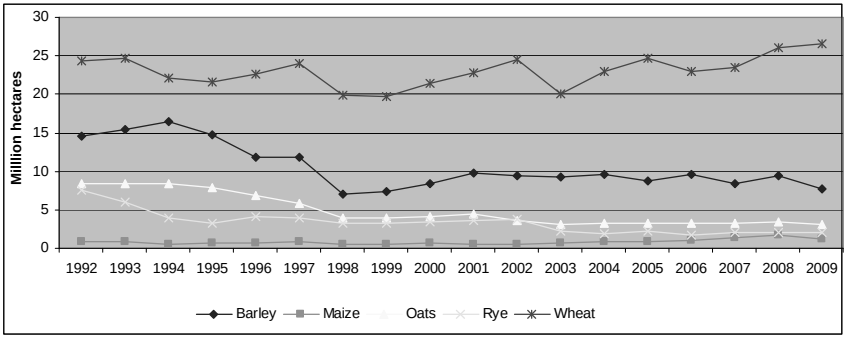
However, according to experts despite the past development, the lack of modern transport and storage infrastructure is the biggest obstacle. Thus, further investments are needed to enable the growth of the Russian wheat export (LIEFERT et al., 2010).

The most common type of farms is the corporate farm, former collective and State companies. These are largely unreformed and thus inefficient (LIEFERT et al., 2009). Some of them were bought by private investors. The private investors have transformed them often to vertically integrated firms, which combine primary agriculture, processing, and distribution. The new owners brought investment, modern technology (e.g. imported high quality seeds and machinery) and modern management (USDA, 2010a; SEROVA, 2007).

The majority of the wheat is produced in only 3 regions: Central Russia, Volga and South Regions (near to the Black Sea), in the best grain producing land (USDA, 2010a). However, only the Black Sea regions are competitive in the world markets, since because of the lack of transport infrastructure the transport costs are too high from the remote areas.

Similarly to the production, the wheat and maize area increased, while much less area is used to produce the other three grain crops than in 1992 (Figure 2.17). However, the growth of the wheat area was volatile. The wheat harvested area similarly to the production decreased in the 1990s and grew during the 2000s. In 1992 24.2 million hectares were used to produce wheat, while it was 20.3 million hectares in 2000 and 26.7 million hectares in 2009 a 10 % growth since 1992 and 24 % growth since 2000. The maize area grew (from 0.8 million hectares to 1.1 million hectares), and the harvested area of the other three grains decreased constantly (the barley area comprised 14.5 versus 7.8 million hectares, the oats 8.5 million hectares compared to 3 million hectares and the rye 2 million hectares versus 7.5 million hectares in 2009 and 1992 respectively) (Figure 2.17). The decrease of the grain area was a correction of the Soviet Union policy which pushed production to marginal lands and resulted inefficient production (USDA, 2010a). However, the high world market prices in 2007/2008 attracted interest in the re-cultivation of these lands. In order to increase the wheat production area substantially the world market prices should remain high combined with investment in the wheat production (LIEFERT et al., 2009).

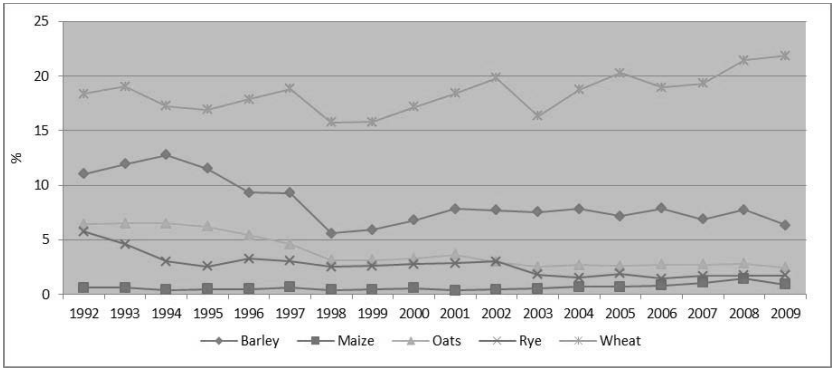
Figure 2.17: Development of the harvested area of grain crops



Source: Own compilation based on FAOSTAT.

The total agricultural area and the arable land decreased since 1992. The former was 221,6 million hectares in 1992 while in 2009 it was only 215,6 million hectares. The arable land was 132,0 million hectares and became 121,8 million hectares in 2009. The share of grain crops from the arable land changed differently (Figure 2.18). The share of wheat and maize increased (from 18 % to 21 %, and from 0.6 % to 1.4 %), while the share of the other crops decreased. The share of barley decreased from 11 % to 7.9 %, the oat and rye from 6 % to 3 % and from 5.7 % to 1.7 % in the last two decades.

Figure 2.18: Share of grain crops from total arable land



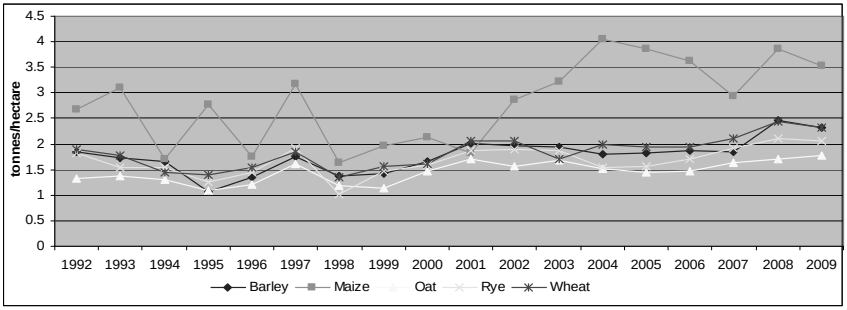
Source: Own compilation based on FAOSTAT.

The yields of all grains increased since 1992. The maize and oats reached the most spectacular development (31 and 34 %), but the yield of wheat increased also (21 %). This explains the larger growth of production in the case of wheat

and maize and modest production reduction of the other three crops compared to the change in the harvested area.

The yields of grains decreased during the 1990s, while they grew in the 2000s (Figure 2.19). In 2001-2009 compared to 1992-2000 the yield of barley was 30 % higher, the yield of oats and rye increased by 24 and 21 %. The maize yield shows the highest change, it was 42 % higher in the 2000s than in the 1900s. The wheat yield rose by 28 % in 2001-2009 compared to the yields in 1992-2000. The problem of transition, restructuring of agriculture, lack of investment and the inefficient management and decreased use of fertilizer and pesticide were the reasons of the yield decrease in the 1990s (USDA, 2010). The growth of grain yields in the 2000s was induced by high private investment inflow and as a result the increased fertilizer and pesticide use as well as investment in agricultural machineries and modern management practices (USDA, 2010a). The change from spring wheat to higher yielding winter wheat was also a central aspect of the yield development (USDA, 2010; LIEFERT et al., 2010). Further increase of the production is expected since there are significant potentials in both area and yield (FAO, 2009, p. 19; USDA, 2010a).

Figure 2.19: Yields of grain crops in Russia 1992-2009

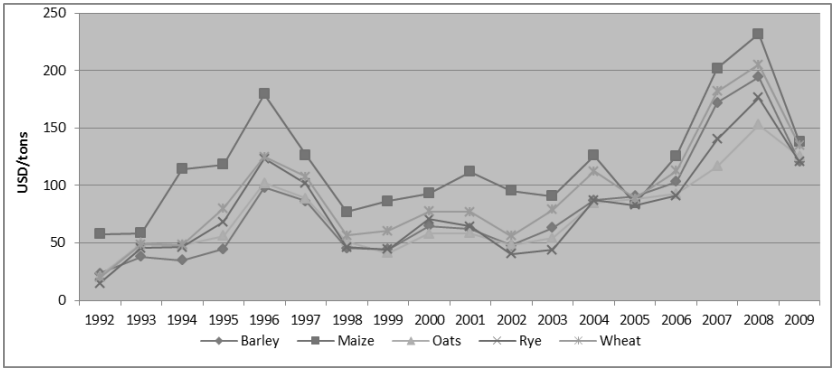


Source: Own compilation based on FAOSTAT.

The producer prices of the grain products show the reason of the production development (figure 2.20). The maize and wheat prices were higher since 1992 than the prices of other crops. Generally, the prices show similar developments with high increase in the middle of 1990s and the end of 2000s.

The main part of the winter wheat is used for bread production (2009: 76 %). From this approximately 33 % is the grade 3 wheat (protein content 13.5 %) and 42 % is grade 4 wheat (protein content is 11.5 %) (RUSSIAN GRAIN ASSOCIATION, 2010).

Figure 2.20: Producer prices of grains in Russia

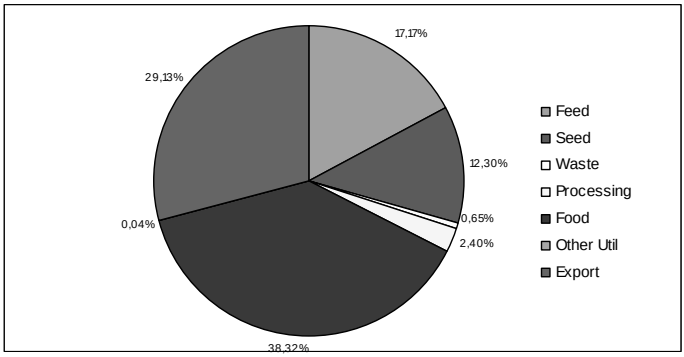


Source: Own compilation based on FAOSTAT.

2.2.2 Wheat consumption

In the end of the 2000s the food use was the most important form of wheat utilization, followed by the export (Figure 2.21). The third and fourth was the feed and seed use, with much less share from the total use. The waste, processing and other use were only a minor part of the wheat consumption.

Figure 2.21: Russian wheat utilization 2007



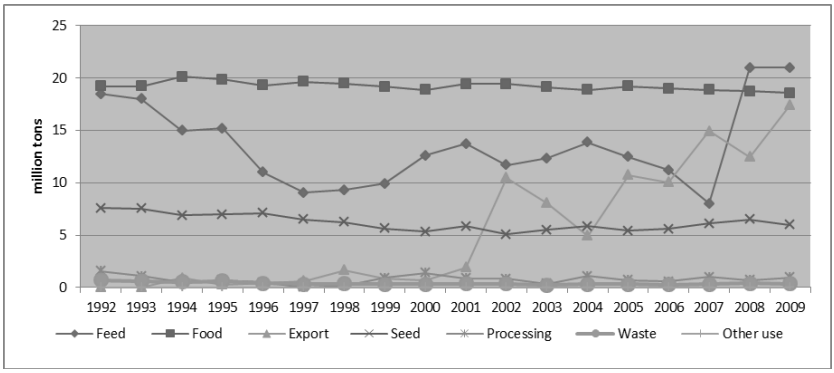
Source: Own compilation based on FAOSTAT.

However, in the last two decades powerful changes have occurred in the volume of wheat use (Figure 2.22). While the food consumption was stable in volume around 19 million tonnes, the feed use decreased sharply (from 18.5 million tonnes in 1992 to 8.5 million tonnes in 2007 (FAOSTAT).

This is the result of the contraction of the livestock after the collapse of the central planning system. The communist government developed a large and

inefficient livestock sector using high subsidies in order to increase the meat and dairy consumption and thus consumer welfare. However, the transition to the market economy indicated the competitive disadvantage of the high cost Russian meat and dairy industries. This process led to the significant decrease of the domestic production and high growth of the import in these sectors (LIEFERT, 2002; LIEFERT et al., 2009).

Figure 2.22: Development of the Russian wheat utilization



Source: Own compilation based on FAOSTAT.

This large reduction of feed made large quantities of wheat available for export. The export showed a spectacular growth, it increased from 4300 tonnes in 1992 to 16.8 million tonnes in 2009, whereby the large part of the growth has occurred since 2002. The seed use and waste decreased (from 7.6 million to 6 million tonnes and from 800 thousand to 300 thousand tonnes), and the processing and other utilization increased powerfully (from 800 thousand to 1.2 million and from 3 thousand to 19 thousand tonnes). However as argued, the last three are only a minor part of the total use. In the future, decrease of the human consumption can be expected as a result of the decreasing population. Furthermore, the Russian government supports the development of the meat production, thus the share of feed use is expected to increase.

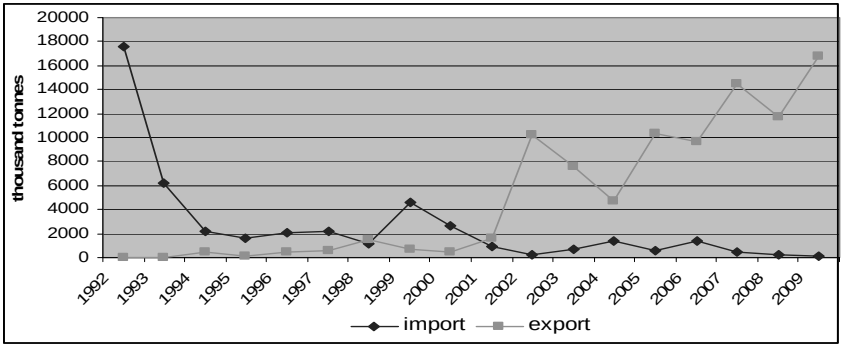
The per capita consumption of wheat is high (133 kg/capita/year) and has increased slightly since 1992. The bread and bakery products and noodles are important part of the Russian dietary culture, which explains the high wheat consumption. The growing income of the consumers induced increase in the per capita consumption.

2.2.3 Wheat trade

The pattern of the international wheat trade of Russia changed substantially in the last two decades (Figure 2.23). In the beginning of the 1990s Russia was

a net importer, in 1992 more than 19 million tonnes of wheat was imported and only 4295 tonnes exported. The import dependency ratio was 30 % in 1992. As mentioned earlier the large part of the import was feed wheat, which was used by the large and inefficient domestic meat production. This sector decreesed powerfully in the 1990s and Russia became a major meat importing country (LIEFERT et al., 2009; USDA, 2010a). In contrast, in the beginning of the 2000s the country became a net wheat exporter, in 2002 the export became 10 million tonnes and in 2009 16.8 million tonnes (FAOSTAT). Thereby, the import comprised only 94 thousand tonnes in 2009. The wheat export was a record of 30 % of the production in 2007, while in 2009 it became 27 %. As the investment in production and in export infrastructure is increasing, further export expansion is expected. Especially the development of the transport infrastructure is important since it would make the export profitable from remote areas (USDA, 2011). This would induce growth in the wheat production area and thus the export. Economists indicate that Russia can be the biggest wheat exporter of the world by 2019 (USDA, 2010a; OECD-FAO, 2010).

Figure 2.23: Development of the Russian wheat export and import



Source: Own compilation based on FAOSTAT.

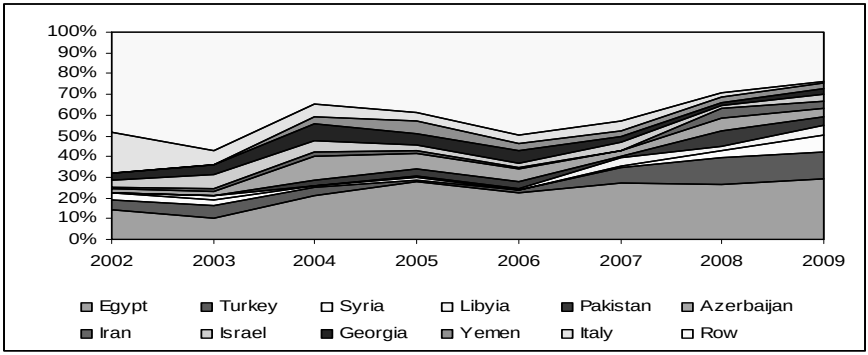
The government policies had a high influence on the Russian wheat export. Russia has applied export tax in 2003/2004 and 2007/2008. Furthermore, the government banned the wheat export in 2010/2011. These interventions were aimed to secure the domestic wheat supply and thus protect consumers from high bread prices. However, they made an unsure environment for the wheat export and impeded the sustained growth.

In the end of the 2000s, the most important export markets of Russia were from North Africa, the Middle East, Caucasus and South Europe. They include Egypt, Georgia, Libya, Tunisia, Turkey, Syria, India, Bangladesh, Italy, Azerbaijan and Greece (table 2.1). They are mainly developing countries (except Greece

and Italy) with growing population, their concern is to be able to ensure food security, therefore it is expected that they buy wheat of very similar quality and their major concern is the price.

The Russian wheat export has become more concentrated since 2002, while the share of the top 10 importing countries was 50 % in 2002 it has grown to 73 % in 2008 (FAOSTAT). However except some stable countries, the partners of Russia changed significantly over time (Figure 2.24, table 2.1). In figure 2.24 the shares from the Russian export of the top 10 partners in 2009 and a major partner of the beginning of the 2000s: Italy is presented. It points out that the share of Egypt, Turkey and Syria increased significantly, while the share of the other countries was rather volatile. The export to Italy almost dropped to zero in the last years (Figure 2.24). In contrast, the main markets of France and the United States are quite stable every year. One explanation is that France and the US have long term relationships with their buyers, while Russia has rather short term trading relationships induced by several factors (such as strong government interventions and volatile production). Another explanation can be that Russia is rather price competitor exporting mostly undifferentiated and modest wheat quality. The residual demand of undifferentiated bulk products is generally more elastic, since it is relatively easy for the buyer to switch supplier.

Figure 2.24: Development of the share of the major partners from the Russian wheat export



Source: Own compilation based on FAOSTAT.

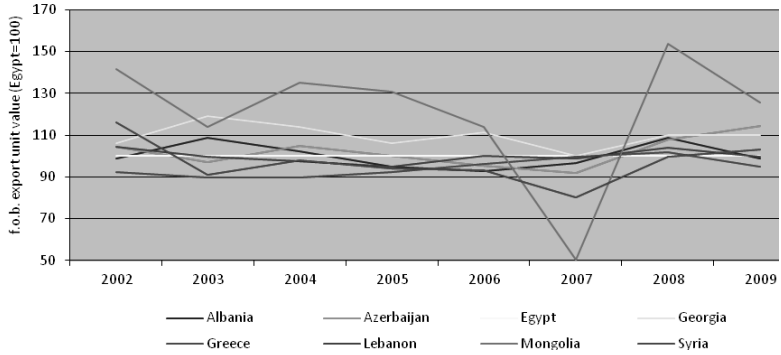
Table 2.1: The top 10 export markets of Russia

	2002	2003	2004	2005	2006	2007	2008	2009
1	Italy	Ukraine	Egypt	Egypt	Egypt	Egypt	Egypt	Egypt
2	Egypt	Egypt	Azerbaijan	Azerbaijan	India	India	Turkey	Turkey
3	Algeria	Israel	Georgia	Yemen	Bangladesh	Turkey	Pakistan	Syria
4	Greece	Italy	Italy	Algeria	Azerbaijan	Tunisia	Azerbaijan	Libya
5	Morocco	Turkey	Israel	Georgia	Georgia	Italy	Iran	Pakistan
6	Spain	Romania	Greece	Bangladesh	Italy	Bangladesh	Syria	Azerbaijan
7	Turkey	Georgia	Morocco	Morocco	Yemen	Libya	Jordan	Iran
8	Georgia	Greece	Tunisia	Italy	Pakistan	Israel	Bangladesh	Israel
9	Israel	Algeria	Lebanon	Lebanon	Greece	Jordan	Yemen	Georgia
10	Syria	Syria	Spain	Pakistan	Israel	Georgia	Tunisia	Yemen

Source: Own compilation based on FAOSTAT.

There is a significant difference in the Russian f.o.b. export unit values to the major importing countries (Figure 2.25). This can come from either price discrimination or quality differences. The econometric research presented in the next chapters will answer the question as to Russian exporters are able to price discriminate and have market power or they are rather price takers.

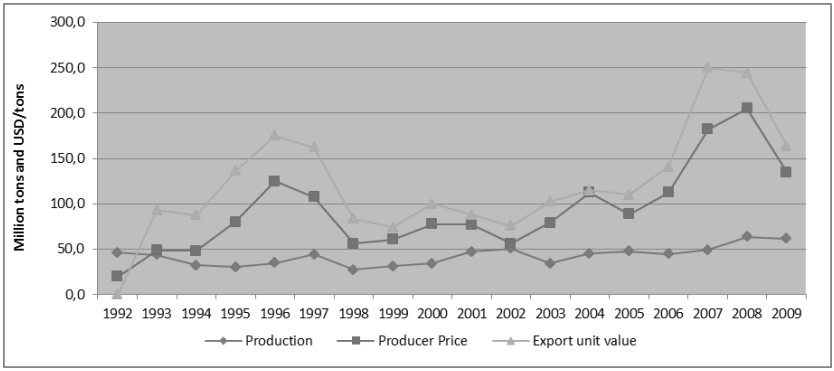
Figure 2.25: Development of relative Russian wheat export unit values



Source: Own compilation based on FAOSTAT.

Figure 2.26. shows the wheat producer prices, export unit values and production quantity between 1992 and 2008. The producer prices and export unit values are close correlated, but the export unit values are more volatile. This shows that the export prices have powerful influence on the producer prices which is modified by some external factors.

Figure 2.26: Development of the Russian wheat production and prices



Source: Own compilation based on FAOSTAT.

In the followings a brief description of the main export markets of the Russian wheat is presented. They include Egypt, Italy, Turkey, Georgia and Azerbaijan.

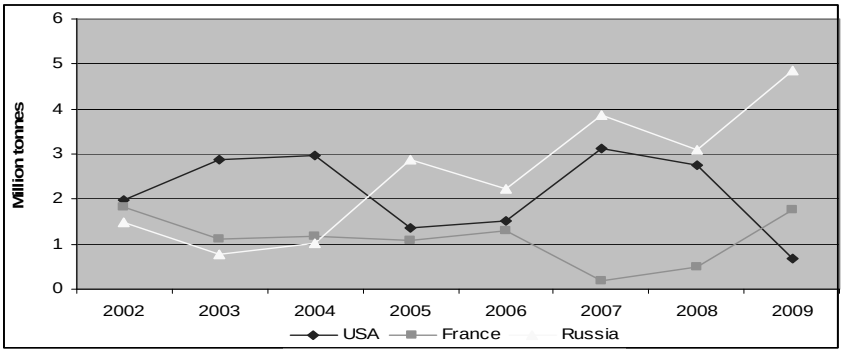
Egypt

Egypt is one of the world's biggest wheat importers and the most important market of Russia. The high wheat demand is explained by the growing population and the Arabic diet with high bread consumption. The total import of Egypt was quite volatile between 4 and 8 million tonnes between 1992 and 2009, but it was mostly approximately 5-6 million tonnes. The country was the fifth biggest in 2006 and 2007 and the biggest importer of the world in 2008 in quantity. The relative importance of the wheat import (the import dependency ratio) was high, 40-44 % in the 2000s. However, the wheat production developed strongly, from 6.5 million tonnes in 2000 to 8,5 million tonnes in 2009. This decreased its dependence on the wheat import.

The total wheat utilization increased powerfully, in 1992 it was 10 million tonnes and increased to 13 million tonnes in 2007. The lion share of wheat is used as food (10,9 million tonnes in 2007), and for feed 1,1 million tonnes in 2007.

The exporters to Egypt are the USA, France and Australia and Russia (Figure 2.27). The figure shows that before 2005 the US was the main exporter to the country, however its export started to decrease.

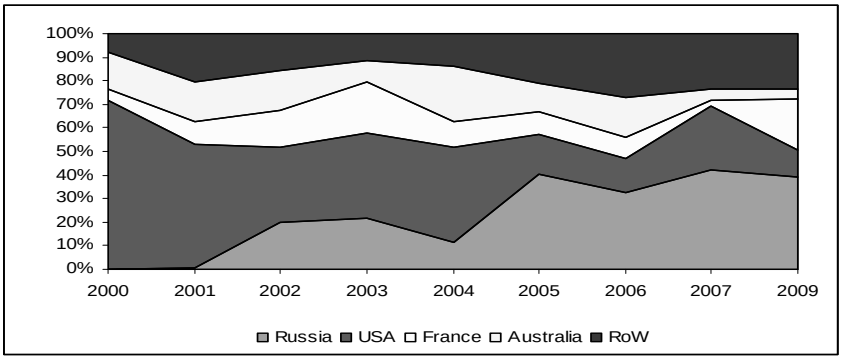
Figure 2.27: Development of the wheat export of the major partners to Egypt



Source: Own compilation based on COMTRADE.

The share of Egypt from the Russian wheat export has grown from 14 % in 2002 to 29 % in 2009 and is the main export market of Russia. Similarly, Russia is the major supplier of Egypt since 2005. Its share increased from 0% in 2000 to 19 % in 2002 and to 41 % in 2005 and remained in the same range in the considered period (Figure 2.28). This rapid growth was driven by the significant price advantage of Russia as illustrated in Figure 2.29.

Figure 2.28: Development of the market shares of the top exporters in Egypt

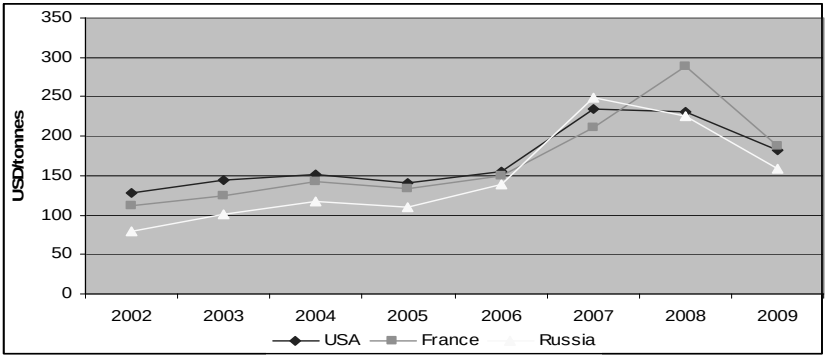


Source: Own compilation based on FAOSTAT, the data were not available for 2008.

The main part of the wheat import is organized by a state company the General Authority for Supply Commodities (GASC) (USDA, 2010a). The wheat is sourced in the form of tenders.

As Egypt has a large poor population, it is expected that the high wheat quality is not the first concern for the country. Therefore the main wheat exporters to Egypt are price competitors and they do not difference their product by quality.

Figure 2.29: The wheat export unit values to Egypt 2002-2009

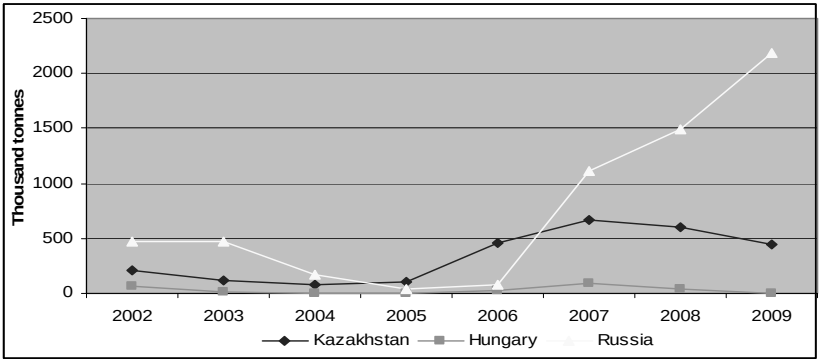


Source: Own calculation based on COMTRADE.

Turkey

The wheat import of Turkey increased from 963 thousand tonnes in 1992 to almost 4 million tonnes in 2008, however it was very volatile. The Russian export to Turkey started to increase in 2007 and in 2009 it was more than 2 million tonnes (Figure 2.30).

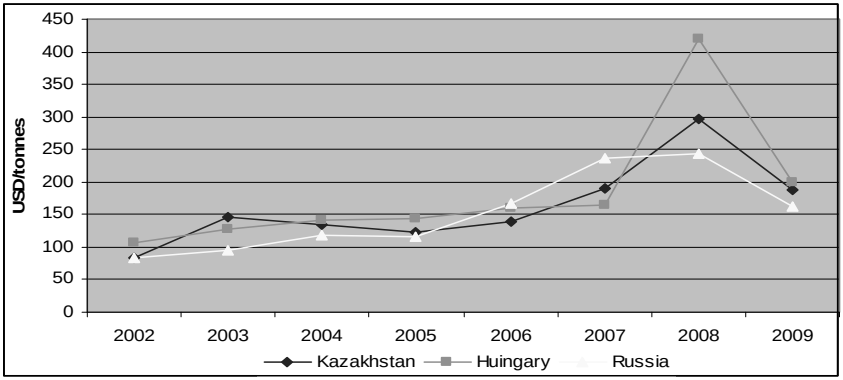
Figure 2.30: Development of the wheat export of the major partners to Turkey



Source: Own compilation based on COMTRADE.

The export unit values indicate that Russia has a price advantage in most years, and Kazakhstan is its biggest competitor in Turkey (Figure 2.31). This is plausible, given the geographic proximity of the two countries.

Figure 2.31: Wheat export unit values to Turkey, 2002-2009



Source: Own compilation based on COMTRADE.

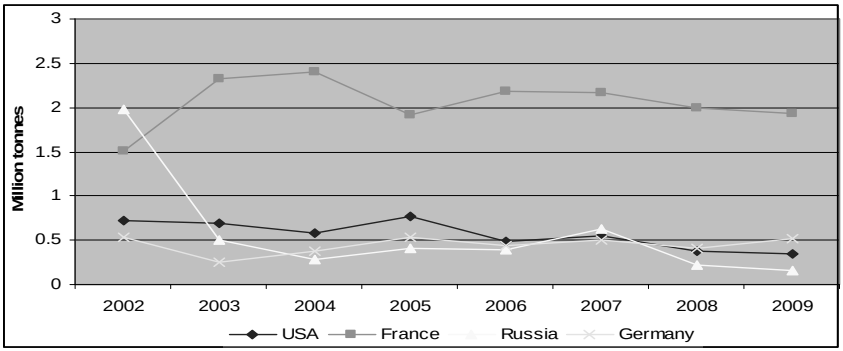
The Turkish wheat production shows high volatilities during the 2000s, the production varied between 21 and 17 million tonnes. The production almost always equals the domestic consumption, the import approximately is the same as the exports, which shows the potential significance of intra-industry trade and wheat re-export. Since Turkey has good access to the seas, this is not surprising. The wheat utilization was rather stable during the 2000s.

Italy

The country was the most important export market for Russia in the beginning of the 2000s, but its import from Russia dropped to almost zero in the end of the 2000s. Surprisingly, the unit values of the Italian wheat import from Russia are less than of Egypt, despite of the difference in the countries development. One explanation is that the Russian wheat in Egypt is used as a food, while in Italy it is mainly feed.

The main sources of wheat for Italy have been during the 2000s France, the United States, Canada, Russia and Germany (Figure 2.32). The wheat export of Germany and US remained quite constant in the considered period, while the French and Russian wheat export decreased dramatically. Furthermore, Russia exported at significantly smaller prices than the competitors (Figure 2.33). Thus, it is assumed that Russia sells mainly feed wheat to Italy, while the other countries might export rather food quality.

Figure 2.32: Development of the wheat export of the major countries to Italy

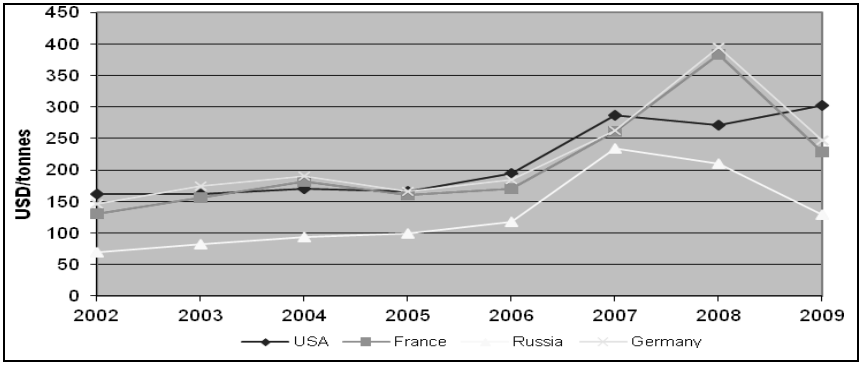


Source: Own compilation based on COMTRADE.

The wheat production was volatile in the 2000s, it changed between 6 and 8 million tonnes. The import followed the volatility of the production and varies also between 6 and 8 million tonnes between 2000 and 2008. The total wheat utilization increased slightly, mostly as a result of the increase of the feed utilization. The Russian export to Italy increased to the maximum of 1.9 million tonnes in 2002 and 600 thousand tonnes in 2003 and stabilized between 400 and 500 thousand tonnes in the following years. (Figure 2.32.)

Interestingly, Italy exports approximately 3 million tonnes a year as well. Therefore the high amount if import wheat can be re-exported, or Italy might export his own wheat and import foreign wheat instead driven by quality differences.

Figure 2.33: Development of the export unit values to Italy 2002-2009



Source: Own calculation based on COMTRADE.

Georgia

Georgia has been among the main buyers of the Russian wheat during the 2000s. It imported 300-400 thousand tonnes of wheat in the last years, which was the approximately 50 % of the total import of Georgia. The importance of Russia as wheat supplier originates from the proximity of the country. The other main wheat supplier is Kazakhstan.

The production was very volatile but decreased powerfully in the last years. The import dependency ratio was high, approximately 76 % in the 2000s and has increased in the last years. Thus Georgia seems to be an important trading partner for Russia in the future as well.

Azerbaijan

The wheat import market of Azerbaijan is characterized by a duopoly with Russia and Kazakhstan as major competitors. The import market share of Russia was 51 % while the share of Kazakhstan was 44 % between 2002 and 2009. The country imported approximately 500-800 thousand tonnes of wheat from Russia in the end of the 2000s. Its import dependency ratio was quite high, 39 %. The wheat production was 1.5-2 million tonnes between 2002 and 2009. Russia has small transport costs to Azerbaijan because of its geographic proximity and thus it is very competitive in the Azeri wheat market.

2.2.4 Grain transport

There are no official data on the capacity of the Russian grain export terminals. However, the USDA Foreign Agricultural Service in Moscow has published estimates of this capacity (USDA, 2011). According to this report the capacity of the Russian ports is approximately 25 million tonnes per year. The major ports include This estimate includes deep water ports on the Black Sea, shallow water ports of the Volga-Don basin and Azov Sea, insignificant port capacity on the Caspian Sea and in the Russian Far East. Russian traders may also export trough the deep water ports of Ukraine and through some ports of the Baltic countries, but the competition with the Ukrainian and Kazakh wheat is high. There are two major ports in the Black sea, the Novorossyisk (export capacity 11.5 million tonnes per year) and Tuapse (export capacity 2.5million tonnes per year). The most important shallow water ports are Rostov-on-Don, Eysk, Azov, Temryuk, Kavkaz, Taganrog. Besides, there are several Volga-Don river terminals (USDA, 2011).

However, the major obstacle for the growth of the Russian wheat export is the railway transport. Due to inappropriate management, bureaucracy and high prices, it is very expensive to transport the wheat from remote areas to the ports (USDA, 2011). For example, while for transport with trucks the traders need one

document, for the transport with rail they need nine documents. Furthermore there is a strong competition with the Kazakh grain and other Russian products for the railway transport. Thus, the transport of wheat from e.g. Siberia to the export ports is 50-67 USD per tonne, while from Southern European Russia it is less than 17 USD per tonnes. Thus, despite of the small producer prices in Siberia, the wheat can not be exported profitably.

2.2.5 Summary of the descriptive analysis of the Russian market for wheat

The wheat is the most important grain of Russia. The wheat yields, harvested area and consequently the production decreased throughout the 1990s and increased in the 2000s. The reasons of this change are the private investment inflow in wheat production attracted by the improved export profitability and the government investments in export infrastructure. The investors bought big state or collective farms and created modern, often vertically integrated companies. This new type of farms is characterized by modern technology and management and increased and higher quality input use (seed and fertilizer). Beside the production growth the decrease of the livestock and thus the feed use made large quantities of wheat available for export.

As a result in the 2000s Russia became a major exporter and can be the biggest exporter of the world in the end of the 2010s. However, further investments in the transport and storage infrastructure are needed. Thus, in the short run the Russian export cannot increase significantly despite the higher prices. The main markets for Russia are Egypt, Italy, Turkey, Azerbaijan and Greece. In some countries Russia dominates the market. The wheat export prices to different countries suggest that the market is imperfectly competitive.

The descriptive analysis of the Russian wheat market and trade indicates important characteristics of the competitive structure of the Russian wheat export.

The growth of the Russian wheat production together with the powerful decreese of the domestic demand made large quantities of wheat available for export. Thus the country has become a major wheat exports with constantly growing market share. Moreover Russia is the dominant supplier of several importing countries. This would suggest that the country might exercise market power. However, Russia offers often lower prices than its competitors and has no stable trading relationships. This indicates that the structure of the Russian wheat export is rather competitive and the Russian wheat exporters are price takers.

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3 IMPERFECT COMPETITION AND THE IMPACT OF EXCHANGE RATE VOLATILITY IN INTERNATIONAL TRADE: THEORIES AND APPLICATIONS

This chapter describes the theoretical concepts of imperfect competition in international trade and introduces the pricing to market and residual demand elasticity approaches in order to make a sound bases for the three subsequent empirical essays.

3.1 Pricing behaviour and international trade

In the neoclassical trade theory perfect competition and integrated markets were assumed. This assumption means that all economic actors are a small part of the market. Therefore, the firms do not have any influence on the price, rather they are price takers. Furthermore, as markets are integrated the geographic location and nationality of the buyers does not affect the price of identical goods (GOLDBERG and KNETTER, 1997). Thus, the price of identical goods is the same (net of transportation cost), in other words the law of one price holds. Any price difference would be eliminated by the arbitrage.

In contrast, the new trade theory, based on the results of the new industrial organization, suggests that international trade is often characterized by segmented markets, imperfect competition and oligopolistic market structures. Thus, the firms have influence on the price and consequently they are price makers. The market is segmented if the location and nationality has a systematic influence on the price of the transactions (GOLDBERG and KNETTER, 1997). This can be the result for example of trade policies and quality standards. (GOLDBERG and KNETTER, 1997).

The segmented markets do not lead to the balance of prices. These can induce price discrimination as the optimal decision of a profit maximizing exporter. There are three forms of price discrimination (PIGOU, 1920). In the first degree (or perfect) price discrimination a seller charges different price from different buyers and different price for the different quantities of the product. If a seller applies second degree price discrimination, it sets different prices for different quantities of a product but the price is the same for all costumers. Third degree price discrimination is present if the price of identical goods is different for different group of buyers, but it is the same for all quantities (VARIAN, 2006) This latter is called also as interpersonal price discrimination (STOLE, 2007). In the context of international

trade segmented markets induce third degree price discrimination. For example if Azerbaijan and Armenia pay different prices, net of transportation costs, for the same quality of Russian wheat, there is third degree price discrimination.

According to VARIAN (1989) there are three preconditions of price discrimination. First, firms have market power. Thus, they set prices above marginal costs. Therefore, the market structure cannot be perfectly competitive. Rather there is monopoly or oligopoly. Second, firms can sort customers. They can set different prices according to the demand of the costumers. Third, arbitrage is costly. Buyers cannot easily resale the products and thus balance the price difference. This induces difference in international relative prices.

As argued above, market power is essential to price discrimination. Market power is defined by LERNER (1934) as the ability of a firm to charge price above marginal costs. Based on this definition it is measured by the Lerner index (or relative markup): L=(P-MC)/P, where P is the price and MC is the marginal cost of a unit of output.

There is an important link between the integration and segmentation and the competition (GOLDBERG and KNETTER, 1997). First, any perfectly competitive market must be integrated since price equals marginal costs. Second, integrated markets may or may not be competitive. A monopoly supplier may charge a common markup in all markets, when it is not able to price discriminate. Third, segmented markets are characterized by imperfect competition since price does not equal marginal costs. If the market is segmented the sellers can price discriminate.

In both perfectly and imperfectly competitive markets the optimal price depends on the marginal cost of the seller (exporter) and the residual demand elasticity facing the seller in the importing country. The residual demand elasticity is the difference between the market demand elasticity and the supply elasticity of the competitors (VARIAN, 2006). The following equation describes the optimal pricing behaviour of an exporter (after KNETTER, 1989):

$$p_{it} = MC_t\left(\frac{\varepsilon_{it}}{\varepsilon_{it}-1}\right) \tag{3.1.}$$

Where p_{it} is the price for buyer i in time t, MC_t is the marginal cost of the seller in time t, ε_{it} is the residual demand elasticity facing the seller.

In perfectly competitive markets the residual demand elasticity is infinite. Thus the price equals marginal costs. The seller faces a flat demand schedule, thus it can sell any quantity at the market price, but is not able to sell above the market price. However, in imperfectly competitive markets the residual demand elasticity is finite, thus sellers face a residual demand with a negative slope and thus charge a markup over marginal costs. The markup is shown

by $\left(\frac{\varepsilon_{it}}{\varepsilon_{it}-1}\right)$. Buyers with less elastic residual demand face higher prices than buyers with more elastic residual demand. Thus, the markup is influenced by the market demand and the supply of competitors. Generally, in markets with strong competition the prices are closer to the marginal costs than in markets which are characterized by the existence of a dominant firm (VARIAN, 2006).

This formula can be used to describe the optimal pricing of a price discriminating monopolist (VARIAN, 2006). In the case of third degree price discrimination the exporter sells to different buyers for different price. The exporting country faces different residual demand elasticity in different countries. In the optimum solution the common marginal cost should equal to the marginal revenue in each market (equation 3.2). Thus, the marginal revenue in each market should be the same in equilibrium.

$$\begin{aligned} MR_{it}(y_{it}) &= MC_t(y_{1t} + y_{2t} ..... + y_{nt}) n \neq j \\ MR_{jt}(y_{jt}) &= MC(y_{1t} + y_{2t.} ... + y_{nt}) n \neq i \end{aligned} \tag{3.2}$$

Using the formula described in equation 1 we get:

$$p_{it}(y_{it})\left[1-\frac{1}{|\varepsilon(y_{it})|}\right] = MC(Y_1 + y_2 ..... + y_n) = p_{jt}(y_{jt})\left[1-\frac{1}{|\varepsilon(y_{jt})|}\right] j \neq i \tag{3.3}$$

After rearrangement we get:

$$\frac{p_{it}(y_{it})}{p_{jt}(y_{jt})} = \frac{|\varepsilon_{jt}(y_{it})|}{|\varepsilon_{it}(y_{it})|} \tag{3.4}$$

This shows that if price in importing country i is bigger than price in importing country j the residual demand elasticity should be bigger in country j than in country i. In other words the country where the residual demand is more elastic has the smaller price. This is plausible since the more elastic residual demand is more price sensitive. Therefore, the exporting country which has market power will set higher price for the relatively price insensitive country (VARIAN, 2006)

In the context of international trade the demand facing an exporter depends on the local currency price of the product. However, the main costs of the exporter are in the currency of the exporter. Thus, the exchange rate changes play a central role in the profit maximising problem of the exporter. Therefore, the first equation is modified to incorporate the exchange rate:

$$p_{it} = e_{it} MC_t \left(\frac{\varepsilon_{it}}{\varepsilon_{it}-1}\right) \tag{3.5}$$

Where e_{it} is the bilateral exchange rate between the exporter and country i in time t.

Thus, this equation shows that the exchange rate changes the marginal costs of the exporter in terms of the currency of the buyer. Therefore the exchange rate changes influence the optimal export price. The equation also indicates the potential reaction of the exporter on the exchange rate changes. If the market is competitive (the residual demand elasticity is infinite) the price equals marginal costs, than any change in the exchange rate is completely passed through in the prices. For example if the currency of the exporter depreciates (appreciates) by 3 % the export price in terms of the local currency falls (rises) by 3 %.

However, if the market is imperfectly competitive the impact of the exchange rate on the export price depends on the characteristics of the residual demand. First, if the elasticity of the residual demand is constant, the pass-through is full. The markup of the exporter is constant. Second, if the residual demand becomes more (less) elastic as the local currency prices rise (fall), the exporters offset the impact of the exchange rate. The literature termed this as local currency price stabilization (e.g. KNETTER, 1989, 1993). In this case an appreciation (depreciation) of the currency of the exporter results in a smaller rise (fall) in the local currency. For example, if the currency of the exporter appreciates (depreciates) by 3 %, the local currency export price rises (falls) by less than 3 %. Therefore, the markup of the exporter decreases. Third, if the residual demand becomes less (more) elastic as the local currency prices rise (fall) the exporters amplify the impact of exchange rate changes. For example, if the currency of the exporter appreciates by 3 % the prices rise by more than 3 % (KNETTER, 1989). Therefore, the markup of the exporter increases.

However, the markup can be maximum the difference between the own marginal costs and the marginal cost of the competitors including the transportation and other costs of supplying a given market (equation 3.6). If the markup would be bigger than this difference, the buyer would have an incentive to change. Of course if the exporting country is a monopoly supplier, this constraint does not hold.

$$MC_{it}^{c} + t_{it}^{c} - MC_{it}^{e} - t_{it}^{e} \geq M_{it}^{e} \tag{3.6}$$

Where t is the transaction costs, the cost of supplying the market.

3.2. Market share and pricing behaviour

The concept of several firms in Cournot equilibrium is useful to explain the relationship between price setting and market share. In the Cournot oligopoly companies decide on the quantity. If there are n firms in the market and the total quantity is Y it can be shown that the optimal price is given by

$$p(Y)_{it}\left(\frac{1}{\frac{\varepsilon_{it}}{s_{it}}}\right) = MC_t(y_{it}) \tag{3.7}$$

Where s is the market share.

This shows that the smaller the market share of the given company is the more elastic the residual demand it is facing. If the market share is 1, the company is a monopolist and the residual demand is the market demand. If the market share is close to zero, there is perfect competition, and the residual demand is effectively flat (after VARIAN, 2006).

In the new trade theory the competition between firms is often termed as monopolistic competition (e.g. KRUGMAN, 1979) Monopolistic competition assumes the existence of product differentiation and oligopolistic market structures. Since the products are differentiated they are not perfect substitutes. Thus the sellers face residual demand with a negative slope. Consequently, they can increase their price above the marginal cost and thus are price makers. However, they should compete with other sellers which sell similar but not identical products in both price and product variety. Thus, the market has some characteristic of both monopoly and perfect competition (VARIAN, 2006).

The wheat market is characterized by monopolistic market structures. The wheat is not a homogenous product, different wheat quality is used for different uses (e.g. LAVOIE, 2005). Furthermore, wheat for the same use can have different characteristics such as protein content, milling quality and moisture. Some of these characteristics depend on the soil and climate of the production area. Thus wheat for the same use from different countries are not perfect substitutes.

3.3 The sources of price discrimination

The sources of price discrimination are connected to the preconditions and can be the followings. Exporters are able to sort customers only if the market is segmented. Furthermore, market segmentation can make impossible or at least difficult the resale. The market segmentation can be due to geographic, infrastructural political and economic – business reasons. The geographic reason is intuitive, for example a country is not connected to the world market because

of its geographic characteristic such as the lack of seaports (Kazakhstan, Belarus). The infrastructural reason includes cases when the lack of transport infrastructure prohibits the integration to the world market, e.g. CIS countries where there is no developed rail transport. Further very important sources of price discrimination are political. They include export – import restrictions, preferential agreements, and trade subsidies. These result in different payoffs for exports to different destinations. The economic – business reasons consist of, among other, the contract terms. These terms can define the timing of the delivery, dates and method of the payment. Contracts can also explicitly prohibit resale of the product. Thus they can prevent arbitrage. A further possibility is product bundling. Sellers might give discounts if different products or different quality segments of one product is purchased by the buyer. Furthermore, the quantity influences significantly the price. Therefore, one could argue that these conditions are enough to differentiate. As a result transactions about the same quality of wheat can be very different. These differences could be comparable with product differentiation.

Furthermore, as it was argued, one precondition of price discrimination is market power. Market power can come, among others, from quality differences. For example a seller can have market power if he supplies products of different quality. Different quality classes of a product, which have often different end use, are not direct substitutes. Therefore the demand for these different quality products differs. Usually, the demand for more expensive products is more inelastic (KNETTER, 1989). For instance buyers of high quality wheat for premium pasta are willing to bear higher price increase as buyers of modest quality. The competetion is also more intensive for the suppliers of bulk products than for the suppliers of high quality differentiated products. However, the difference in quality sometimes causes pseudo price discrimination. As KNETTER (1989) and LAVOIE (2005) argue the exchange rate movements might affect the quality what a buyer demands. For example if the currency of a buyer appreciates, the product will be cheaper in the buyer's currency. Therefore, the bilateral trade might consist of larger quantity of high quality products than before. Thus, the correlation of unit values with exchange rates does not give always a proof for price discrimination.

A further reason is the market structure according to several authors. It is expected that in export markets where there are many small players none of them has market power. There is more room for price discrimination in concentrated markets. Exporters who have a high share of the market of a country might have power to price discriminate. In contrast countries having a large share of the total export of another country might have monopsony power to get better prices. The exporter might depend on them in the absence of

alternative export markets. PICK and PARK (1991) have found that China and the Soviet Union got discounts from the United States for wheat import.

Exporters might invest in infrastructure to supply specific countries (e.g. seaports, rail transport). These costs can be viewed often as sunk costs if the infrastructure can be used only to supply a country or a group of countries. This can be found also in the importer part when an importer builds infrastructure to import from a specific group of countries and it cannot use this if he buys form a different supplier. Therefore these sunk costs can cause rigidity of the trading relationships as they might decrease the price elasticity of both supply and demand.

3.4 Pricing to market

KRUGMAN (1986) introduced a special form of third degree price discrimination, which he termed pricing to market (PTM). PTM is exchange rate induced price discrimination and occurs when the change in bilateral exchange rates between an exporter and its buyers change the ratio of prices paid by the buyers. Krugman argues that when the US Dollar depreciates the import prices do not rise always in proportion and as a result the international relative prices change. This is evidence of imperfect competition, because if the exchange rate pass through is not complete, the price cannot always equal marginal cost. Therefore the price contains a destination specific markup over marginal cost. Exporters price their products according to the characteristics of the different importing countries.

Furthermore, it assumes that the exchange rate change does not change the costs of the exporter in own currency. If the share of the imported inputs is high the depreciation of the exporter currency increases the production costs and thus the export price.

Another important condition is that the international relative prices do not change. If, for example, the currency of the exporter depreciates and consequently the local currency price in the importing countries decrease it might induce increase in demand. If the exporter is not able to adjust the production in the short term it causes increase of the price in all markets. Thus, the price in the importing country does not decrease in proportion with the depreciation, but the international relative prices do not change (KRUGMAN, 1986). For example if the Russian rouble depreciates in terms of the Egyptian pound, Egypt might import more wheat from Russia. Since Egypt is the major buyer of Russia, the wheat price in Russia and in all of its partner countries might rise. Thus, the price will rise in Egypt too. This is an example where the exchange rate pass-through is not full but it is not pricing to market.

However, the observed pricing to market effects can be induced by other factors than market power and segmented markets. One cause is the existence of adjustment or menu costs, when exporters face cost of changing their prices

(GOLDBERG and KNETTER, 1997; GERVAIS and LARUE, 2009). In these cases small exchange rate changes are not passed trough in the local currency import price. Furthermore, long term contracts in the buyer and third currency can also induce incomplete pass-through and pricing to market effects in the short run (GOLDBERG and KNETTER, 1997 and GLAUBEN and LOY (2003). These can induce pricing to market al.so in perfectly competitive market.

Another reason can be that the prices are fixed in short term in a common currency (e.g. USD) because of the competition. However, in the long run the exporters are able to pass-through the differences. Another possibility is that in the case of rouble depreciation the Russian companies do not decrease the local currency price. In the long run other Russian firms start to export to the given country, thus the local currency price will adjust.

In the wheat market the long term contracts or menu costs are not reasonable, thus these do not result in PTM. The wheat prices are set on a daily basis and long term contracts are not common. Thus, exchange rate changes can be mirrored in the export price easily.

Based on the concept of pricing to market empirical studies were conducted in both partial and general equilibrium settings. The latter includes for example BETTS and DEVEREUX (2000). In the context of partial equilibrium studies several authors have found evidence of pricing to market in different countries and industries. For example KNETTER (1989 and 1993) found price discrimination in the trade of some food and industrial products (like breakfast cereals, automobile and chemicals). GAGNON and KNETTER (1995) reported also on discriminative pricing of the Japanese and German auto exporters. FALK and FALK (2000) observed PTM in the case of German exports of several industries. Therefore, international markets should be viewed often as segmented and imperfectly competitive (GOLDBERG and KNETTER, 1999). Other studies investigate the impact of exchange rate changes on the import prices (e.g. HERZBERG et al., 2003).

The pricing strategies of the exporters depend strongly on the industry characteristics. KNETTER (1993) states that PTM varies according to the industries in a given source country.

Several article document that exporters tend to stabilize the local currency prices by adjusting the markup if the exchange rate changes (e.g. KNETTER, 1989, 1993 and GAGNON and KNETTER, 1995). For example if the currency of an importer appreciates the exporters raise their price, while if the currency of the importer depreciates they decrease the price in their currency.

FEENSTRA et al. (1996) using Bertrand differentiated product model for the automobile industry argue that the relationship between the local currency price stabilization is non-linear. If the market is perfectly competitive and the exporters

have only minor market shares local currency price stabilization is not possible since exporters do not have market power. If the market share of an exporter increases the pass through decreases. However, if the exporter becomes a monopolist, the pass-through becomes almost complete again. KNETTER (1993) also indicate that adding more competitors the local currency price stabilization increases.

The existence of price discrimination depends on the characteristics of the importing country. BUGAMELLI and TEDESCHI (2008) investigating the export of five major EU countries found that more PTM happen in the case of advanced importing countries and oligopolistic market structures. While the pass-through is almost complete in the case of developing countries, it is approximately 60 % for advanced countries. The second is consistent with the results of the other studies for advanced countries.

Furthermore, based on the methods developed by KNETTER (1989 and 1993) also agricultural economists have observed pricing to market behaviour. However, its extent differs between sectors. PICK and PARK (1991) examine the competitive structure of the US wheat, corn, soybean, soybean meal, oil and cotton export. The strongest evidence of pricing to market was observed in the wheat export. The authors find mixed results in the processed soybean market, with evidence of both nearly perfect and imperfect competition. The cotton, soybean and corn markets were found to be rather competitive. Similarly, PICK and CARTER (1994) found PTM in the US and Canadian wheat exports. Furthermore, they indicated that the US/Canadian dollar exchange rate influence the pricing decision of both exporter countries. BROWN (2001) also confirmed the discriminative pricing behaviour of Canadian agrifood exporter companies by the example of the Canadian canola exports to US, Japan and Mexico. This article found that the Canadian exporters stabilize the local currency prices in Japan and apply constant markup in the US and Mexico. Similarly, GRIFFITH and MULLEN (2001) investigating the NSW Rice Marketing Board in Australia found pricing to market behaviour in two out of four importing countries.

CAREW (2000) modifies the model of KNETTER (1989) to account for the change in marginal costs and price elasticity of demand induced by the exchange rate change. Investigating the pricing strategies of US and Canadian wheat, pulse and tobacco exporters he found evidence of PTM behaviour in most cases.

CAREW and FLORKOWSKI (2003) examine the markup adjustment to exchange rate changes of US and Canadian export prices. Extending the basic model of KNETTER (1989) including the Canadian/Us dollar exchange rates they found different evidence for pricing to market for the two countries. Generally US exporters stabilize local currency prices when exchange rates changes, while Canadian

exporters tend to increase the local prices when the destination country currency depreciates.

JIN (2008) gives a further evidence of price discrimination in the wheat export. He investigates the competitive structure of the Canadian wheat export. He finds that Canada behaves as a competitive exporter in 10 cases, applies price discrimination with constant markup in 4 countries, and PTM is observed in 5 countries.

JIN and MILIJKOVIC (2008) investigate the competitive structure of the US wheat, corn and soybean exports. They find evidence of PTM for all three commodities, however the extent of price discrimination differs. The reasons include the different extent of competition what the US exporters face in the different destination countries, different economic situation of importing countries, in some countries the demand for US imports becomes inelastic as import price increases and possible product differentiation.

GLAUBEN and LOY (2003) examine the competitive behaviour of German food exporters and found mixed evidence of market power. The article found PTM in the German export to the US and Canadian beer, the UK sugar confectionery and the Italian cocoa powder market, while the other markets were competitive.

The pricing to market model of KNETTER use time dummies to measure the common changes of export prices instead of marginal cost data. SAGHAIAN and REED (2003) modify the basic model and include US domestic wholesale prices as indicators of marginal costs and lagged export prices as indicators for the speed of price adjustment. Investigating the export pricing behaviour of US companies they observe pricing to market in the case of beef and feed, while the other products are found to be rather competitive with a small extent of country and exchange rate induced distortions.

The previous studies assume that the products are homogenous. In contrast, LAVOIE (2005) considers the vertical product differentiation in the wheat export. She states that wheat is not homogenous product and quality has a significant impact on the export price. Furthermore the exchange rate change can change the quality composition of the import. The article uses confidential price and quantity data to four destination countries: UK, Japan and two aggregated importers. The findings show that the CWB has market power arising from product differentiation. However, the sophisticated data needs of this model do not allow applying it widely.

To summarize, the results of these literature state that first, pricing to market occurs often in the international agricultural trade and second, its extent differs between the different markets and industries. The most pronounced evidence of PTM was found in the wheat market. However, all articles investigate

traditional and developed exporting countries (for example USA, Canada and Australia). No study was found which examine the competitive structure of non-traditional and emerging exporters like Russia. It is surprising given that these countries (e.g. China, Brazil, and Russia) dominate the growth of the world agricultural trade. Furthermore, Russia has a high share in the world wheat export.

The main advantage of the pricing to market approach is its easy applicability, and modest data needs. Thus a relatively large number of countries can be included in the model and consequently it provides a sound evidence of the competitive structure of a given exporter. Alternative approaches require far more sophisticated data, which are often impossible to collect. In the case of Russia and its export markets the data availability is a key issue, thus the PTM is a suitable model. On the other hand the pricing to market model indicates only the existence of price discrimination, but it cannot quantify the extent of market power.

A similar concept is the exchange rate pass-through (ERPT): ERPT is the percentage change in the local currency import prices induced by one percent change in the exchange rate between the exporting and importing country. GOLDBERG and KNETTER (1997) survey the literature and finds that there was strong evidence of incomplete exchange rate pass trough. The extent varies between importing countries. It is the smallest to the US and largest to Italy. However, the ERPT model requires precise marginal cost data, which can be only approximated, therefore significant errors can arise. Thus this model is not well applicable in the case of the Russian wheat export.

3.5 Residual demand elasticity

The PTM concept can indicate the existence of price discrimination and thus market power, however it is not able to measure the extent of it. Thus, GOLDBERG and KNETTER (1999) apply the models of the industrial organization literature to international trade to measure market power. More specifically, they use the model constructed by BAKER and BRESNAHAN (1988). The basic idea is that an exporter facing flat residual demand curve does not have impact on the price, rather it is a price taker. Thus, this exporter does not have market power. This case happens if the exporter has a small share from the import market and/or there is strong competition. However, if the exporter faces a residual demand with negative slope, it has influence on the price. If it wants to sell more, it has to decrease the price. This is the situation if the exporter has only few competitors and has a large share from import market.

The advantage of the model compared to the PTM and ERPT models is first, that it takes into account the competitors of the exporter in the importing

country and second, it includes the quantity adjustments of the exporter. GOLDBERG and KNETTER (1999) apply the framework for the German beer export to the US and the US export of linerboard papers. The results indicate that the residual demand that German beer exporters face is dependent on the competition in the importing country. The stronger the competition in a market is the less market power Germany has. The highest market power has Germany in France and UK. In the US and Canada there is strong competition, however, Germany is still able to charge a markup over marginal cost. The authors find mixed evident on the market power of US linerboard paper exporters. The European countries, Germany, UK, and Japan were competitive, where the US did not have market power, while the US exporters had market power in Australia. Japan and Canada were found rather competitive with insignificant German market power.

This model was also used in the context of agricultural markets. One part of the studies investigates the market power of one exporting country in several markets, while the second part focuses on one importing country and its most important suppliers. The articles use quite similarly the model. Japan as a major food importer, with regulated import markets, is often subject of these articles.

CARTER et al. (1999) investigate the market power of the US, Canadian and Australian wheat exporters in the Japanese market. The results indicate that only the US has market power in Japan and the other countries are price takers.

REED and SAGHAIAN (2004) provided more pronounced evidence of market power studying the Japanese beef market. They distinguish between the beef cuts and forms, since the beef products are highly differentiated. The results indicate market power in more than half of the cases. Surprisingly, this is the case by only one category of the US beef. In contrast the Australian and New Zeeland beef exports were found to have market power in more segments.

TASDOGAN et al. (2005) focus on the market power of the Italian, Spanish and Greek olive oil exporters in the EU market. The results indicate that all three countries have market power but different magnitude: Italy has the largest and Greece has the smallest.

YANG and LEE (2001) report mixed evidence of market power of wheat and corn exporters in the South Korean market. The main wheat exporters in Korea are the US, Australia and Canada, while the main sources of corn are the US and China. The results show that in the wheat import market of Korea all the three considered exporters have market power. In contrast in the corn market the exporters do not have any market power.

In contrast to the previous studies CHO et al. (2002) examine the market power of one exporter, the USA, in the wheat market of six Asian countries. The results

show that the US has market power in Philippine, Korea, Malaysia and Singapore, while the US exporters price competitively in Japan and Indonesia. Furthermore, Australia is a strong competitor for the United States in five out of the six countries.

ZHANG et al. (2007) investigate the competitive behaviour of the US and Brazilian soybean exporters. The results indicate that the US exporters have market power in two countries, namely in Taiwan and Mexico and Brazil has no market power. Therefore the authors have found both countries to behave rather competitively in the world market.

In contrast to previous articles GLAUBEN and LOY (2003) do not observe market power studying the German export of beer, chocolate, cocoa powder and sugar confectionary to six importing countries (US, UK, Canada, France, Italy and Belgium). These results are inconsistent with the work of GOLDBERG and KNETTER (1999), who observe that German beer exporters have market power. Furthermore, the results are inconsistent with the results of their PTM model, which show imperfect competition in four cases. The most likely cause of the difference is the existence of menu costs and long term contracts in local or third currencies.

FAHLBUSH (2009) examines whether the New Zealand dairy exporter, Fonterra, has market power in the import market of dry whole milk, non-fat dry milk and butter. Significant market power was identified in many cases.

FELT et al. (2010) investigate the market power of the major exporters in the Japanese pork import market. Furthermore, they research the effect of the ban on Taiwanese exports to Japan. They consider three competitors: the US, Canada and Denmark. The results indicate that all three countries have some market power, thus they are not price takes. The US faces the most inelastic residual demand, followed by Canada and Denmark. The effect of the ban of the pork imports from Taiwan is considered investigating whether there was a structural break in the parameters. The findings show that there are structural breaks in the parameters in the case of the three countries in the same month, but two years after the Taiwanese import ban. The US residual demand becomes more inelastic, thus the US exporters have gained market power induced by the export ban.

Generally, the results confirm the pricing to market literature that international trade is often characterized by imperfect competition and market segmentation and consequently market power. Furthermore the wheat market gives pronounced evidence of market power. However, the articles focus on traditional exporters and no article was found about Russia.

The literature indicates that the residual demand that an exporter faces is dependent on the demand characteristics and the competition in the importing country. The more elastic the demand is and the stronger the competition in a market is the less market power an exporter has. For example wheat is a staple food and thus its demand is relatively inelastic. If an exporting country has monopoly in an importing country and it is highly dependent on wheat import, the exporter has high market power.

The advantage of the model compared to the PTM model is first, that it takes into account the competitors of the exporter in the importing country and second, it includes the quantity adjustments of the exporter (GOLDBERG and KNETTER, 1999). However the RDE model has quite sophisticated data need, which is a hard constraint for its application. Thus it can be used only in a relatively small sample, where all the necessary data are available. Consequently the PTM and RDE models are not competitive, rather completing approaches. The first can indicate whether the given exporter use price discrimination, while the second is able to quantify the extent of its market power.

3.6 Exchange rate volatility and trade volume

The theoretical and empirical papers provide controversial results about the impact of the exchange rate volatility on the export. Some articles found a negative link between them, while others report rather positive impact. A third group did not find any causal relationship. First the general economics literature is surveyed, while the agricultural economics articles are considered afterwards.

DELL'ARICCIA (1999) investigates the effect of the exchange rate risk on the trade flows of 14 EU countries and Switzerland using a gravity model. Three exchange rate measures are considered: the standard deviation of the first difference of the logarithmic exchange rate, the sum of the squares of the standard errors and the percentage difference between the maximum and minimum spot nominal exchange rate. The results reveal that the exchange rate volatility reduces international trade and it is valid across measures.

CHIT et al. (2010) examine the impact of the exchange rate volatility on the export of five emerging East Asian countries. The article focuses on the time period of Q1 1982- to Q4 2006 and uses three different exchange rate volatility measures: the standard deviation of the first difference of the logarithmic real exchange rate, the moving standard deviation of the log real exchange rate and the conditional volatilities using GARCH model. The results indicate that the exchange rate risk has a significant and negative effect on the export flows. Furthermore, the increase of the relative prices (a measure of competitiveness) has a positive impact on the bilateral exports, while the increase of the relative prices of third countries (a measure of the competitiveness of other exporters) has negative

impact on export. Beyond this, the exchange rate volatility of a third country has positive impact of the bilateral export.

McKenzie (1998) investigates the influence of the exchange rate volatility on the Australian trade using export and import equitation. He employs currency risk measure coming from an ARCH process. Furthermore, aggregate, bilateral and sectoral data are examined. The results indicate that the exchange rate variation has positive effect on the aggregate export, while it impacts negatively the aggregate import. The bilateral models did not give significant results. The sectoral export results show inconclusive results, the exchange rate volatility has positive impact on some sector, while it is insignificant for other.

Tenreyro (2007) focus on the trade impact of nominal exchange rate variability using the gravity model. She included as measure of currency risk the first difference of the log exchange rates. Furthermore, the model is estimated with a pseudo maximum likelihood estimator. The exchange rate risk is considered as endogenous, thus it is instrumented. The results indicate that the exchange rate risk does not impact international trade.

Huchet-Bourdon and Korinek (2011) investigate the impact of the exchange rates and its volatility on the bilateral trade volume of the Euro area, US and China. The results reveal that the exchange rate has a greater impact on the trade volumes than its volatility, and further the exchange rate has bigger impact on the US-Chinese than Euro area. Chinese trade. Furthermore, the exchange rate affects more exports than imports and agriculture than manufacturing.

The issue of the impact of the exchange rate volatility on international trade was also analysed in **agricultural economics** and the results are mixed similarly to the general economics literature.

Anderson and Garcia (1989) survey the response of US soybean exports on exchange rate risk. They argue that the impact of exchange rate risk can differ across commodities. The results show that soybean export is sensitive on exchange rate volatility and importers react differently on it.

Langley et al. (2000) focus on the impact of the exchange rate volatility on the Thai poultry export and apply a model similar to the gravity models. They use GARCH model to evaluate exchange rate volatility. The results indicate positive link between risk and export.

In contrast, Cho et al. (2002) indicate rather negative impact and argue that the impact of the exchange rate volatility on international trade may vary across sectors, thus should not be studied at the national economy level. Furthermore, they highlight that the short and medium to long run risks have different impacts on international trade. While the former can be hedged efficiently, the latter could not be handled easily. Thus, the article investigates the impact of the

medium to long run exchange rate volatility on agricultural trade and compares it to aggregate trade, and trade in machinery, chemical and other manufacturing. The results are robust across exchange rate volatility measures and show that the exchange rate risk has negative effect on the aggregate trade and on the other sectors except machinery, and the biggest negative effect is on the agricultural trade.

KANDILOV (2008) extends the research of CHO et al. (2002) in several ways. First, it uses another measure of the exchange rate volatility, the GARCH process to model the conditional exchange rate variance. This was originally developed by BOLLERSLEV (1986) and applied in the agricultural economics literature by WANG and BARRETT (2007) for example. Second, he estimates the model for the G10 countries included in CHO et al. (2002), for other developed countries, for emerging as well as for developing countries. Furthermore, this article uses different specification of the gravity model: only the export and not the total trade is considered, the GDP and population data are separately, and not their products, included in the model. Despite the differences in specifications and exchange rate risk measures the article produced largely the same results for the G10 countries as CHO et al. (2002). In contrast, the results considering a broader group of developed countries, and emerging as well as developing countries show no statistically significant link between exchange rate risk and total and agricultural trade. In addition, the article considers the impact of the possible non linear effects by excluding the top and bottom 1 % of the exchange rate volatility distributions. This suggests that the impact of risk is negative and significant and is the same for both G10 and developing countries. Moreover to incorporate the effect of the possible non linear impacts, the square of the exchange rate volatility is included in the model. In this case, the impact of exchange rate volatility is greater for the developing than for G10 exporters.

The results are also sensitive on the model employed. YUAN and AWOKUSE (2003) examine the impact of the exchange rate volatility on the US poultry export using a gravity model and three different exchange rate measures. They find that the exchange rate volatility has a negative and significant effect only using only one measure, while the others were insignificant. In contrast AWOKUSE and YUAN (2006) studied the impact of the exchange rate volatility on the US poultry export using three measures of exchange rate volatility and demand equitation for the time period of 1976-2000. The Chow test showed that there was a structural break in 1985, thus the model was estimated for two sub samples. The results indicate that the exchange rate risk has a positive impact of the US poultry export.

FERTŐ and FOGARASI (2011) research the impact of exchange rate volatility on the bilateral trade flows of the Central European countries. They use a gravity

model and the moving standard deviation of the first differences of the log exchange rates as measure of exchange rate volatility. The results indicate that the exchange rate volatility has significant negative impact on the trade flows of the Central European countries.

KARAMERA et al. (2011) conduct a research on the exchange rate sensitivity of vegetable trade flows among selected OECD countries. A commodity specific gravity model is estimated. Both short and long term exchange rate volatility measures are included. The results are ambiguous, while both short and long term the exchange rate volatility has significant impact on the export in the case of most commodities, there are vegetables for which exchange rate volatility has positive impact. Thus, the article highlights that this question is rather commodity specific. In addition, the free trade agreements have as expected, trade creating effects.

3.7 Summary of imperfect competition and the impact of exchange rate volatility in international trade

In the neoclassical trade theory perfect competition and integrated markets were assumed. This assumption means that all economic actors are a small part of the market. Therefore, the firms do not have any influence on the price, rather they are price takers. In contrast, the new trade theory, based on the results of the new industrial organization, suggests that international trade is often characterized by segmented markets, imperfect competition and oligopolistic market structures. Thus, the firms have influence on the price and consequently they are price makers. The presence of imperfect competition does not lead to the balance of prices. These can induce price discrimination as the optimal decision of a profit maximizing exporter.

There are two major empirical approaches in the international economics literature which infer imperfect competition from the firm behaviour, the pricing to market (PTM) and residual demand elasticity (RDE) models. These are complementing approaches, the PTM is able to indicate whether there is price discrimination in a large number of countries using the bilateral exchange rate. The RDE model can quantify the extent of market power taking explicitly into account the cost shifters of the competitors and the demand conditions of the respective importing country. However the residual demand elasticity model should be estimated for each importing country separately and has more sophisticated data needs.

Beside price discrimination and market power, the impact of the exchange rate and its volatility is a central question in the international economics literature. There is no consensus as to how exchange rate volatility impacts trade volumes. Theoretical articles state that there is no ex ante prediction, the impact can be

both positive and negative depending on the risk aversion of companies and thus the relative role of substitution and income effects. The empirical works are also inconclusive, authors argue that the impact of exchange rate volatility might vary across commodities in a given sector since the nature of competition, product characteristics and the size of the companies differs. Furthermore, it is important to distinguish between short and long term volatility. While exporters can easily hedge against short term volatility, the impact of the long term volatility is more difficult to offset.

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4 Are Russian wheat exporters able to price discriminate? Empirical evidence from the last decade[1]

Abstract

Significant changes have taken place in the world wheat market in the last decade. Russia, a former net wheat importer, has become a leading exporter with a world market share of 11.2 % in 2009. This increasing importance and the discussion about the establishment of a grain-OPEC consisting of Ukraine, Kazakhstan and Russia, has raised the issue of pricing behaviour of Russian wheat exporters. Though there are several studies on the pricing behaviour of Canadian and U.S. wheat exporters, there is none so far for Russian wheat exporters. The present paper provides a quantitative analysis of the pricing behaviour of Russian wheat exporters, explicitly taking account of the export tax imposed between 2007 and 2008. We employ a pricing-to-market (PTM) model on quarterly Russian wheat export data, covering the period from 2002 to 2010 and 25 export destinations. Our findings indicate that (i) Russian wheat exporters exercised pricing to market in only a few importing countries over the whole time period and (ii) PTM behaviour was more pronounced in the aftermath of the export tax period (i.e., 2008 to 2010) than before.

4.1 Introduction

Significant changes have taken place in the world wheat market in the last decade. Russia, a former net wheat importer, became the fourth largest exporter in 2008, increasing wheat exports more than tenfold. While in 2000 Russia's market share was only 0.5 %, it increased by 10.7 percentage points to 11.2 % by 2009. Other post-Soviet countries such as Ukraine and Kazakhstan were also able to recover from the tremendous decline in agricultural production after the breakdown of the Soviet Union and entered the world wheat market (FAO, 2009, p. 19; USDA, 2010). As a result, total wheat exports from Kazakhstan, Russia and Ukraine (KRU) increased more than threefold and accounted for 34.2 million

[1] The chapter is based on the paper "Are Russian Wheat Exporters Able to Price Discriminate? Empirical Evidence from the Last Decade" by Zsombor Pall, Oleksandr Perekhozhuk, Ramona Teuber and Thomas Glauben published in *Journal of Agricultural Economics, Vol. 64, No. 1, 2013*, 177-196. Oleksandr Perekhozhuk provided econometric analysis of panel data and together with Ramona Teuber and Thomas Glauben contributed the motivation of the study and discussion of the results.

tons, 27 % of world wheat exports. It is expected that the market share of these countries in world trade will increase further because there is still significant production potential in terms of both area and yield (FAO, 2009 p. 19; USDA, 2010). At the same time, the market share of both the top-five and the top-10 wheat exporters declined from 79 % (2000) to 62 % (2009) and from 93 % to 84 %, respectively.

In general, these changes suggest that the global wheat market is becoming more competitive. However, two recent incidents have drawn a lot of media attention and caused concern about collusive behaviour and the exercise of market power. The first is Russia's creation of a state trader for grain, the United Grain Company (UGC). The UGC was established by presidential decree in March 2009 and became operational in June 2009. The UGC is supposed to increase purchases and sales of grain on the domestic market, modernize the storage and shipment of wheat and increase exports (USDA, 2009). The second incident was the announcement of the creation of a grain pool by the three Black Sea countries, Russia, the Ukraine and Kazakhstan, sometimes also referred to as "grain-OPEC" (WORLD BANK, 2009). This grain pool is supposed to increase the region's competitiveness by the coordination of crop sales and creation of a single infrastructural platform (RIA NOVOSTI, 2009). Though the establishment of such a "grain-OPEC" was recently put on hold, these developments raise a number of research questions about current and future competition and price setting behaviour in the world wheat market. These incidents suggest that the world wheat market will become less competitive. But given the low market share of either the UGC or the grain pool and the fact that all three countries produce quite distinct wheat qualities these fears may be misplaced (WORLD BANK, 2009).

Though these possibilities are controversial amongst policy makers and in the media, there is little scientific literature on the issue. There is particularly no empirical evidence on the pricing strategies of Russian wheat exporters and the competitive structure of Russian wheat exports. However, more detailed knowledge on the export behaviour of one of the largest wheat exporters is also of great interest in the context of highly volatile agricultural prices and the dependency of some countries on wheat imports. The import dependency ratio for wheat (share of wheat imports in total wheat consumption) is especially high for Algeria (71.5 %), Cyprus (94 %), Israel (90 %) and Jordan (96 %), which all import wheat from Russia.

Moreover, world wheat prices were unusually high from 2007 to 2008. To secure domestic supply and protect Russian consumers from high bread prices the Russian government introduced an export tax in November 2007, which was lifted in May 2008. This tax had a great impact on the quantity of wheat exported.

However, it is not clear that it also influenced the pricing strategies of Russian exporters. We investigate (i) whether Russian exporters were able to price discriminate across export destinations and (ii) whether the imposed export tax from 2007 to 2008 had a significant impact on the export pricing pattern.

Section two describes the conceptual background and provides a review of the relevant empirical literature. In section three, the modelling approach is presented, followed by a description of the data, market definition and summary statistics. Section five discusses the results. The final section presents concluding remarks.

4.2 Conceptual background and relevant empirical studies

New trade theory suggests that international trade is often characterized by imperfect competition and oligopolistic market structures. Such conditions can induce price discrimination as the optimal decision of a profit maximizing exporter. Generally, the ability to price discriminate depends on the importer's residual demand elasticity. If the residual demand is elastic, price discrimination cannot be exercised. However, in case of an inelastic residual demand, e.g., as a result of a lack of alternative supply or inelastic market demand, price discriminatory behaviour may exist. Thus, the possibility of price discrimination depends on the demand characteristics and the competitive environment of the respective market (GOLDBERG and KNETTER, 1997 and 1999).

KRUGMAN (1986) introduced a special form of third degree price discrimination, which he termed pricing to market (PTM). PTM is exchange rate induced price discrimination and occurs when a change in bilateral exchange rates between an exporter and several buyers changes the ratio of prices paid by the buyer. He argues that when the U.S. dollar depreciates the import prices do not always rise proportionally and, as a result, international relative prices change. This is evidence of imperfect competition; if the exchange rate pass-through is not complete, prices cannot always equal marginal cost. Consequently, the export price contains a destination specific markup over marginal cost, meaning that exporters price their products according to the demand characteristics of the different importing countries.

Numerous empirical studies have been conducted based on the PTM concept for industrial products as well as agricultural products (i.e., KNETTER, 1989, 1993, 1995; MARSTON, 1990; GAGNON and KNETTER, 1995; FALK and FALK, 2000; GLAUBEN and LOY, 2003). The results from these studies are rather heterogeneous and it is hard to draw general conclusions about PTM behaviour. PTM behaviour seems to differ across source countries and export industries. The PTM concept has also been applied rather frequently in studies analysing the wheat market because

several countries possess state-trading enterprises (STEs) for wheat.[2] These institutions are often considered to be able to exercise market power and thus have drawn a lot of scientific interest as table 4.1. illustrates.

Table 4.1: Studies on wheat export pricing

Authors	Considered Data	Methodological Approach	Results
Pick and Park (1991)	U.S. wheat exports, Quarterly data, 1978-88 8 destination markets	PTM	The results indicate that the U.S. price discriminates across destinations; China and the Soviet Union seem to exercise monopsony power.
Patterson and Abott (1994)	Firm-level data set on U.S. grain exports, Annual data, 1979-89 98 destination markets	Generalized Cournot model	Evidence of discriminatory export pricing behaviour, which is significantly related to export seller concentration, U.S. market share, total export volume, and import market size
Pick and Carter (1994)	U.S. and Canadian wheat exports, Quarterly data, 1978-88, 8 destination markets	PTM with two exchange rates: (i) importer/exporter (ii) Canadian/U.S. dollar	Evidence of PTM for U.S. (Canadian) exporters in six (three) of seven (four) wheat importing countries; Canadian/U.S.: exchange rate influences export pricing decisions of both exporters
Carew and Florkowski (2003)	Canadian and U.S. wheat exports, Annual data, 1980-1998	PTM with two exchange rates: (i) importer/exporter (ii) Canadian/U.S. dollar	Canadian pricing strategy tends to amplify exchange rate effects, whereas U.S. exporters tend to stabilize foreign currency prices.
Lavoie (2005)	Canadian wheat exports, Monthly confidential price data, 1982-1994, 4 destination markets	PTM with product differentiation	CWB has market power emerging from product differentiation and discriminates across destinations.
Jin and Miljkovic (2008)	U.S. wheat exports, Quarterly data, 1989-2004, 22 destination markets	PTM	Relative exchange-rate movements influence U.S. wheat export prices in 9 of 22 export destinations.

Source: Own compilation.

The results on wheat exports indicate that there is price discrimination across different destinations exercised by U.S. and Canadian exporters. However, the price markup seems to be rather small. ANANIA et al. (1992) pointed out that excess profits are not present on the international wheat market. This result seems to be still valid as the FAO (2009, p. 22) characterizes the wheat business as a high-volume, low-margins business. Nevertheless, there are incidents of price discrimination in wheat trade. There are also few studies not only trying to detect PTM behaviour but also to identify the underlying reasons. For example, PATTERSON and ABOTT (1994) analyse export pricing behaviour of U.S. wheat exporters showing that the export market structure has a significant though small impact on the export price markup. The price markup is positively related to the U.S. seller concentration, measured by the Herfindahl-Hirschman index

[2] The WTO defines state-trading enterprises (STEs) as "…governmental and nongovernmental enterprises, including marketing boards, which have been granted exclusive or special rights or privileges, including statutory or constitutional powers, in the exercise of which they influence through their purchases or sales the level of direction of imports or exports (ACKERMAN and DIXIT, 1999, p. 2)."

(HHI)[3], in the destination market. In contrast, large importers, which account for a large share of U.S. grain exports, were found to receive lower export prices.

4.3 Modelling Approach

We adopt the model proposed by KNETTER (1989)[4] to test econometrically for alternative market structures:

$$\ln p_{it} = \beta_i \ln e_{it} + \lambda_i + \theta_t + u_{it}, \ \forall\, i = 1,...,N \text{ and } t = 1,...,T. \quad (4.1.)$$

where p_{it} is the wheat export price in Russian rouble to importing country i in period t, e_{it} is the destination-specific exchange rate expressed as units of the domestic currency in Russian rouble, β_i denotes the parameter on the exchange rate variable, λ_i represents the country effect, θ_t represents the time effect, and u_{it} is the error term. Because the model is estimated in logarithmic terms, β_i represents the elasticity of the domestic currency export price with respect to the exchange rate.

The estimated parameters β_i and λ_i can be used to distinguish between different scenarios of export pricing behaviour (KNETTER, 1993). The first scenario refers to the competitive market structure (see table 2). In this scenario, movements in the bilateral exchange rates do not affect bilateral export prices. Export prices are the same across all destinations, i.e., $\lambda_i = 0$ and $\beta_i = 0$. However, these results are also consistent with imperfect competition with a common markup across all export destinations. In this case, both country and exchange rate effects are zero, but the price contains a common markup over marginal cost.

However, if the estimated parameters β_i or λ_i are statistically significant different from zero, imperfect competition and price discrimination across destination countries exists. Two different scenarios of price discrimination can be distinguished. The first assumes a constant elasticity of demand with respect to the domestic currency price in each importing country, leading to a constant markup over marginal cost, i.e., $\beta_i = 0$. This markup can differ across destination countries, which implies $\lambda_i \neq 0$. However, because the country effect can also capture

[3] The HHI is an indicator for the degree of competition in an industry or a market. It is defined as $H = \sum_{i=1}^{N} s_i$ where s_i is the market share of firm i in the market and N is the number of firms.

[4] We apply the original model proposed by KNETTER (1989), as the most flexible because our dataset is highly unbalanced.

constant quality differences, a significant country effect does not necessarily show imperfect competition (KNETTER, 1989; FALK and FALK, 2000).

The second imperfect competition scenario is based on price discrimination with varying price elasticity of demand. In this scenario, the demand elasticity may vary with changes in the exchange rate. Consider a depreciation of the importer's currency relative to the exporter's currency which raises the price faced by consumers in the importing country. If the demand elasticity changes, the optimal markup over marginal cost will change too, so export prices will depend on exchange rates. This is pricing-to-market (PTM) behaviour because the optimal markup by a price-discriminating firm will vary across destinations ($\lambda_i \neq 0$) and with changes in bilateral exchange rates ($\beta_i \neq 0$). KNETTER (1993) further distinguishes the situations of a positive versus a negative sign for β_i. A negative β_i implies that exporters do not pursue a constant markup policy but rather stabilize prices in the buyer's currency. KNETTER (1993) termed such behaviour local-currency price stability (LCPS). In contrast, a positive β_i signals that exporters amplify the effect of destination-specific exchange-rate changes through destination-specific changes in the markup. Table 4.2 provides an overview of the relationship between the model parameters and the different market structures.

Table 4.2: Overview of the relationship between the estimated parameters and different market scenarios

λ	β	**Market Scenarios**
Not significant	Not significant	Perfect competition, imperfect competition with common markup
Significant	Not significant	Constant elasticity of demand > constant markup, which can differ across countries
Not significant/ Significant	Significant	Varying elasticity of demand > varying markup, which can differ across countries
	• Positive	Amplification of exchange-rate effects
	• Negative	Local-currency price stability (LCPS) > PTM

Source: Own compilation based on KNETTER (1993).

Several model specifications based on the original pricing to market model as presented by equation (4.1) have been introduced and discussed in the literature. They include the original model in first differences (KNETTER, 1993) and a non-linear form imposing the constraint that changes in marginal costs affect export prices in the same way as exchange-rate changes (KNETTER, 1995). We apply the original model proposed by KNETTER (1989), as the most flexible because our dataset is highly unbalanced and thus a first-difference model to test econometrically for alternative market structures is not feasible.

4.4 Data, market definition and descriptive statistics

To test for noncompetitive behaviour and price discrimination by Russian wheat exporters, equation (1) was estimated using quarterly data for the time period from 2002:1 to 2010:2. Although wheat prices change on a daily basis, many countries import via STE's which tender substantial quantities so that the price is fixed. However, such tenders are often valid for three to six months, so a quarterly frequency is approximately appropriate. The period reflects the facts that Russia became a major wheat exporter in 2002 and, the Russian government banned wheat exports from 2010:3 to 2011:2.

We use f.o.b. unit values of Russian wheat exports (wheat other than durum wheat and meslin, HS code: 100190) obtained from the Global Trade Atlas database and nominal exchange rates between Russia and the importing countries from the International Financial Statistics (IFS) database of the International Monetary Fund. The exchange rate data of Syria are taken from two different sources, January 2002 to December 2009 from the Central Bank of Russia, January 2010 to June 2010, it is obtained from the Syrian Central Bank.

In response to rising world prices, Russia introduced an export tax of 10 % on wheat in November 2007, which was increased to 40 % in December 2007 and applied until May 2008. The major objective of the tax was to discourage exports to secure domestic supply and protect consumers against increasing food prices. As a result of the tax, Russian wheat exports nearly dropped to zero in February and March 2008. This fact suggests that Russian exporters fulfilled their existing contracts but did not make new ones. After the tax had been lifted in May 2008, Russian exports recovered. Exports in July 2008 were approximately the same quantity as in the period before. The export tax might have led to contract breaks and thus made Russia an unreliable supplier. As a result, the residual demand Russian exporters face might have become more elastic. This might have changed their pricing behaviour after the tax had been lifted with the aim to get trading partners back. However, the effect of the export tax can not be separated from the impact of the high world prices in 2007 and 2008.

In order to investigate possible changes induced by the export tax and high world prices on the pricing behaviour of Russian wheat exporters, we estimate our empirical model for three different time periods. First, the model is estimated for the full period (2002:1-2010:2) and second for two sub-periods, i.e., for the period before the tax was introduced (2002:1-2007:3) and for the period afterward (2008:3-2010:2).

There is a discussion in the literature whether it is more appropriate to apply nominal or real exchange rates in PTM studies. Proponents of the nominal exchange rates argue that traders use nominal rather than real exchange

rates in their business decisions (c.f., GRIFFITH and MULLEN, 2001). Authors using real exchange rates state that the inflation differential between countries should be considered (c.f., KNETTER, 1989; JIN and MILIJKOVIC, 2008). This is often explained by the following argument. If the exporter's currency depreciates, its cost in relation to other currencies will fall. Thus, in the short-run the exporter becomes more competitive. However, the currency depreciation induces inflation, which leads in the medium-run to an increase in the exporter's cost. In case the depreciation rate equals the inflation rate, the exporter's competitiveness does not change at all and exchange rate changes cannot be passed through. This explanation assumes that the inflation increases the exporter's cost proportionally. This might be especially relevant for industrial products, where the production is continuous during the year and inflation increases the input costs. However, it is not that obvious in the case of wheat, where the production occurs once a year and the highest share of the exporter's cost is the cost of the wheat. The consumer price index consists of the price of many goods, which are likely not relevant for wheat prices. Because there is no domestic wheat price or consumer price index for bread and flour products available for all countries in our sample, nominal exchange rates seem to be more appropriate than real ones. This can also be justified by the argument put forward by YUMKELLA et al. (1994) that nominal and real exchange rates are used to investigate short- and long-term PTM, respectively. Because we apply quarterly data, our dataset is rather short term. However, for comparison and as a robustness check, the results using real exchange rates are reported in the annex (Annex 1).

Real exchange rates were calculated by multiplying the nominal exchange rates by the consumer price index (CPI) of Russia and dividing by the consumer price index of the importing country. For most countries the CPI was obtained from the IFS, while for Armenia, Azerbaijan and Lebanon it was taken from the International Labour Statistics Database of the International Labour Organization. The CPI of Lebanon for 2010 is obtained from the Central Administration of Statistics of Lebanon.

We include 25 export destination countries selected on the frequency of purchase, i.e., regular shipments. Nevertheless, we have an unbalanced panel because not all countries import wheat from Russia in each quarter. During the investigation period, the 25 destination markets accounted on average for 87 % of Russian wheat exports. Egypt is the most important destination market for Russian wheat. In the study period, on average 25 % of Russian wheat was exported to Egypt. The remaining exports are very fragmented across the other export destinations.

The data in table 4.3 illustrate a rather high variation in export unit values and exchange rates across countries. The unit values range from 2,893 roubles (Spain)

to 5,187 roubles (Jordan) and the coefficient of variation of the exchange rate ranges from one to 26 %.

Table 4.3: Summary statistics of export unit values and exchange rates

Country	Total period: 2002:1-2010:2						Pre-tax period: 2002:1-2007:3						Post-tax period 2008:3-2010:2					
	EUV[a)]		*NER*[b)]		*RER*[c)]		*EUV*		*NER*		*RER*		*EUV*		*NER*		*RER*	
	Mean	CV%[d)]	Mean	CV%	Mean	CV%	Mean	CV%	Mean	CV%	Mean	CV%	Mean	CV%	Mean	CV%	Mean	CV%
Albania	4144	34	3.62	11	3.76	12	3507	28	3.8	10	3.54	8	3.21	8	3.21	8	4.34	8
Algeria	2957	40	2.55	5	2.55	16	3123	22	2.58	3	2.50	16	2.39	6	2.39	6	3.04	1
Armenia	4912	41	15.38	18	15.37	8	4307	50	16.92	12	15.80	6	11.92	10	11.92	10	14.67	10
Austria	4156	39	0.03	11	0.03	13	3374	34	0.03	8	0.03	12	0.02	9	0.02	9	0.03	7
Azerbaijan	4323	31	0.03	10	0.02	11	3557	26	0.03	4	0.02	9	0.03	11	0.03	11	0.02	8
Bangladesh	4634	27	2.28	15	2.59	8	4007	28	2.19	14	2.55	8	2.34	11	2.34	11	2.62	7
Cyprus	4007	36	0.02	10	0.02	14	3362	32	0.02	8	0.02	11	0.01	9	0.01	9	0.02	7
Egypt	4206	32	0.20	13	0.20	25	3550	27	0.2	14	0.19	26	0.19	9	0.19	9	0.23	16
Georgia	4555	32	0.06	9	0.06	5	3923	29	0.07	4	0.06	4	0.06	6	0.06	6	0.06	7
Greece	3725	42	0.03	11	0.03	12	3324	30	0.03	8	0.03	10	0.02	9	0.02	9	0.03	7
India	5162	30	1.59	5	1.72	4	4814	22	1.58	4	1.73	3	1.59	8	1.59	8	1.67	2
Iran	3689	44	312.24	18	281.90	10	2484	17	295.5	20	293.12	8	334.2	10	334.2	10	265.08	11
Israel	4002	37	0.15	9	0.16	18	3331	31	0.16	4	0.15	20	0.13	7	0.13	7	0.18	4
Italy	3665	36	0.03	11	0.03	14	3113	30	0.03	8	0.03	12	0.02	9	0.02	9	0.03	7
Jordan	5187	28	0.02	9	0.03	12	4129	43	0.02	7	0.03	16	0.02	11	0.02	11	0.03	6
Lebanon	4133	34	53.05	9	51.64	16	3422	27	52.53	7	49.61	18.	51.07	11	51.07	11	54.01	7
Libya	4290	39	0.04	9	0.05	18	3380	38	0.05	8	0.04	20	0.04	10	0.04	10	0.05	7
Mongolia	4944	39	42.55	10	42.26	13	3928	33	40.67	9	40.54	14	45.78	5	45.78	5	44.52	7
Morocco	4127	49	0.31	9	0.32	18	3300	35	0.32	5	0.29	14	0.28	9	0.28	9	0.38	9
Pakistan	4080	61	2.27	16	2.32	13	3269	10	2.07	8	2.10	5	2.75	8	2.75	8	2.65	12
Spain	2893	58	0.03	11	0.03	11	2972	37	0.03	8	0.03	11	0.02	9	0.02	9		
Syria	4470	34	1.79	12	1.82	14	3577	28	1.81	8	1.81	14	1.59	14	1.59	14	1.74	11
Tunisia	4382	38	0.05	7	0.05	20	3553	30	0.05	7	0.04	18	0.05	8	0.05	8	0.06	7
Turkey	4544	36	0.05	6	0.05	6	3712	31	0.05	6	0.05	6	0.05	5	0.05	5	0.05	4
Yemen	4701	28	6.82	12	7.09	8	3904	26	6.57	11	7.06	7	6.98	11	6.98	11	6.96	9

Source: Own compilation based on Global Trade Atlas, International Financial Statistics, Central Bank of Russia and Central Bank of Syria.

Notes: [a)] Export unit values expressed in Russian rouble (EUV).[b)] The mean value of the nominal exchange rate (NER) is computed as foreign (local) currency per unit of Russian rouble multiplied, [c)] RER is real exchange rates. [d)] CV is the coefficient of variation expressed in percent.

Table 4.4 illustrates the importance of Russian wheat in the 25 destination countries expressed as a share of Russian wheat in total wheat imports of these countries and the number of competitors in the importing countries.

Table 4.4: The share of Russian wheat in total wheat imports for each destination country in % and the number of competitors in the three different time periods

Country/ Year	2002-2009		2002-2007		2008-2009	
Albania	63.81	(3)	66.40	(3)	56.05	(3)
Algeria	11.38	(6)	14.96	(6)	0.63	(5)
Armenia	52.89	(2)	39.26	(2)	93.79	(2)
Austria	10.35	(4)	12.65	(3)	3.44	(4)
Azerbaijan	51.35	(1)	46.89	(1)	64.74	(2)
Bangladesh	18.86	(3)	18.89	(3)	18.77	(3)
Cyprus	30.06	(3)	36.73	(3)	10.03	(2)
Egypt	42.65	(4)	37.07	(4)	59.39	(4)
Georgia	71.70	(2)	72.54	(2)	69.16	(1)
Greece	29.59	(5)	34.74	(5)	14.15	(5)
India	21.44	(1)	17.25	(1)	34.01	(2)
Iran	30.86	(2)	37.94	(1)	9.64	(6)
Israel	25.51	(2)	27.43	(2)	19.76	(3)
Italy	10.74	(7)	12.07	(7)	6.73	(8)
Jordan	27.23	(3)	16.13	(4)	60.52	(2)
Lebanon	67.83	(2)	68.70	(2)	65.25	(2)
Libya	30.78	(4)	28.49	(4)	37.64	(3)
Mongolia	54.16	(1)	43.19	(2)	87.05	(1)
Morocco	10.49	(4)	12.94	(4)	3.14	(4)
Pakistan	38.44	(3)	36.06	(2)	45.58	(6)
Spain	2.81	(14)	3.49	(17)	0.78	(6)
Syria	64.95	(1)	63.13	(1)	70.41	(1)
Tunisia	19.78	(5)	19.58	(5)	20.39	(5)
Turkey	37.94	(3)	32.23	(3)	55.05	(3)
Yemen	16.20	(3)	15.61	(3)	17.99	(5)

Source: Own compilation based on Comtrade.

Note: A country is considered a competitor if its share is >3 % in the respective year, number of competitors in parentheses.

Throughout the whole period, Russia had a high share (above 50 %) in Albania, Armenia, Azerbaijan, Georgia, Lebanon, Mongolia and Syria. The Russian share is modest (between 20 and 50 %) in Egypt, Greece, India, Iran, Israel, Jordan, Libya, Pakistan and Turkey, and small, i.e., below 20 %, in the remaining countries. In general, Russia exports predominantly to middle- and low-income countries in which quality preferences might be not that pronounced and price is the most important aspect. Though wheat is a staple food in many of these countries and the demand for staple foods is usually rather inelastic, we assume that there are two different country groups. One group consists of countries for which it is rather easy to switch to another supplier. This implies that the residual demand facing an exporting country is rather elastic. However, the second group consists of countries that are not well integrated into the world market, i.e., there might be no alternative suppliers and the country does strongly depend on one exporter. This

will result in an inelastic residual demand. Thus, the residual demand of importers might vary because they have different number of poten tial suppliers.

4.5 Estimation results and discussion

The model (equation 1) is estimated using fixed effects regression with cluster robust standard errors[5]. Because there are pro and con arguments for real and nominal exchange rates, we estimated models with each, though we focus on the nominal rates (results with real exchange rates are presented in table 4.7 in the end of the chapter).

Because panel data are employed, nonstationarity might be a problem. Though our time series are rather short with a maximum of T=34 (unbalanced panel), panel unit root tests have been carried out. More specifically, the fisher type panel unit root test with several specifications was conducted because it allows for an unbalanced panel. The results rejected the null hypothesis that all panels contain a unit root for both the export unit value and the exchange rate (table 4.8 in the end of the chapter).

Moreover, we used the Wooldridge test for autocorrelation in panel data (WOOLDRIDGE, 2002). The results did not reject the null hypothesis of no first order autocorrelation.

To test the joint significance of both country and exchange rate effects, we conducted two F tests. In both cases, the null hypothesis, i.e., all country effects are equal $(H_0 : \lambda_1 = \lambda_2 = ... = \lambda_{27})$ and all exchange rate effects are zero $(H_0 : \beta_1 = \beta_2 = ... = \beta_{27} = 0)$, was rejected at the 10 % level indicating the presence of country-specific markups and pricing to market in at least some destinations.

With respect to parameters β_i and λ_i our results suggest that we can identify two different pricing scenarios, as in section 3.

First, we discuss the results of the model based on the whole time period using nominal exchange rates. In most importing countries, we cannot reject the null hypotheses of competitive pricing, i.e., $\beta_i = 0$ and $\lambda_i = 0$. There is perfect competition or imperfect competition with a common markup for all countries. The change in marginal costs (time effects) explains most of the change in the price.

[5] We estimated the PTM model applying several estimators and estimation methods: First, we applied the least squares dummy variable estimator (LSDV) with dummy variables for each quarter period using robust standard errors. Second, we estimated the model using the linear regression with panel-corrected standard errors specifying the panel-specific AR1 autocorrelation structure by correlation and independent autocorrelation structure. Finally, we estimated the PTM model using a fixed-effects estimator both with robust and clustered standard errors. The estimated coefficients were very stable and nearly identical independent of the estimator used.

However, there is evidence of pricing to market in five countries, namely Algeria, Azerbaijan, Cyprus, India, and Mongolia. The exchange rate effect is significantly different from zero ($\beta_i \neq 0$). The Russian wheat exporters amplify the effect of the exchange rates in Algeria and India. In contrast, they stabilize the local currency prices in Azerbaijan, Cyprus and Mongolia indicated by a negative exchange rate coefficient.

Table 4.5: Results of the PTM model using nominal exchange rates

Countries	Model 1: Total period (2002:1-2010:2)		Model 2: Pre-tax period (2002:1 to 2007:3)		Model 3: Post-tax Period (2008:3 to 2010:2)	
	β_i	λ_i	β_i	λ_i	β_i	λ_i
Albania	0.0488	-0.0266	0.1592	0.3201	-0.2468	1.6344
	[0.725]	[-0.043]	[1.640]	[0.344]	[-0.813]	[1.031]
Algeria	**0.9060***	-0.8598	-0.2139	0.7124	**-1.9570*****	2.8677
	[1.870]	[-1.048]	[-0.247]	[0.546]	**[-4.729]**	[1.868]
Armenia	0.2583	-0.5431	0.5564	-0.8821	**-0.7225*****	**3.2051****
	[0.822]	[-0.493]	[1.003]	[-0.491]	**[-6.023]**	**[2.440]**
Austria	0.2256	0.8411	0.2071	1.2676	0.5952	3.5263
	[1.010]	[0.945]	[1.395]	[1.095]	[1.014]	[1.422]
Azerbaijan	**-0.2919***	-0.9454	-0.0057	0.5488	-0.3915	0.0162
	[-1.777]	[-1.334]	[-0.015]	[0.393]	[-1.414]	[0.015]
Bangladesh	0.3194	-0.2331	0.0481	0.5236	0.0913	1.2588
	[1.522]	[-0.358]	[0.307]	[0.534]	[0.325]	[0.905]
Cyprus	**-0.4121***	**-1.6824***	-0.0525	0.2813	**-1.3436****	-4.3235
	[-1.746]	**[-1.743]**	[-0.144]	[0.196]	**[-3.362]**	[-1.893]
Egypt	-0.0087	0.0563	-0.0730	0.4628	-0.4738	0.5512
	[-0.136]	[0.095]	[-0.933]	[0.489]	[-1.853]	[0.367]
Georgia	0.0350	0.2295	-0.1302	0.2880	**-0.8826*****	-1.1232
	[0.341]	[0.418]	[-0.473]	[0.269]	**[-5.255]**	[-1.094]
Greece	0.1134	0.3926	0.0743	0.7565	-0.5708	-0.8534
	[0.580]	[0.459]	[0.371]	[0.630]	[-1.072]	[-0.301]
India	**1.2360****	-0.5604	0.3359	0.4094	**-7.6571*****	**4.5155****
	[2.142]	[-0.849]	[0.578]	[0.484]	**[-12.233]**	**[3.183]**
Iran	0.3787	-2.2086	-0.4873	3.1194	-0.2414	2.8095
	[1.342]	[-1.216]	[-1.117]	[1.181]	[-0.895]	[1.024]
Israel	0.1567	0.2965	0.5387	1.4888	-0.0183	1.2736
	[1.561]	[0.570]	[1.431]	[1.251]	[-0.052]	[1.448]
Italy	0.3911	1.3169	0.2226	1.2238	0.0606	1.3837
	[1.579]	[1.315]	[1.198]	[1.114]	[0.074]	[0.357]
Jordan	0.1865	0.8211	-0.0693	0.4168	-0.1418	0.8907
	[0.943]	[1.089]	[-0.207]	[0.327]	[-1.195]	[0.627]
Lebanon	-0.0653	0.3111	**-0.4756*****	**2.4453***	-0.3036	2.5237
	[-0.552]	[0.355]	**[-3.418]**	**[2.037]**	[-1.372]	[1.444]
Libya	-0.0285	-0.0903	0.1542	0.9310	**-0.5262***	-0.2865
	[-0.139]	[-0.124]	[0.473]	[0.746]	**[-1.914]**	[-0.445]
Mongolia	**-0.8315***	**3.2867****	**-1.7586***	**7.1500***	**-2.2417****	**10.1739****
	[-1.875]	**[2.087]**	**[-1.795]**	**[1.957]**	**[-2.536]**	**[2.979]**
Morocco	-0.0167	0.0601	0.1427	0.7327	-0.1886	1.1848
	[-0.141]	[0.103]	[0.633]	[0.732]	[-0.246]	[0.913]
Pakistan	0.0814	0.0204	**-2.2248****	**2.2141***	**-0.3274****	1.7538
	[0.917]	[0.035]	**[-2.513]**	**[1.870]**	**[-2.633]**	[1.257]
Spain	0.2738	0.8842	0.1781	1.0432	-0.2920	.
	[1.593]	[1.345]	[0.786]	[1.034]	[-0.838]	.
Syria	-0.1264	0.1451	**-0.9232****	1.1355	**-0.3755****	1.5476
	[-0.960]	[0.233]	**[-2.715]**	[1.148]	**[-2.766]**	[1.135]
Tunisia	-0.0297	.	-0.1953	.	-0.4455	.
	[-0.155]	.	[-0.644]	.	[-1.045]	.
Turkey	0.3213	1.0498	0.3615	1.6772	-0.5250	-0.2003
	[1.055]	[0.844]	[0.987]	[0.973]	[-1.560]	[-0.419]
Yemen	-0.0847	0.2433	0.2568	0.0741	-0.2230	1.8422
	[-0.328]	[0.283]	[1.084]	[0.069]	[-0.617]	[0.999]
Constant	**8.2452*****		**7.5754*****		**7.2002*****	
	[14.127]		**[8.196]**		**[5.450]**	
Observations	624		413		165	
R-sq:within	0.2797		0.3338		0.6680	
R-sq:adjusted	0.2182		0.2438		0.5307	
R-sq:overall	0.0378		0.0446		0.3609	
R-sq:between	0.0110		0.0481		0.0026	
AIC	-871.76		-553.52		-396.59	

Notes: Numbers in parentheses are *t*-statistics. The superscript ***,** and * denotes statistical significance at the 1 %, 5 % and 10 % levels, respectively. Estimated parameters in bold indicate statistically significant values. For the cross-sectional specification, Tunisia is treated as the intercept.

The countries for which the results do not indicate price discrimination are all well integrated into the world market. Russian wheat exports account only for a small to modest share of the import market (table 4.5.) and/or there are numerous competitors for Russia. Thus, it seems most likely that the residual demand for Russian wheat is elastic, which induces competitive behaviour. The other possibility is that Russia has some market power, but these countries are integrated and arbitrage is possible, which outbalances any price differences and, therefore, Russia cannot price discriminate (the law of one price holds in these countries). Consequently, Russia applies a common markup in all countries. According to KNETTER (1989) and GOLDBERG and KNETTER (1997), these two cases cannot be separated empirically with the given data.

Finally, pricing to market might be due to market power stemming from Russia's high share in total imports of Azerbaijan and Mongolia (see table 4.5). Furthermore, the geographical proximity of these countries makes Russia very competetive because transport costs are low. The adjustment of the markup induced by the bilateral exchange rate changes depends on the elasticity of the residual demand. If the residual demand is less convex than the constant elasticity demand schedule, exporters will stabilize local currency prices (negative exchange rate effects) (KNETTER, 1993). This is the case in Azerbaijan, Cyprus and Mongolia. In contrast, if the residual demand becomes more inelastic as the local currency prices rise, the exporters will amplify the effect of the exchange rate changes. This happens in the other two countries. Another explanation for such a finding might a change in the composition of exports (KNETTER, 1989). If the rouble appreciates, Russia becomes less competitive in the market of the undifferentiated wheat. It might remain competitive in the higher quality segment because higher quality products typically have less elastic residual demand. Thus, the unit value increases with the appreciation. Finally, pricing to market is observed in cases where the country effect is not significant. However, Russia should charge a markup if it offsets the impact of the exchange rate changes because the export price always should be over marginal costs. This suggests that Russia charges a common markup over marginal cost.

The results using real exchange rates (table 4.7) indicate that there is no price discrimination in 17 countries. Furthermore, price discrimination with constant markup is observed in Libya and Morocco. However, as discussed above, quality differences could explain the constant price difference as well. In contrast, Russia uses PTM in six countries: Azerbaijan, Iran, Israel, Lebanon, Mongolia and Syria. The coefficient of the exchange rate is positive for Israel, while it is negative for the other five countries. The model indicates PTM in Azerbaijan and Mongolia using both nominal and real exchange rates. There are more significant country effects using real exchange rates.

In order to investigate whether the export tax and high wheat prices in 2007 and 2008 had an impact on the pricing behaviour of Russian wheat exporters, we estimated the model for the time period before the tax was introduced (2002:1 to 2007:3) and the time period afterward (2008:3 to 2010:2). Because nominal exchange rates seem to be more appropriate, only these results will be discussed.

The results for the first time period indicate no price discrimination in 21 countries. Second, the results suggest PTM in four countries, namely Lebanon, Mongolia, Pakistan and Syria. The coefficients of the exchange rate are negative in all four countries. Thus, Russian exporters stabilize local prices if there is a change in the exchange rate in these countries. The share of Russian wheat in total wheat imports is rather high in Mongolia (43 %), Lebanon (53 %) and Syria (63 %). Pakistan started to import wheat from Russia only in 2004, but the Russian share is rather high with on average 54 % between 2004 and 2007.

If we turn to the estimates for the post-tax period, there are significantly more pricing to market effects. No price discrimination is found in 15 countries. However, the results indicate pricing to market in nine countries: Algeria, Armenia, Cyprus, Georgia, India, Libya, Mongolia, Pakistan and Syria. However, the results for Algeria and India must be interpreted with care because very few wheat shipments from Russia took place in the after-tax period. Spain was omitted because there is only one observation.

The significant exchange rate effects are negative for all these countries. Again, the results suggest that Russian wheat exporters tend to adjust markups of price over costs to stabilize local currency prices.

The more pronounced PTM effects in the second sub-period might be due to generally high world market prices in that period. In 2008, wheat demand far exceeded supply. The competition was less fierce than before because there was a shortage of wheat and thus a seller's market. Consequently, Russian exporters were able to set prices above marginal costs. However, the Russian exporters had to take into account the demand schedule present in each importing country. Thus, they offset more often the exchange rate changes.

Furthermore, the break in Russian wheat exports due to high export taxes reduced Russia's reliability as a supplier. Thus, in the aftermath of the tax, the Russian suppliers might have aimed to get their partners back by altering their pricing strategies to regain custom.

In addition, Russian exporters might have been encouraged to exploit government and private companies major investments in domestic transport and export infrastructure such as railway, sea ports and storage facilities. They would have to secure long-term export demand to make these investments profitable.

These arguments are consistent with FROOT and KLEMPERER (1989) and ABBOT et al. (1993), who argue that the pricing strategy is influenced by strategic variables such as market share and investment.

Moreover, at a higher price level exchange rate changes might induce a stronger and faster response in export prices than in the case of lower prices. In such a situation of different elasticities of the domestic currency price with respect to exchange rate changes at different price levels, exporters might find it profitable to offset the exchange rate changes to stabilize the demand more often in the case of high prices than otherwise. This is consistent with the results that all exchange rate effects are negative in the second period.

Generally, we found less PTM for Russian wheat exporters than other studies for the United States and Canada (e.g., PICK and PARK, 1991; PICK and CARTER, 1994; JIN, 2008; JIN and MILIJKOVIC, 2008). There are several reasons why the pricing behaviour of Russian wheat exporters might differ from their competitors, the United States and Canada, reported by previous studies. Table 4.6 gives a short summary.

Table 4.6: Comparison of the Russian, U.S. and Canadian wheat export market structure

	United States	Canada	Russia
Product characteristics	Differentiated high quality	Differentiated, very high quality	Undifferentiated, second class quality
Trade relationship length	High share of long-term relationships	High share of long-term relationships	High share of short-term relationships
Importing countries	Developed and developing countries	Developed and developing countries	Mostly developing countries
Export restrictions	None	None	Several times
Export market structure	Oligopolistic	Monopolistic	Oligopolistic

Source: Own compilation based on PICK and PARK, 1991; PICK and CARTER, 1994; CAREW, 2003; LAVOIE, 2005; JIN, 2008; JIN and MILIJKOVIC, 2008; USDA, 2010; WORLD BANK (2009) and own results.

First, the United States and Canada produce predominantly differentiated high-quality wheat, therefore they might be able to exercise market power due to product differentiation. The demand for high-quality wheat is rather inelastic because differentiated products have fewer direct substitutes. It is more difficult for the buyer to change the supplier. Consequently, the demand for differentiated products from a given source country is more inelastic than for undifferentiated products. Also, there are special types of wheat for different uses (e.g., pizza, pasta or bread) that are not direct substitutes (LAVOIE, 2005). In contrast, the major part of Russian wheat is considered to be of lower quality with only a small share of production to be high quality (WORLD BANK, 2009). Therefore, it seems reasonable to assume that the residual demand for Russian wheat is rather

elastic. Undifferentiated goods have many direct substitutes and it is relatively easy for buyers to switch to another supplier. Thus, there is less opportunity to use pricing to market. However, in the countries where there are few alternatives (e.g., they are not fully integrated in the world market), price discrimination is still possible. Looking at export statistics we can discover that the United States and Canada have quite stable export partners, supplying quite similar quantities of wheat to those countries every year. Thus, the United States and Canada might have long-term relationships with their buyers. In contrast, Russian wheat exporters change the quantity supplied to its partners almost every year. There are only a few countries where Russia exports similar quantities over several years (e.g. Egypt, Italy). This indicates short-term relationships. The United States and Canada supply both affluent and developing countries, while Russia ships its wheat mainly to developing countries. Developing countries might be more price sensitive, thus price discrimination is less likely. A final issue is the influence of trade policies. Russia imposed export restrictions in the last decade several times. These interventions create an unstable environment for Russian exporters and their buyers and make it hard to plan in the long-run. In contrast, the United States and Canada possess a stable business environment without any quantity restrictions. This facilitates long-term planning.

4.6 Concluding remarks

Over the last 10 years, Russian wheat exporters have achieved a strong market position in the international wheat market. Russia's share has grown from 0.5 % to 11.2 % from 2000 to 2009. It is expected that Russia will be the biggest wheat exporter in the world by 2019 (USDA, 2010). This increasing influence on the world market has resulted in a growing interest in the Russian wheat export market.

Our analysis suggests that Russia exercises pricing to market in some wheat-importing countries. However, this does not imply that Russia exerts market power in the world wheat market. Generally, the structure of the Russian wheat export was found to be more competitive than U.S. or Canadian wheat exports in previous studies. Estimates provide evidence for the existence of pricing to market behaviour of Russian exporters, first, in wheat importing countries where Russia has a large share in total imports and/or in countries in which there are few competitors. Second, our results suggest that Russia exercised pricing to market in more countries after the export tax of 2007 and 2008 than before. The more pronounced PTM effects can be due to the fact that wheat demand far exceeded supply in this period making the wheat market a seller's market, and therefore Russia was able to exercise market power in more countries than before. Alternatively, these results may reflect Russia's need to re-establish confidence

amongst their buyers following disruption of Russian supplies, and/or the need to justify the substantial investment in export infrastructure.

Finally, as stated in the beginning, Russia's plan to establish a grain pool with Ukraine and Kazakhstan has drawn some media attention. However, it seems unlikely that such a grain pool will be able to exercise significant market power. The world wheat market is characterized by low trade margins and high volumes. Moreover, wheat quality differs rather strongly across countries. Hence, it seems most likely that each country will search for the most profitable quality niche to compete on the world market.

This research would be enhanced by using a complement methodology, the residual demand elasticity approach introduced by GOLDBERG and KNETTER (1999). This model takes into account the cost shifters of the competitors and the demand shifters of the importing country. Furthermore, it is able to quantify the market power of the exporting country. However, it has more sophisticated and substantial data needs and should be estimated for each importing country separately. Thus, the PTM approach provides first evidence of the competitive structure of the Russian wheat export. Based on the presented results market power should be examined in more detail for selected countries in future research.

4.7 Appendix

Table 4.7: Results with real exchange rates

Countries	Model 1: Total period (2002:1-2010:2)		Model 2: Pre-tax period (2002:1 to 2007:3)		Model 3: Post-tax Period (2008:3 to 2010:2)	
	β_i	λ_i	β_i	λ_i	β_i	λ_i
Albania	0.0593	0.2637	**0.2807***	-0.3043	-0.0374	1.5694
	[0.802]	[0.777]	**[2.012]**	[-0.550]	[-0.181]	[1.014]
Algeria	-0.0887	0.3837	0.1215	-0.0837	**-5.1436*****	**7.0528*****
	[-0.553]	[1.068]	[0.782]	[-0.162]	**[-4.796]**	**[3.530]**
Armenia	0.2021	-0.0963	0.7883	-1.9814	**-0.6286*****	**3.2710***
	[0.361]	[-0.061]	[0.809]	[-0.719]	**[-4.541]**	**[2.257]**
Austria	-0.0856	0.0442	0.0163	0.1210	0.6337	3.6185
	[-0.990]	[0.119]	[0.092]	[0.217]	[0.674]	[1.003]
Azerbaijan	**-0.2349****	-0.5062	0.0962	0.4418	-0.3050	0.4162
	[-2.077]	[-1.027]	[0.643]	[0.828]	[-0.886]	[0.320]
Bangladesh	0.1582	0.2071	0.1368	-0.0206	0.6094	0.9189
	[0.848]	[0.565]	[1.022]	[-0.040]	[1.338]	[0.633]
Cyprus	0.0827	0.6533	0.1659	0.7000	-0.7309	-1.3374
	[0.407]	[0.718]	[0.569]	[0.561]	[-1.051]	[-0.439]
Egypt	-0.0529	0.2880	0.0374	0.1649	**-0.4108***	0.8124
	[-1.121]	[0.922]	[0.710]	[0.378]	**[-2.171]**	[0.589]
Georgia	-0.0105	0.4101	**0.8372*****	**2.4648*****	**-0.7256*****	-0.4179
	[-0.046]	[0.644]	**[3.037]**	**[3.442]**	**[-4.280]**	[-0.339]
Greece	0.0677	0.5341	**0.3972****	**1.4357****	-0.0106	1.3854
	[0.381]	[0.800]	**[2.414]**	**[2.531]**	[-0.012]	[0.392]
India	1.1095	-0.2671	0.5051	-0.1528	**-11.6432*****	**7.3261*****
	[1.577]	[-0.594]	[0.582]	[-0.295]	**[-20.365]**	**[4.675]**
Iran	**-0.8097*****	**4.8295*****	-0.4145	2.2271	-0.0641	1.9324
	[-2.986]	**[3.226]**	[-0.708]	[0.652]	[-0.356]	[0.919]
Israel	**0.1403****	**0.5668***	**0.2297****	0.4517	0.1783	1.7892
	[2.181]	**[1.758]**	**[2.701]**	[1.069]	[0.320]	[1.601]
Italy	-0.0424	0.0766	0.2287	0.7784	1.2461	5.5397
	[-0.249]	[0.112]	[1.540]	[1.601]	[1.338]	[1.403]
Jordan	-0.1056	0.0606	0.0352	0.3311	0.2323	2.4198*
	[-0.850]	[0.131]	[0.210]	[0.576]	[1.602]	[1.945]
Lebanon	**-0.1735****	**1.0413****	-0.0952	0.4513	-0.0897	1.8561
	[-2.524]	**[2.119]**	[-1.216]	[0.649]	[-0.433]	[1.050]
Libya	0.1235	**0.6837***	0.0802	0.2270	**-0.6178****	-0.2778
	[1.215]	**[1.867]**	[0.538]	[0.457]	**[-2.558]**	[-0.294]
Mongolia	**-0.8986****	**3.8337*****	-1.0248*	**3.9443****	**-1.7540*****	**8.4264****
	[-2.590]	**[3.003]**	[-1.916]	**[2.094]**	**[-3.689]**	**[3.117]**
Morocco	0.1509	**0.5630***	**0.4174*****	0.6079	-0.2847	1.3212
	[1.108]	**[1.744]**	**[3.068]**	[1.440]	[-0.496]	[0.851]
Pakistan	0.0696	0.3346	-0.9286	0.7747	-0.0994	1.6991
	[0.830]	[1.106]	[-1.548]	[1.157]	[-1.258]	[1.223]
Spain	0.2608	1.1535	0.4879	1.6864	-0.3612	.
	[0.976]	[1.180]	[1.456]	[1.363]	[-0.929]	.
Syria	**-0.3354****	**0.5781***	**-0.4074****	0.3315	**-0.2693****	1.6928
	[-2.107]	**[1.697]**	**[-2.076]**	[0.658]	**[-2.898]**	[1.233]
Tunisia	-0.1312	.	-0.0382	.	-0.5442	.
	[-1.315]	.	[-0.261]	.	[-1.176]	.
Turkey	0.1367	0.8010	0.3498	1.1556	-0.1794	1.0111
	[0.490]	[0.891]	[0.760]	[0.789]	[-0.703]	[0.912]
Yemen	-0.1973	0.7684	0.3324	-0.5385	-0.0612	1.6961
	[-0.647]	[1.097]	[1.170]	[-0.641]	[-0.147]	[0.880]
Constant	**7.9388*****		**8.0555*****		**7.0318*****	
	[26.383]		**[17.844]**		**[5.223]**	
Observations	624		413		165	
R-sq:within	0.3006		0.3481		0.6825	
R-sq:adjusted	0.2409		0.2601		0.5511	
R-sq:overall	0.0468		0.1371		0.4914	
R-sq:between	0.0346		0.2669		0.4466	
AIC	-890.20		-562.50		-403.93	

Notes: Numbers in brackets are *t*-statistics. The superscript ***,** and * denotes statistical significance at the 1 %, 5 % and 10 % levels, respectively. For the cross-sectional specification, Tunisia is treated as the intercept.

Table 4.8: Fisher type panel unit root test for the Russian export unit value and nominal exchange rate

	Augmented Dickey-Fuller panel test	
	Export unit value Inverse normal	Nominal exchange rate Inverse normal
1 lag with drift	-4.3182***	-8.3045***
1 lag demeaned	-7.0054***	-3.9376***
1 lag demeaned with drift	-11.2959***	-9.7832***

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5 Residual demand measures of market power of Russian wheat exporters[67]

Abstract

Traditionally, the international wheat market has been considered a good example for a market with perfect competition. Yet, several articles provide evidence of imperfect competition and price discrimination in the wheat trade. However, these studies focused on traditional high-quality wheat exporters such as Canada and the USA. In contrast, this article investigates whether Russian wheat exporters exercise market power in eight selected importing countries using the residual demand elasticity model. The article makes two major contributions. First, it focuses on a non-traditional exporter, who exports mainly wheat of mediocre quality to low- and middle-income countries. Second, the residual demand elasticity model is estimated for the first time using a non-linear estimator, the instrumental variable Poisson pseudo maximum likelihood estimator. This is important because the double logarithmic functional form can provide biased results in the presence of heteroskedasticity. The results indicate that Russian wheat exporters can exercise market power in only a few markets, while they are price takers in the majority of importing countries.

5.1 Introduction

Traditionally, the international wheat market has been considered as one of the best examples of a market with perfect competition. Accordingly, the law of one price would hold and all players would behave as price takers without any influence on the market price. However, the results from several empirical studies indicate that this assumption does not hold for all exporters and importers. Imperfect competition and price discrimination and thus market power seem to be present at least in certain segments of the international wheat

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[7] The chapter is based on the paper "Residual demand measures of market power of Russian wheat exporters" by Zsombor Pall, Oleksandr Perekhozhuk, Thomas Glauben, Sören Prehn and Ramona Teuber published in *Agricultural Economics Vol. 45, 2013*, 1-11. Oleksandr Perekhozhuk provided econometric analysis of time-series data and together with Thomas Glauben, Sören Prehn and Ramona Teuber contributed to the empirical model and discussion of the results.

market. For example, using the pricing to market (PTM) model, PICK and PARK (1991), PICK and CARTER (1994), CAREW (2000), CAREW and FLORKOWSKI (2003), LAVOIE (2005) and JIN (2008) find strong evidence of price discrimination by American and Canadian wheat exporters. Employing the residual demand model proposed by GOLDBERG and KNETTER (1999), CARTER et al. (1999), CHO et al. (2002), and YANG and LEE (2005) show that American, Canadian, and Australian wheat exporters are able to exercise market power in certain export markets.

While previous articles using the residual demand elasticity (RDE) approach examine the market power of traditional wheat exporting countries, which export large quantities of high-quality wheat to developed countries, no analysis has been carried out so far on Russia, a country which supplies mainly wheat of undifferentiated quality to developing and transition countries. This fact could imply on the one hand that Russia behaves more competitively because the country has no market power originating from product differentiation. On the other hand, Russia might have market power in certain wheat-importing countries that are not yet well- integrated into the world market.

Russian wheat exports have gone through an especially spectacular development in the last decade. While the country was a major wheat importer in the beginning of the 1990s, it had become the fourth largest exporter by the end of the 2010. In 1992, Russia imported more than 19 million tons of wheat and its exports were negligible. In 2009, Russia was one of the leading wheat exporters with a net export of more than 16 million tonnes. It is expected that Russia's market share in the global wheat trade will increase further, because there is still significant production potential in terms of both area and yield (FAO, 2009, p. 19; USDA, 2010).

Russia has become the major wheat supplier for several countries. Between 2002 and 2009 Russian exporters had a market share of more than 60 % in Albania, Georgia, and Syria, and more than 50 % in Azerbaijan, Lebanon, and Mongolia (Table 1). All of these countries, with the exception of Syria, which is a major wheat producer itself, are highly dependent on Russian wheat exports. Thus, it is hypothesized that Russia might have market power in these countries.

The Russian wheat export is organized by large private companies. Although in 2009 the Russian government has created a state trader for grain, the United Grain Company (UGC), it has not started to operate so far. Thus, the Russian wheat trade has preserved its oligopolistic structure.

The aim of this article is twofold. First, we investigate whether Russian wheat exporters can exercise market power in selected importing countries by employing the residual demand model proposed by GOLDBERG and KNETTER (1999). Usually, it is assumed that market power arises from product differentiation and

the supply of a high-quality product that has few or no substitutes. This seems to be the case for Canadian wheat, which is considered to be very high in quality (LAVOIE, 2005). However, market power can also arise from other factors such as geographic location, for example the lack of alternative suppliers in landlocked countries. Second, we compare the results from two different estimators with respect to consistency of the RDE results. SANTOS SILVA and TENREYRO (2006) and TENREYRO (2007) have shown that in the presence of heteroskedasticity, any non-linear transformation and consequently estimation of log linearized models yields biased results. Thus, the instrumental variable Poisson pseudo maximum likelihood estimator (IVPPML) is applied for the first time to estimate the residual demand elasticity model. For comparison and as a benchmark the model is also estimated by using the generalized method of moments (GMM) estimator.[8]

Table 5.1: Import market share of Russia and other major exporters in destination markets

Destination	Exporting country	2002	2003	2004	2005	2006	2007	2008	2009
Albania	Russia	62.92	65.3	38.8	74.24	59.98	80.15	42.46	67.39
	Bulgaria	*7.13*	*0.96*	*3.21*	*9.21*	*6.19*	*0.04*	*7.58*	*0.22*
	Hungary	*6.95*	*3.77*	*0.85*	*1.73*	*0*	*0.95*	*18.57*	*10.76*
	Ukraine	*2.66*	*1.57*	*1.41*	*11.32*	*24*	*8.08*	*5.88*	*3.12*
Azerbaijan	Russia	27.84	21.98	45	88.61	64.3	32.29	55.48	74.38
	Kazakhstan	*69.73*	*78.01*	*38.19*	*11.39*	*35.36*	*67.37*	*35.84*	*21.62*
Egypt	Russia	19.81	21.45	11.56	40.58	32.41	42.32	35.8	39.39
	France	*32.25*	*36.68*	*40.37*	*16.6*	*14.78*	*27.09*	*24.62*	*10.94*
	USA	*15.5*	*21.53*	*10.93*	*9.84*	*8.91*	*2.04*	*7.54*	*21.94*
	Australia	*16.69*	*8.63*	*23.6*	*12.05*	*16.6*	*4.88*	*3.15*	*4.49*
Georgia	Russia	65.47	67.29	39.13	89	69.05	63.04	56.67	83.82
	Kazakhstan	*11.87*	*4.26*	*20.53*	*8.53*	*17.36*	*36.91*	*29.63*	*12.19*
	USA	*20.7*	*25.97*	*16.82*	*0*	*5.83*	*0*	*0*	*3.84*
	Ukraine	*1.92*	*0*	*1.71*	*1.13*	*4.26*	*0.01*	*9.17*	*0*
Greece	Russia	50.23	36.76	22.96	33.02	22.71	31.6	23.57	3.17
	France	*2.92*	*17.71*	*20.97*	*15.25*	*19.75*	*18.8*	*16.46*	*20.12*
	Germany	*4.47*	*10.31*	*5.63*	*3.07*	*3.56*	*9.57*	*4.63*	*7.35*
	Hungary	*0*	*0.14*	*6.21*	*11.79*	*16.81*	*16.35*	*22.71*	*21.51*
	Kazakhstan	*0.85*	*3.94*	*0*	*9.63*	*8.15*	*7.72*	*4.86*	*5.6*
	Ukraine	*14.23*	*3.72*	*2.65*	*5.02*	*9.11*	*0.98*	*11.13*	*6.15*
Lebanon	Russia	51.15	48.3	34.94	80.61	35.46	69.91	53.18	55.92
	Kazakhstan	*0*	*16.91*	*0*	*4.43*	*7.51*	*25.78*	*33.42*	*0*
	Ukraine	*6.04*	*1.61*	*0*	*0*	*4.16*	*1.16*	*7.08*	*22.1*
	USA	*26.5*	*16.87*	*19.35*	*2.59*	*12.55*	*0*	*0*	*0.84*
Mongolia	Russia	77.96	79.55	0.33	27.78	33.60	39.54	95.50	78.60
	Kazakhstan	*22.04*	*11.50*	*31.96*	*44.57*	*66.22*	*29.71*	*4.10*	*0.05*
	USA	*0.00*	*0.00*	*64.01*	*21.82*	*0.00*	*28.48*	*0.00*	*21.35*
Syria	Russia	57.99	97.91	46.52	80.79	28.16	68.25	78.75	59.8
	Ukraine	*0*	*0*	*34.82*	*13.11*	*71.84*	*13.32*	*10.15*	*15.36*
	Kazakhstan	*0*	*0*	*0*	*0*	*0*	*14.86*	*0*	*0*

Source: Own compilation based on COMTRADE.

[8] IVPPML is also based on an iterative GMM approach. Hence, small sample properties should be comparable.

Altogether eight importing countries are considered. These comprise Egypt, the most important export market for Russia, and countries in which Russia has a modest to high import market share and thus market power can be expected (see table 5.1). Market power seems to be more likely in countries where there are few competitors and Russia has a high market share.

The article is organized as follows. In the next section the theoretical model and the estimation procedure are described. Section three provides a description of the data and summary statistics. Section four presents and discusses the results. The final section concludes.

5.2 The Residual demand elasticity approach

In our analysis we employ the residual demand elasticity (RDE) approach which was introduced by GOLDBERG and KNETTER (1999) to measure market power in international trade based on aggregated market data. The RDE approach assumes oligopolistic market structures, which seems to be a reasonable assumption for the international wheat market. The theoretical model is based on GLAUBEN and LOY (2003).

As it is evident from Table 1, there are usually several exporters selling wheat to a particular foreign destination market. For simplicity we assume two competing exporters $(k = 1,2)$ which both face an inverse residual demand function in this destination market. The residual demand of k depends on its own export quantity (Q^k), the supply of its competitor (Q^j), and demand shifters of the importing country (Z).The inverse residual demand function that each competitor faces can be written as:

$$p^1 = p^1(Q^1, Q^2, Z) \tag{5.1}$$

and

$$p^2 = p^2(Q^2, Q^1, Z), \text{ respectively.} \tag{5.2}$$

Based on the residual demand and individual cost functions, the profit maximization problem of the competitor k can be expressed as follows:

$$\max_{Q^k} \Pi^k = Q^k P^k(Q^k, Z) - e^k C^k(Q^k, W^k).$$

Where e^k is the exchange rate between the importing country and the competitor k, and W^k are cost shifters of the competitor.

The supply relations of the competitors can be expressed as:

$$e^1 MC^1(Q^1, W^1) = MR^1(Q^1, Q^2, Z) \tag{5.3}$$

and

$$e^2 MC^2(Q^2, W^2) = MR^2\left(Q^2, Q^1, Z\right), \tag{5.4}$$

with MC^k the marginal cost and MR^k the marginal revenue of the competitor k.

To quantify the market power of competitor 1, the inverse residual demand function needs to be estimated following GOLDBERG and KNETTER (1999). First, equations 2 and 4 have to be solved for the quantity supplied by exporter 2, with $Q^2 = Q^2\left(Q^1, Z, e^2 W^2\right)$. $Q^2(\cdot)$ is the residual demand function of exporter 2. Second, the quantity supplied by exporter 2 is substituted in equation 5.1.

$$p^1 = p^1\left(Q^1, Q^2\left(Q^1, Z, e^2 W^2\right), Z\right). \tag{5.5}$$

Assuming that the major cost shifters are changes in the exchange rate the model can be reduced to the following equation:

$$p^1 = p^1\left(Q^1, e^2, Z\right). \tag{5.6}$$

Because the exported quantity on the right hand side is endogenous, it needs to be instrumented resulting in the following inverse residual demand equation:

$$p^1 = p^1\left(\hat{Q}^1, e^2, Z\right). \tag{5.7}$$

p^1 is the export price expressed in the importing country's currency, $\hat{Q}$ is the instrumented quantity exported by the exporter of interest to the given importing country, e is the exchange rate between the competitor and the destination market to account for cost changes of the competitor, and Z is a vector of exogenous demand shifter of the importing country.

This model points out that the inverse residual demand curve possesses three observable factors: the quantity exported by he exporter group, cost shifters of the competitors, and demand shifters of the importing country. These factors are included in the following econometric model which will be estimated using the IVPPML method (TENREYRO, 2007):

$$p^{ex}{}_{mt} = \exp\left(\eta Q^{ex}{}_{mt} + \alpha' Z_{mt} + \beta' e^n{}_{mt}\right) + \varepsilon_{mt}, \tag{5.8}$$

All previous RDE models were estimated in the double logarithmic functional form:

$$\ln p^{ex}{}_{mt} = \lambda_m + \eta \ln Q^{ex}{}_{mt} + \alpha' \ln Z_{mt} + \beta' \ln e^n{}_{mt} + \varepsilon_{mt}. \tag{5.9}$$

Where the variables are defined as above, ε_{mt} is an error term and the other Greek letters are parameters (or in the case of α' and β' vectors of parameters) to be estimated. The subscripts m and t denote importing country and time, respectively. The parameter η can be interpreted as the inverse residual de mand elasticity. A zero estimate refers to perfect competition. In this case, the exporting country faces a perfectly elastic demand curve and the export price

is independent from its export quantity, and instead it is defined by the costs of the other competitors and demand characteristics of the importing country. Thus, the exporter is a price taker in this market. In contrast, a negative estimate indicates imperfect competition. The exporter faces a demand curve with a negative slope, which implies that its export quantity influences the price and consequently the exporter is a price maker. The larger the absolute value of the estimate the more market power the given exporter possesses. A monopolist faces the market demand curve. GOLDBERG and KNETTER (1999) argue that under some circumstances the residual demand elasticity is identical to the Lerner index. These are the dominant firm models, perfect competition, and a high degree of product differentiation. In these cases the estimate of η_{mt} is the relative mark-up over marginal cost. In other cases a larger absolute value of the residual demand elasticity indicates more market power, but it is not an exact measure of the relative mark-up.

The coefficients of the cost shifters of the competing countries indicate whether their products are perfect or imperfect substitutes to the product offered by the exporter under consideration. If the coefficients of the cost shifters are positive and significant, the given country supplies a perfect substitute. In this case if the costs of the competing country increase (indicated by its cost shifters), the exporting country of interest can charge a higher price. Thus, the two countries are competitors in the considered destination market and constrain the ability to exercise market power. In contrast, if the coefficients of the cost shifters are negative and significant, the country exports an imperfect substitute.

Previous studies applying the RDE approach used different estimators (see Table A1 in the Appendix) such as two and three stage least squares (2SLS, 3SLS), seemingly unrelated regression (SUR), and generalized method of moments (GMM). However, all of them use the double logarithmic functional form. GOLDBERG and KNETTER (1999) note that there is no assumption of the functional form and the double log form is employed because of its good applicability (the coefficients can directly be interpreted as elasticities). However, SANTOS SILVA and TENREYRO (2006) and TENREYRO (2007) show that in the presence of heteroskedasticity any non-linear transformation and thus the estimation of log-linearized models yields biased results. This is based on Jensen's inequality $\ln E(x) \neq E[\ln(x)]$. SILVA and TENREYRO (2006) illustrate their findings with the gravity equation but emphasize that this problem applies to a wide range of empirical applications.

Consequently, constant-elasticity models should be estimated in their original, i.e. multiplicative form. SANTOS SILVA and TENREYRO (2006) and TENREYRO (2007) further propose a non-linear estimator, the Poisson pseudo maximum likelihood

(PPML) estimator. Following their arguments the instrumental variable Poisson pseudo maximum likelihood (IVPPML) estimator is used for the first time to estimate the residual demand elasticity model. This estimator has two major advantages. First, it estimates the model in multiplicative form and thus it does not require taking logarithms of the variables. Second, it produces semi-elasticities which can be easily transformed to true elasticities by multiplying them with the mean.

5.3 Data and descriptive statistics

Eight wheat importing countries – Albania, Azerbaijan, Egypt, Georgia, Greece, Lebanon, Mongolia, and Syria – are considered in our study. These countries were chosen for the following reasons. First, the pricing behavior of the Russian wheat exporters should be investigated in the most important export market, which is Egypt. Second, we chose export destinations in which Russian wheat accounts for a modest to high share of the total import market (see Table 1), and thus market power might be expected. Third, the choice was driven by data availability. It is expected that the Russian wheat exporters behave rather competitively in Egypt, because that country is one of the biggest importers and there are several competitors. In contrast, market power is assumed in countries where Russia has a high import market share and faces few competitors.

The time period considered is Q1:2002 to Q4:2009. This period was chosen for three reasons. First, Russia became a major exporter in 2002. Second, Russia banned wheat exports in 2010. Third, many of the data are only available up to 2009. Quarterly rather than annual data are used because the model should be estimated separately for all countries (because Russia has different competetors in the different importing countries) and the larger number of observations provides more precise results.

The empirical model is estimated using the following variables (see table 5.2). The dependent variable is the Russian export unit value (EUV) expressed in the currency of the importing country. The cost shifters of the competitors include the wheat producer price (PP) in the competitor country (in the currency of the respective competitor) and nominal exchange rates (ER) between the importing and the competitor countries (in the importing country's currency per unit of the competitor country's currency).

Table 5.2: Summary statistics of variables

Variable	Value	Albania	Azerbaijan	Egypt	Georgia	Greece	Lebanon	Mongolia	Syria
EUV	Mean	14586.0	134.8	827.0	288.0	108.2	221227.0	212856.0	8085.0
	CV	29.5	32.6	41.6	30.8	33.9	43.4	46.7	43.0
REQ	Mean	45579.6	136467.7	691847.6	107589.4	90953.5	63413.6	15698.6	112706.3
	CV	48.9	86.4	68.1	50.9	88.1	56.5	112.2	122.5
ER RUB	Mean	3.642	0.032	0.195	0.064	0.029	53.009	42.372	1.810
	CV	11.6	9.1	13.7	9.0	9.9	9.3	10.1	12.1
ER HUF	Mean	0.502				0.004			
	CV	6.7				4.6			
ER BGN	Mean	65.491							
	CV	4.6							
ER UAH	Mean	19.313			0.341	0.155	276.662		9.315
	CV	21.2			18.2	17.2	13.1		18.2
ER KZT	Mean		0.007		0.014	0.006	11.183	8.905	0.383
	CV		8.7		7.8	8.7	9.3	10.8	11.2
ER USD	Mean			5.550	1.848			1201.320	
	CV			8.8	12.3			8.2	
ER AUD	Mean			4.106					
	CV			19.2					
ER EUR	Mean			6.968					
	CV			17.6					
PP RUS	Mean	3389.9	3462.4	3311.7	3389.9	3279.1	3325.5	3493.1	3527.8
	CV	34.1	38.0	34.7	34.1	35.3	35.2	38.9	33.4
PP USA	Mean			166.2	164.4			172.1	
	CV			35.4	34.9			37.4	
PP FRA	Mean			131.4		132.5			
	CV			32.0		32.4			
PP AUS	Mean			281.1					
	CV			34.0					
PP UKR	Mean	904.9			904.9	871.0	871.4		908.2
	CV	33.3			33.3	34.1	34.1		33.1
PP KAZ	Mean		15904.5		15569.3	14997.1	15684.1	15939.5	16878.3
	CV		39.2		38.3	38.8	40.0	39.8	37.4
PP HUN	Mean	30690.8				30470.2			
	CV	34.3				36.2			
PP BUL	Mean	217.199							
	CV	35.2							
PP GER	Mean					134.3			
	CV					31.2			
GDP	Mean	212339.0	2851.8	141179.8	3716.1	43325.8	7918631.2	1086198.4	480269.3
	CV	14.8	41.7	13.7	49.5	14.6	6.1	71.2	49.7
CPI	Mean	101.8	155.2	110.7	106. 3	101.6	116.3	109.3	144.3
	CV	6.1	29.1	22.9	17.3	7.3	17.4	24.5	20.7
TEQ	Mean			2661102.6					
	CV			62.4					

Source: Own calculations.

Notes: REQ is the Russian export quantity in tons, EUV is the export unit value in local (domestic) currency of the importing country; ER is the exchange rate between the import market currency and the export market currency: RUB=Russian ruble, HUF=Hungarian forint, BGN=Bulgarian lev, UAH= Ukrainian hryvnia, KZT=Kazakhstani tenge, USD=US Dollar, AUD= Australian dollar, and EUR= European Euro; PP is the wheat producer price in the competitor country: RUS=Russian Federation, USA= United States, FRA=France, AUS=Australia, UKR=Ukraine, KAZ=Kazakhstan, HUN=Hungary, BUL=Bulgaria, and GER=Germany; GDP is the real gross domestic product of the importing country in domestic currency; CPI is the consumer price index of the importing country; TEQ is the total export quantity of Russia; CV is the coefficient of variation expressed in percent.

The demand shifters comprise the real gross domestic product (GDP) and the consumer price index (CPI) of the importing country (both expressed in the currency of the importing country). Because the exported quantity is likely endogenous, we use as instruments the cost shifters of the exporter of interest (in this case Russia) as proposed by GOLDBERG and KNETTER (1999).

The Russian f.o.b wheat unit values and quantities (HS code: 1001) and the total import values (in the case of Greece) are obtained from the Global Trade Atlas Database. The nominal exchange rate between the import market currency and the export market currency, quarterly real GDP data, and consumer price indexes of the importing country are from the International Financial Statistics database of the International Monetary Fund.

Since time series data are employed, non-stationarity might be a problem. In this case the time series unit root tests are not reliable, because the time series are rather short. Thus the Fisher type panel unit root test was used for the export unit value (EUV), Russian export quantity (REQ), and exchange rate between the currency of the importing country and the Russian ruble (ER RUB). The results reject the null hypothesis that all panels contain a unit root. The results are presented in Table 5.8. in the Appendix.)

However, no quarterly real GDP data were available for five out of eight countries. Thus, the annual values were interpolated to obtain quarterly data. Wheat producer prices are obtained from the statistical offices of the respective countries and their detailed sources can be found below in the Appendix.

5.4 Results and discussion

Equation (5.8) was estimated using the instrumental variable Poisson pseudo maximum likelihood (IVPPML) estimator (WINDMEIJER and SANTOS SILVA, 1997). The presented results (see Table 3) are transformed into elasticities by multiplying the parameters with the mean of the variables. For comparison, the results of a more traditional technique, the two-step instrumental variable efficient generalized method of moments (GMM) estimator, are also presented in Table 5.3 (Equation 5.9). Different tests for the validity and relevance of instruments are written for the GMM estimator; however, these are not available so far for the IVPPML methodology. Thus, the model was first estimated using GMM and the appropriate instruments were selected based on the test statistics. Thereafter the model was estimated using the IVPPML method and these instruments.

Previous articles employing the residual demand elasticity approach did not explicitly investigate the quality of the applied instruments. However, the quality of instruments is crucial in instrumental variable estimations. If the instruments are not relevant (sufficiently correlated with the instrumented variable) and valid (correctly excluded from the equation), the results will be biased. Thus, the

appropriate instruments first need to be found. The test statistics of the relevance of the excluded instruments, i.e. the F test of the joint significance in the first stage regression, can be found in table 5.5. in the Appendix.

The test results suggest that the Russian ruble exchange rate (ER RUB) is a weak instrument in all cases, whereas the producer price is a strong instrument in six countries and a weak one in two. Additional instruments were employed to increase the efficiency of the instrumental variable estimation. The GDP was proven to be a good instrument in three cases. In Egypt and Greece, all instruments turned out to be weak. Thus, in Egypt the Russian export quantity and in Greece the total import value were used as instruments.

The results of the two estimators are comparable with similar directions but sometimes different magnitude and significance of the coefficients. There are five significant quantity coefficients using GMM, whereas there are only three using the IVPPML. In Egypt the coefficient is in both cases small and close to zero but it is statistically significant only in the GMM model. For Azerbaijan, the quantity coefficients are again very similar, approximately −0.17, but again statistically significant is only the one in the GMM model. Following TENREYRO (2007), it is assumed that the IVPPML results are more consistent. Thus, the results of the IVPPML model will be discussed in more detail in the followings.

The statistical inference indicates a good fit of the models, with the R-squared ranging from 0.65 in Mongolia to 0.98 in Egypt. All regression coefficients for the export quantity are negative, a result that is in line with the theory. Three out of eight quantity coefficients are statistically significant, which indicates that Russian exporters face a demand that is not perfectly elastic and they have an influence on the price and market power. This is the case in Albania, Georgia, and Greece. The largest coefficient can be observed in Albania and the smallest in Greece; however, the difference is rather small (the coefficient of the quantity ranges from −0.0883 to −0.0527). This indicates a small extent of market power. These results are consistent with ANANIA et al. (1992), who pointed out that excess profits are not present on the international wheat market, and FAO (2009, p. 22), which characterizes the wheat business as a high-volume low-margins business. Russian wheat exporters are price takers in the other five countries: Azerbaijan, Egypt, Lebanon, Mongolia, and Syria.

Table 5.3: RDE estimation results by instrumental variable Poisson pseudo-maximum-likelihood (IVPPML) and extended IV two-step efficient GMM estimator

	Albania		Azerbaijan		Egypt		Georgia		Greece		Lebanon		Mongolia		Syria	
	IVPPML	GMM	IVPPML	GMM	IVPPML	GMM	IVPPML	GMM	IVPPML	GMM	IVPPML	GMM	IVPPML	GMM	IVPPML	GMM
REQ	-0.0883*	-0.0628*	-0.1723	-0.1647**	-0.0048	-0.0238*	-0.0730*	-0.0550***	-0.0527**	-0.0650***	-0.0564	-0.0684	-0.2497	-0.0698	-0.0543	-0.0338
	[-1.942]	[-1.761]	[-0.960]	[-2.114]	[-0.272]	[-1.692]	[-1.838]	[-2.890]	[-2.157]	[-3.822]	[-1.278]	[-1.405]	[-0.992]	[-1.069]	[-0.579]	[-0.469]
ER RUB	0.8465**	0.8757**	-0.6040	-1.9531	0.7207***	0.6730***	1.0921***	0.7885**	2.3659***	2.0128***	0.9360	0.8410*	3.0806**	0.5947	1.0302	0.9943
	[2.252]	[2.381]	[-0.279]	[-1.216]	[2.656]	[3.416]	[2.596]	[2.068]	[4.693]	[7.432]	[1.513]	[1.815]	[2.093]	[0.775]	[0.719]	[1.309]
ER HUF	-0.4782	0.0432							0.4063	0.5519						
	[-1.266]	[0.123]							[0.791]	[1.470]						
ER BGN	0.1137	-0.4990														
	[0.177]	[-0.910]														
ER UAH	-0.2628	-0.2049					-0.2108	0.5052	-1.1519***	-0.3473	-0.3525	0.3490			-0.3548	0.4463
	[-0.929]	[-1.015]					[-0.528]	[1.518]	[-3.304]	[-1.558]	[-0.900]	[0.923]			[-0.468]	[0.970]
ER KZT			2.4309	3.0326**			2.0416***	1.3390***	-0.4861	-1.0928***	0.3540	-0.7872*	-2.4383	-1.0944	0.6467	-0.5138
			[0.977]	[2.161]			[5.931]	[4.543]	[-1.144]	[-3.471]	[1.072]	[-1.792]	[-1.130]	[-0.648]	[0.457]	[-0.398]
ER USD					0.1297	-0.0020	-0.9090***	0.4064					-3.5408	-1.1629		
					[0.195]	[-0.003]	[-4.164]	[1.400]					[-1.177]	[-1.543]		
ER EUR					1.2968*	0.7062										
					[1.947]	[1.105]										
ER AUD					-0.6079	-0.2094										
					[-1.303]	[-0.477]										
PP RUS					0.2369*	0.3081***			0.3239**	0.2992***	0.6300***	0.6068***				
					[1.924]	[2.907]			[2.561]	[3.916]	[3.444]	[2.984]				
PP HUN	-0.1913	0.1707							0.0710	0.3165*						
	[-0.898]	[0.887]							[0.348]	[1.804]						
PP BUL	0.8381***	0.5643**														
	[3.077]	[2.452]														
PP UKR	-0.1013	-0.0603					0.5652***	0.4328***	0.0750	-0.1413	0.3416***	0.2564**			0.9189***	0.8704***
	[-0.478]	[-0.466]					[11.627]	[8.645]	[0.652]	[-1.469]	[2.603]	[2.160]			[2.858]	[3.410]
PP KAZ			0.5500**	0.4120*			0.1621*	0.4737***	-0.2052***	-0.0854	-0.1847	-0.0517	2.0045***	1.5653***	0.0235	0.2101
			[2.196]	[1.656]			[1.810]	[4.386]	[-3.037]	[-1.253]	[-1.125]	[-0.232]	[4.694]	[4.683]	[0.090]	[0.750]
PP USA					-0.2031**	-0.1296	-0.0412	-0.0400			0.1867*	0.4520***	-0.8264*	-0.3205*		
					[-2.074]	[-1.159]	[-0.626]	[-0.427]			[1.897]	[4.463]	[-1.703]	[-1.943]		
PP FRA					0.5337***	0.5363***			0.0982	0.0388						
					[5.703]	[3.688]			[0.369]	[0.221]						
PP AUS					0.0968	0.1375										
					[0.943]	[1.518]										
PP GER									0.2798	0.3520*						
									[1.558]	[1.872]						
GDP	0.7079***	0.7825***	0.3339**	0.3109**	0.5057***	0.4302***			0.2930	0.5446***			0.1427	0.0350		
	[3.556]	[3.030]	[2.080]	[2.173]	[3.183]	[3.035]			[1.506]	[4.088]			[0.256]	[0.092]		
CPI							0.5459*	1.3626***			-0.2162	-0.1149				
							[1.743]	[4.048]			[-0.530]	[-0.259]				
Constant	1.2637***	-2.1350	-4.5911***	8.7479***	-2.9749***	-3.2952**	-4.4705***	0.8709	2.6258***	-2.2758	3.6847***	1.7167	7.0851*	7.3029	-0.1922	-0.6993
	[2.853]	[-0.512]	[-8.519]	[2.650]	[-8.808]	[-2.243]	[-7.033]	[0.306]	[5.486]	[-0.671]	[13.608]	[0.833]	[1.862]	[1.079]	[-0.263]	[-0.232]
Obs	31		31		29		31		28		28		30		23	
R-squar.	0.9458	0.9518	0.7170	0.3971	0.9813	0.9860	0.9381	0.9439	0.9772	0.9820	0.9657	0.9480	0.6563	0.6887	0.9368	0.8700

Source: Own calculations using STATA software (version 12.1).

Notes: For description of variables see notes in Table 2. The superscript ***, ** and * denotes that inverse residual demand elasticity is statistically significant at the 1 %, 5 % and 10 % levels, providing evidence of oligopoly market power, respectively. Numbers in brackets are t-statistics.

As discussed in the methodology section, the coefficients of the cost shifters of the other exporting countries highlight whether their wheat is a perfect substitute and they can constrain Russian market power. For instance, in the case of Azerbaijan, the Kazakh producer price is significantly positive, which suggest that the competition with Kazakhstan constrains Russian exporters' market power. In Georgia, the Kazakh exchange rate and the Ukrainian producer price are both significantly positive, which suggests that wheat exports from these two countries constrain Russia's ability to exercise more market power.

All real GDP coefficients are positive and three of them are statistically significant, implying that increasing income induces higher demand for wheat. The countries in which the GDP is significant are Albania, Azerbaijan, and Egypt. All three countries belong to the group of low- to middle-income countries in which wheat is a central source of protein and energy. Thus, growing income induces higher demand for wheat.

Generally, the results suggest that Russian wheat is priced rather competitively. Russia has market power in only three countries and the estimated inverse residual demand elasticities are rather small. Beyond this, the observed Russian market power is smaller than the market power of traditional wheat exporting countries reported by CARTER et al. (1999), CHO et al. (2002), and YANG and LEE (2005). PALL et al. (2013) give arguments why the pricing behavior of Russian wheat exporters might differ from their competitors, the USA and Canada. First, it is often argued that market power originates from product differentiation as in the case of the US and Canada. However, Russian wheat consists mainly of medium-quality wheat (WORLD BANK, 2009, p. 28). This type of wheat seems to have more direct substitutes and thus it is easier for importers to switch among suppliers. Consequently, the residual demand curve that Russian exporters face is more elastic than the one American or Canadian exporters face in their major export markets. However, in the countries where there are few alternateves (e.g., they are not fully integrated in the world market), price discrimination is still possible.

Looking at export statistics we can discover that the United States and Canada have quite stable export partners, supplying quite similar quantities of wheat to those countries every year. Thus, the United States and Canada might have long-term relationships with their buyers. In contrast, Russian wheat exporters change the quantity supplied to its partners almost every year. There are only a few countries where Russia exports similar quantities over several years (e.g., Egypt, Italy). This indicates short-term relationships. The United States and Canada supply both affluent and developing countries, while Russia ships its wheat mainly to developing countries. Developing countries might be more price sensitive, thus price discrimination is less likely. A final issue is the influence

of trade policies. In the last decade Russia imposed export restrictions several times. These interventions create an unstable environment for Russian exporters and their buyers and make it hard to plan in the long-run. In contrast, the United States and Canada possess a stable business environment without any quantity restrictions. This facilitates long-term planning.

The detected Russian market power in Albania and Georgia might be explained by the high market share of Russian wheat in these countries. This in turn might be a result of the geographic proximity to Russia, and thus relatively low transportation costs. The market structure is assumed to be oligopolistic with a dominant country, Russia. In comparison to Albania and Georgia, Russia has a smaller market share in Greece. Furthermore, there are several other countries exporting wheat to Greece. Russia is expected to export a different wheat quality than its competitors, which means that there is no direct competition between these countries. Instead, Russia supplies wheat only in a specific market segment in which it possesses a certain extent of market power. This is indicated by the negative Ukrainian and Kazakh cost shifters and the insignificant cost shifters of the other countries.

When comparing our findings with previous research published by PALL et al. (2013)[9] we can see that the results obtained by two approaches are partly inconsistent (see Table A5 in the Appendix). Similar conclusions have been reached by GLAUBEN and LOY (2003) who compared the results obtained by PTM and RDE approaches considering the time series properties of the model variables. However, it is necessary to underline that the RDE approach has several advantages compared to the traditional PTM approach.[10] First, notwithstanding the fact that both PTM and RDE approaches provide results relevant for making inferences about market power in international markets, the magnitude of market power in international trade can only be estimated by the RDE approach. Second, while the PTM only considers the export price of the exporting country in destination markets, the RDE approach explicitly utilizes both export price and export quantity data. Third, PTM includes measures of the exchange rate between the exporting country and the destination markets. However, in addition to these, the RDE approach considers the exchange rate fluctuations between destination markets and competitors in destination markets. Moreover, the RDE approach takes into account the input prices (e.g. prices of raw materials) incorporating

[9] Using the pricing-to-market (PTM) approach PALL et al. (2013) investigate the pricing behavior of the Russian wheat exporters in 25 countries with regard to the wheat export tax considering the three time periods: total period from Q1:2002 to Q2:2010, pre-tax period from Q1:2002 to Q3:2007 and post-tax period from Q3:2008 to Q2:2010.

[10] For discussion of the advantages and disadvantages of the RDE method see BAKER and BRESNAHAN (1988), GOLDBERG and KNETTER (1999), GLAUBEN and LOY (2003).

cost shifters for the main competitors and includes measures of demand shifters for the destination market (e.g. the GDP, income, or the wholesale price). However the PTM approach is able to investigate the pricing behavior in many countries, while the RDE approach has sophisticated data needs, which are difficult to satisfy. Thus, the RDE model is appropriate if the objective is to focus on a few countries.

5.5 Conclusions

Competition in international trade is usually considered to be imperfect with oligopolistic market structures and the exercise of market power (GOLDBERG and KNETTER, 1997). Market power was also observed in previous studies on wheat trade. However, all previous articles investigated traditional wheat exporters, whereas no study had been carried out so far on market power of a non-traditional wheat exporting country. This is surprising, because these countries are increasingly important in the world wheat market. For instance, Russia has become one of the biggest wheat exporters in the last decade and it is the major exporter in several countries, including countries which are assumed to be not yet fully integrated into the world market. Furthermore, most of these countries strongly depend on wheat imports.

This paper investigated whether Russian wheat exporters have market power in selected importing countries. This question is especially interesting since Russia supplies wheat mainly to transition and developing countries. The results of the IVPPML model confirm previous findings that imperfect competition is present in the international wheat trade. However, Russia has market power in only three countries: Albania, Georgia, and Greece. These results indicate further that Russian wheat exporters behave more competitively than American, Canadian, and Australian wheat exporters. This is partly in line with results presented by PALL et al. (2013) on Russian wheat exporters using the pricing to market (PTM) approach. They included a large number of wheat-importing countries in their analysis and found that Russian wheat exporters are able to price discriminate only in a few countries, while other exporters behave competitively in most of the importing countries. This is consistent with the assumption that Russia, as a supplier of mediocre wheat quality, is not able to exercise market power because of product differentiation.

Finally, the findings of this article have implications on the food security debate. Because Russian wheat exporters behave competitively in most countries, this might contribute to maintaining or even increasing food security in countries heavily dependent on wheat imports.

5.6 Appendix

Table 5.4: Literature review of previous studies employing the residual demand elasticity approach

Author(s)	Journal (Year)	Selected markets	Import country	Export country	Period	Data	Method	Results
Goldberg and Knetter	JIE (1999)	Beer	USA	Germany	1975-93	A	3SLS	-0.065
			Canada					-0.14
			France					-0.44
			United Kingdom					-0.21
Carter et al.	WP (1999)	Wheat	Japan	USA	1970-91	Q	2SLS	-0.93***
				Canada				-0.49
				Australia				-0.08
Yang and Lee	CP (2001)	Wheat	South Korean	USA	1993-99	Q	N./A	-0.384**
				Canada				-0.146***
				Australia				-0.142**
Cho et al.	CP (2002)	Wheat	Indonesia	USA	1973-94	A	SUR	-0.004
			Japan					-0.112
			Korea					-0.614***
			Malaysia					-0.121***
			Philippines					-0.838***
			Singapore					-0.160***
Glauben and Loy	JAFIO (2003)	Beer	USA	Germany	1991-98	M	2SLS	0.19*
			Canada					0.28
			France					-0.71**
			United Kingdom					0.58**
Tasdogan et al.	SEEJE (2005)	Olive oil	EU	Greece	1970-01	A	2SLS	-.079**
				Italy				-0.360***
				Spain				-0.157***
Felt et al.	AB (2011)	Pork	Japan	Denmark	1994-06	M	GMM	-0.02*
				Canada				-0.06*
				USA				-0.17*

Source: Articles cited.

Notes: Journal: AB=Agribusiness; JIE=Journal of International Economics; WP=working paper, CP=Conference Paper of the American Agricultural Economics Association; JAFIO=Journal of Agricultural and Food Industrial Organization; SEEJE=South Eastern Europe Journal of Economics. Data: A=annual, Q=quarterly, M=monthly. Methods: 2SLS=two-stage least squares, 3SLS=three-stage least squares, SUR=seemingly unrelated regression, GMM=generalized method of moments. Results: The superscript ***, ** and * denotes that inverse residual demand elasticity is statistically significant at the 1 %, 5 % and 10 % levels, providing evidence of oligopoly market power, respectively.

Table 5.5: Summary test results for excluded instruments

Country	Excluded instruments	F-test	P-value
Albania	Russian producer price	6.49	0.0187
Azerbaijan	Russian producer price	5.81	0.0236
Egypt	Russian total export quantity	16.84	0.0007
Georgia	Russian producer price Gross domestic product	9.13	0.0015
Greece	Total import value in local (national) currency	14.37	0.0018
Lebanon	Gross domestic product	4.36	0.0512
Mongolia	Russian producer price	5.95	0.0232
Syria	Russian producer price Gross domestic product	6.09	0.0116

Source: Own calculations using STATA software (version 12.1).

The sources of the wheat producer prices:

- Australia: Australian Bureau of Agricultural and Resource Economics and Sciences. Agricultural commodity statistics. ABARES: Canberra.
- Bulgaria: National Statistical Institute, Sofia.
- France: National Institute of Statistics and Economic Studies, Paris
- Germany: German Federal Statistical Services, Wiesbaden.
- Hungary: Agricultural Economics Research Institute, Market Price Information, Budapest.
- Kazakhstan: Agency on Statistics of the Republic of Kazakhstan. Quarterly Statistical Bulletin "Monitoring of the development of aul (village)" KAZSTAT: Astana
- Russia: Russian Federal State Statistics Service. Average producer prices, agricultural products. ROSTAT: Moscow.
- Ukraine: State Committee of Statistics of Ukraine. The sale of agricultural products to procurement organizations by agricultural enterprises. Monthly Statistical Bulletin. Derzhkomstat: Kyiv.
- USA: United States Department of Agriculture, Economic Research Service, Wheat Data, Domestic and International Prices.

Table 5.6: Imported wheat quantities of the considered countries from their major suppliers in thousand tons

Destination	Exporting country	2002	2003	2004	2005	2006	2007	2008	2009
Albania	Russia	155.08	193.04	137.58	233.85	196.64	252.97	120.81	180.12
	Bulgaria	17.57	2.84	11.39	29.02	20.28	0.11	21.56	0.59
	Hungary	17.12	11.14	3.00	5.44	0.00	3.00	52.83	28.76
	Ukraine	6.57	4.65	5.00	35.64	78.69	25.50	16.72	8.35
Azerbaijan	Russia	182.96	177.50	508.64	805.74	658.43	455.87	726.43	692.64
	Kazakhstan	458.22	630.00	431.71	103.58	362.07	951.04	469.27	201.37
Egypt	Russia	1104.20	870.19	504.30	2307.97	1885.16	2501.39	1459.87	1599.12
	France	863.98	873.37	477.10	559.81	518.00	120.34	307.63	890.91
	USA	1797.68	1488.06	1761.71	943.98	859.86	1601.39	1003.95	444.16
	Australia	930.24	350.10	1029.62	685.37	965.55	288.58	128.51	182.18
Georgia	Russia	110.77	129.64	151.00	284.32	400.91	353.00	192.02	431.65
	Kazakhstan	20.08	8.21	79.24	27.25	100.81	206.67	100.40	62.76
	USA	35.03	50.04	64.90	0.00	33.84	0.01	0.00	0.00
	Ukraine	3.25	0.00	6.60	3.62	24.74	0.04	31.05	19.80
Greece	Russia	663.62	400.74	202.27	295.86	249.83	373.75	204.21	28.73
	France	38.52	193.10	184.67	136.60	217.23	222.42	142.58	182.32
	Germany	59.09	112.43	49.57	27.54	39.19	113.22	40.09	66.64
	Hungary	0.00	1.57	54.71	105.65	184.94	193.44	196.76	194.95
	Kazakhstan	11.23	42.93	0.00	86.30	89.68	91.27	42.12	50.72
	Ukraine	187.98	40.60	23.36	45.01	100.21	11.63	96.46	55.73
Lebanon	Russia	190.57	215.40	169.50	324.53	114.00	286.94	222.75	300.67
	Kazakhstan	0.00	75.40	0.00	17.82	24.15	105.79	139.98	0.00
	Ukraine	22.51	7.17	0.00	0.00	13.38	4.75	29.66	118.81
	USA	98.73	75.21	93.88	10.44	40.35	0.00	0.00	4.50
Mongolia	Russia	80.32	44.45	0.38	31.82	29.59	34.71	157.60	92.03
	Kazakhstan	22.77	10.57	37.20	51.05	58.33	26.08	6.76	0.06
	USA	0.00	0.00	74.50	25.00	0.00	25.00	0.00	25.00
Syria	Russia	326.07	216.34	26.00	175.37	35.61	64.58	445.22	1378.82
	Ukraine	0.00	0.00	19.46	28.45	90.85	12.60	57.39	354.21
	Kazakhstan	0.00	0.00	0.00	0.00	0.00	14.06	0.00	0.00

Source: Own compilation based on FAOSTAT.

Table 5.7: Fisher type panel unit root test for the selected variables

Test specification	Augmented Dickey-Fuller test using inverse normal statistics		
	Export unit value (EUV)	Export quantity (REQ)	Exchange rate (ER RUB)
1 lag with drift	-1.7722**	-7.0430***	-4.3797***
1 lag demeaned	-1.4499*	-2.2710**	1.1824
1 lag demeaned with drift	-5.1573 ***	-5.5864***	-2.3368***

Source: Own calculations using STATA software (version 12.1).

Notes: The superscripts ***, ** and * denote statistical significance at the 1 %, 5 % and 10 % levels, respectively.

Table: 5.8: Comparison of the PTM and RDE estimation results

	Albania	Azerbaijan	Egypt	Georgia	Greece	Lebanon	Mongolia	Syria
PTM-Total period	–	±	–	–	–	–	+	–
PTM-Pre-tax period	–	–	–	–	–	+	+	±
PTM-Post-tax period	–	–	–	±	–	–	+	±
RDE-PPML	+	–	–	+	+	–	–	–
RDE-GMM	+	+	+	+	+	–	–	–

Source: PTM results published by PALL et al. (2013). RDE results obtained by authors.

Notes: "+" means evidence of market power; "–" means no evidence of market power; ± means evidence of market power via the exchange-rate effects or the price effects.

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6 THE IMPACT OF THE EXCHANGE RATE AND ITS VOLATILITY ON THE RUSSIAN WHEAT EXPORT VOLUME

Abstract

The impact of the exchange rate and its volatility on the international trade is a central question in international economics. Theoretical articles conclude that the impact can be positive, negative or neutral, depending on the characteristic of the respective market. Empirical works are also inconclusive finding evidence of all three impacts. Later articles argue that the aggregation could bias the results, since it is not likely that the exchange rate and its volatility have the same impact on all sectors and commodities. Thus, later articles focus on sectors and commodities instead. This article aims to investigate the impact of exchange rate and its long term volatility on the Russian wheat export. A panel consisting of 10 major wheat exporting and 24 major wheat importing countries is constructed to control for third country effects and to compare the results. A gravity model is specified using two long term exchange rate volatility measures. The model is estimated using the Poisson pseudo maximum likelihood estimator.

6.1 Introduction

The Russian wheat export has developed dramatically in the last decade. While Russia was a net importer of wheat in the 1990s, it became one of the biggest wheat exporters in the 2000s. The country exported more than 16 million tonnes of wheat in 2009 and was the fourth largest player in the world wheat market. It is expected that the country will be the largest wheat exporter of the world by the end of the decade (USDA, 2010). This development happened despite the appreciation of the rouble in the 2000s, which according to general economic expectations made the Russian export less competitive. Furthermore, the rouble experienced also significant volatilities during the last decade. This was particularly strong during the economic crisis in 2008. However its impact on the export is not clear. This raises the question how the exchange rate and its volatility impacted the Russian wheat export. The exchange rate has a strong impact on the profitability of the export, since the cost of the exporters are mainly in local currency while the revenue is received in a foreign currency (usually USD or euro).

There is no consensus in the literature as to how exchange rate volatility impacts trade volumes. Theoretical articles state that there is no ex ante prediction,

the impact can be both positive and negative depending on the risk aversion of companies and thus the relative role of substitution and income effects. Thus, this issue is rather empirical (WANG and BARRETT, 2007; CHIT et al., 2010). The empirical works are also inconclusive. Some of them found that it has a significant and negative impact (e.g. ABRAHMS, 1980; THURSBY and THURSBY, 1987; FRANKEL and WEI, 1993; DELL'ARICCIA, 1998), while other reported rather positive effects (e.g. LANGLEY et al., 2000; AWOKUSE and YUAN, 2006). A third group did not see any link between exchange rate volatility and export volumes (e.g. TENREYRO, 2007).

However, authors argue that the impact of exchange rate volatility might vary across commodities in a given sector since the nature of competition, product characteristics and the size of the companies differs. Thus, AWOKUSE and YUAN (2006) focus on the US poultry export and report on positive impact. Later, KARAMERA et al. (2011) investigate the fresh vegetable trade flows among OECD member countries, and indicate both negative and positive link between exchange rate volatility and export. Similarly, SHELDON et al. (2013) focus on the US bilateral trade of fresh fruit and vegetables and found negative impact. However, no article was found on the export of an emerging country.

Furthermore, it is important to distinguish between short and long term volatility. While exporters can easily hedge against short term volatility, the impact of the long term volatility is more difficult to offset (WANG and BARRETT, 2007; CHO et al., 2002; FERTŐ and FOGARASI, 2011). Indeed, some articles for example PERÉE and STEINHERR (1989), OBSTFELD (1995) and CHO et al. (2002) found that longer term currency fluctuations have rather impact on trade than short term changes

Beside volatility the level of exchange rate could also impact the volume of the international trade. According to general economic theory, a depreciation of the exporter's currency increases its export, while an appreciation decreases. A depreciation of the exporter's currency makes its goods cheaper in the importing country's or third country's currency and thus it becomes more competitive. Consequently it is expected that the depreciation stimulates export. An appreciation of the exporter's currency is expected to have the opposite effect. However, the empirical works are also inconclusive. For example CHAMBERS and JUST (1981) investigating the wheat corn and soybean markets report on strong effect of the exchange rate on the export. In contrast, BESSLER and BABULA (1987) do not find any link between wheat export and exchange rate.

The aim of this article is to investigate the impact of the exchange rate and of the long term exchange rate volatility on the Russian wheat export. While the short term exchange rate volatility can be hedged effectively in the financial markets, the long term volatility may have an impact on the wheat export through investment and crop selection decisions.

A panel consisting of 10 major wheat exporting and 24 main wheat importing countries is constructed to account for the possible third country effects (i.e. the export of a competitor influences the Russian export). Beyond the inclusion of several exporting countries enables us to make a comparison. Thus, it can be shown whether the impact of the exchange rate and its volatility is the same across countries or specific to the given exporter. However, the primary focus of the article remains Russia. The gravity model is estimated using two different long term exchange rate volatility measures.

The possible policy implications are the followings. First, if the impact of exchange rate volatility is important the measures to reduce it (e.g. currency union, monetary policy instruments) would encourage exports since it reduces uncertainty and transaction costs. However, if the exchange rate variation does not have impact on the export volume, the measures to offset it are not profitable. Furthermore it is important to investigate the impact of the exchange rate change on the trade volumes, since it helps to conduct sound monetary policy. Experts often argue in policy debates that the currency devaluation encourage export, however its extent is unclear.

The article is organized as follows. The next section describes the methodology followed by the description of the data. Chapter four introduces and discusses the results. The final chapter provides a summary and conclusion.

6.2 Methodology

To investigate the impact of the exchange rate volatility on the Russian wheat export a gravity model is used and estimated with the Poisson pseudo maximum likelihood estimator (PPML) based on TENREYRO (2007) and SANTOS SILVA and TENREYRO (2006). The gravity model is based on the work of TINBERGEN (1962) and indicates that export between two countries increases with the size of the economy of the two countries often measured using the GDP, and decreases with any trade barriers between them (e.g. the distance to the two countries) (e.g. SHELDON et al., 2013). A huge literature evolved about the gravity model. These also use other variables that can influence trade such as common border or language, free trade agreement, currency union, common colonial past and institutional quality (SANTOS SILVA and TENREYRO, 2006; DELL'ARICCIA, 1998). ANDERSON and VAN WINCOOP (2003) state that the traditional gravity model is not correctly specified as it does not consider the multilateral resistance terms. Thus, they suggest to include exporter and importer fixed effects in the equation.

Recently, the gravity model was used to examine the impact of exchange rate volatility on international trade (e.g. DELL'ARICCIA, 1998 and TENREYRO, 2007). CHO et al. (2002), KANDILOV (2008) and FERTŐ and FOGARASI (2011) employ gravity model to examine the impact of exchange rate volatility on the agrifood trade.

Furthermore, different measures of exchange rate uncertainty were used in the literature. There is no consensus which measure is the most appropriate (e.g. DELL ARICCIA, 1998; KANDILOV, 2008). The exchange rate volatility is often measured using the standard deviation of the first difference of the logarithm of the exchange rate series (e.g. TENREYRO, 2007). FERTŐ and FOGARASI (2011) takes in account the past values and apply a moving standard deviation of the first differences in the log monthly nominal exchange rate over the last 4 years. A different approach is to use the standard deviation of the percentage change of the exchange rates (DELL'ARICCIA, 1998). Exchange rate volatility can be measured as the conditional variance of the bilateral real exchange rates using generalized autoregressive conditional heteroskedasticity (GARCH) processes developed by BOLLERSLEV (1986) and applied in the agricultural economics literature by WANG and BARRETT (2007), KANDILOV (2008) and ERDEM et al. (2010). This has the advantage that it generates the future expectations of the exporters. PERÉE and STEINHERR (1989) introduce a measure which takes into account the past experiences and the deviation from the equilibrium exchange rates. This was used in the agricultural economics literature among others by CHO et al. (2002), KARAMERA et al. (2011) and SHELDON et al. (2013).

To avoid that the results depend on the given measure, and to get more robust results, the article will use and compare different measures of volatility. More specifically, two measures of exchange rate volatility are used, the moving standard deviation of the first difference of the logarithmic exchange rate and the PERÉE and STEINHERR measure both on a 2 years window. These two measures can capture the impact of the long term exchange rate volatility and are widely accepted in the literature.

The authors use nominal as well as real exchange rates to investigate the impact of the exchange rate volatility on international trade. However, the real exchange rate also contains the price volatility, thus this can not show the impact of the exchange rate risk only. Thus, it is not evident whether the policy interventions should focus on the product or rather the foreign exchange market. Thus, it is more appropriate to include nominal exchange rate instead as for instance TENREYRO (2007) and FERTŐ and FOGARASI (2011).

Thus, monthly nominal exchange rates (importing country's currency per unit of exporting country's currency) are used to compute the moving standard deviation and the PERÉE and STEINHERR measure.

In order to capture the effect of thee exchange rate change and volatility on the volume of the wheat export the following gravity model is specified:

$$Exp_{it} = \exp(\alpha_1 \ln DIST_{ei} + \alpha_2 \ln XL_{ei} + \alpha_3 \ln XV_{ei} + \alpha_4 CD_i + \alpha_5 TD_t) + \eta_{it}, \quad (6.1)$$

Where: Exp is the export value measured in USD, DIST is the distance between Russia and the respective importing country, XL is the exchange rate, XV is the exchange rate volatility, η is an error term, t is time, e is exporting country, i is importing country. Furthermore, country (CD) and time dummies (TD) are included to capture the unobserved effects to account for omitted variables following ANDERSON and VAN WINCOOP (2003, 2004) and BALDWIN and TAGLIONI (2006). The country specific effects can be for example the difference in quality, institutions and contracting. The time specific effects might capture the changes in world market conditions or macroeconomic shock which are the same for all countries. The model is also estimated using time varying exporter and importer effects to control for factors such as wheat production or import demand.

6.3 Data

To investigate the impact of the exchange rate and its volatility on the Russian wheat export a panel dataset consisting of 10 major wheat exporting and 24 major wheat importing countries was constructed. This was necessary to account for the third country effects (i.e. the export of other countries impact also the Russian export). Further information on the included countries can be found in the appendix.

The wheat (HS: 1001) export values come from the Comtrade database of the United Nations, while the exchange rates are obtained from the International Financial Statistics of the International Monetary Fund and are importing country's currency per unit of exporting country's currency. The distance data originate from MAYER and ZIGNAGO (2011).

Annual data for the period of 2002-2009 were employed because of two reasons. First, Russia became a major wheat exporter in 2002. Second, Russia banned the wheat export in 2010.

6.4 Results and discussion

The gravity model, equation 6.1 is estimated using the Poisson pseudo maximum likelihood (PPML) estimator following SANTOS SILVA and TENREYRO (2006) and TENREYRO (2007). They argue that in the presence of heteroskedasticity the estimation in double logarithmic functional form using OLS provides biased results. Thus, the gravity model should rather be estimated in its multiplicative form. They suggest using the PPML estimator since it does not require taking the logarithm, rather it estimates the model in its original (i.e. multiplicative) form.

The results of the PPML estimator are reported in Table 6.1. The model was estimated also using time varying exporter and importer fixed effects (e.g. wheat production, demand shifters). The results were very similar to the results with exporter and importer fixed effects, thus they are not reported here.

The results using both volatility measures are quite similar. They highlight first that the exchange rate has significant impact on the export of only two countries: Canada and the United Kingdom. The coefficient is positive for Canada and negative for the United Kingdom. Furthermore, the volatility measures are significant for eight out of the ten exporting countries: Argentina, Australia, France, Germany, Kazakhstan, Ukraine, United Kingdom and the United States. The impact is positive for Argentina, Australia, Kazakhstan and Ukraine, while it is negative for France, Germany, United Kingdom and the United States. The exchange rate volatility has no impact on the export of Canada and Russia. Beyond this the distance has a significant and negative impact on the export.

The mostly insignificant impact of the exchange rate can be explained by the followings. In perfectly competitive markets, the traders set the price according to the prices of the competitors and pass-through the exchange rate changes to the producers. However, if the producers have to sell the wheat (the export quantity is fixed in the short term), they have to accept the price even if it is not profitable at a given exchange rate. These insignificant effects are consistent with BESSLER and BABULA (1987) who find no link between wheat export and exchange rate. A positive coefficient indicates that the price is set in the currency of exporter and the exporter has market power. In this case some part of the amount of the exchange rate change is passed through to the importer and consequently the USD value of the export increases. In contrast a negative value reveals that the exporter can not pass through the exchange rate change to the buyers or to the producers, thus an appreciation of its currency decreases the export, while a depreciation increases it.

As the theoretical articles argue the impact of the exchange rate volatility can be negative, positive and insignificant depending of the risk aversion of the exporters, the nature of competition and product characteristics (WANG and BARRETT, 2007). Thus, it is expected that in countries where volatility has a positive impact, the traders export more in times when the exchange rate is weak and trade in the domestic market or store the wheat when the exchange rate is strong. Thus, the exchange rate volatility does not reduce the profit of the exporter, rather it offers profitable opportunities. In contrast, in countries where the coefficient is negative, the volatility could have impact on the investment and crop selection decisions. If the volatility is high, producers and traders invest less in wheat production, storage and transport and producers are more likely to switch to non export commodities. In countries where the impact is insignificant, the exchange rate is likely not important determinant of the export. Instead other factors, such as climate, input costs, domestic and export demand influence the export.

Table 6.1: The results using the moving standard deviation of the first difference of the logarithmic exchange rates as measure of exchange rate volatility

	Moving standard deviation 2 years				Perée and Steinherr measure 2 years			
	Exchange rates		Exchange rate volatility		Exchange rates		Exchange rate volatility	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Argentina	-0.000039	-0.14	**5.515225*** **	**3.15**	-0.0000514	-0.16	**0.1070838*** **	**2.56**
Australia	0.000038	0.44	**11.05948*** **	**2.59**	0.0000357	0.35	**0.5608451*** **	**3.43**
Canada	**0.0002566*** **	**2.72**	-0.9793615	-0.34	**0.0002448** **	**2.08**	-0.2219652	-0.97
France	-0.000112	-1.11	**-49.37173** **	**-2.37**	-0.0001202	-1.19	**-3.883948** **	**-2.55**
Germany	0.0001391	1.62	**-78.89813*** **	**-3.37**	0.0001233	1.3	**-6.786815*** **	**-2.86**
Kazakhstan	-0.001357	-0.45	**8.682028** **	**2.53**	-0.0016086	-0.49	**0.4939367** **	**2.36**
Russia	-0.0003379	-0.53	0.7173872	0.17	-0.0003715	-0.51	-0.1623038	-0.8
Ukraine	0.0070001	0.39	**6.99401** **	**2.11**	0.0068631	0.37	**0.4206733** **	**2.01**
United Kingdom	**-0.0175567***	**-1.83**	**-80.51582*** **	**-2.63**	**-0.0193958***	**-1.86**	**-1.862519***	**-1.78**
United States	0.0001065	1.08	**-19.51339** **	**-2.29**	0.0000951	0.85	**-0.7404288***	**-1.64**
Distance	**-0.0003484*** **	**-5.84**			**-0.0003543*** **	**-5.91**		
Constant	**13.3994*** **	**19.03**			**13.56593*** **	**20.08**		
Export country dummy	yes				yes			
Import country dummy	yes				yes			
Year dummy	yes				yes			

PALL et al. (2012) argue that the Russian wheat export is not characterised by strong market power and thus the development of the Russian wheat export would contribute to the food security and the policies which promote it help to reduce hunger. The results of this article suggest that in contrast to several other countries, the exchange rate and its volatility do not have a significant impact on the volume of the Russian wheat export. Thus, the decrease of the volatility of the rouble or rouble depreciation would not increase the Russian wheat export.

Thus, other policies should be identified which can develop the Russian export. These can be the investment in rail transport and storage infrastructure, in sea ports and in the recultivation of abandoned land. For example, experts argue that the lack of modern rail transport makes it expensive to transport the wheat from remote areas (e.g. Siberia) to the sea ports (e.g. USDA, 2011). Thus, despite the small production costs, the wheat of these remote regions can not be exported. Furthermore, there are only few sea ports available for the wheat (USDA, 2011). Thus, the building of new ports could stimulate the export in the direction of large importing countries in the Middle East and North Africa.

These results suggest that the exchange rate volatility rather than the exchange rate level affects wheat export. However, this effect is different across exporting countries. This could depend on the characteristics of the wheat production and trade in the countries. Thus, this highlights that the impact of the exchange rate volatility depends not just on commodities rather the exporting country itself should be considered. The exchange rate and its long term volatility do not have a significant impact on the Russian wheat export. Thus, the decrease of the volatility of the rouble would not stimulate the Russian wheat export.

6.5 Summary and conclusion

The impact of the exchange rate and its volatility on the export is a central question in the international trade literature. Theoretical articles are inconclusive finding that the impact can be positive, negative or neutral depending on the characteristics of the given market, such as the nature of competition, market structure, product characteristics and risk aversion. Similarly, empirical articles yield diverse results. However, later works indicate that it is not a reasonable assumption that the exchange rate volatility has the same impact on all sectors or products. Thus, this articles focus on sectors and recently on products. Most results indicate that the exchange rate volatility has a negative impact on the agrifood trade, while both positive and negative impacts were reported on the product level. However, there are only a few product level works, and all of them used OLS. According to SANTOS SILVA and TENREYRO (2006) and TENREYRO (2007) in the presence of heteroskedasticity, the estimation of log linearized models yields biased results.

This article aimed to investigate the impact of the exchange rate and its long term volatility on the Russian wheat export. This is an important issue since Russia is a major wheat exporter having consequences on the food security. To account for the third country effects, 10 major wheat exporting and 24 major wheat importing countries are considered. Furthermore the inclusion of several exporting countries made it possible to examine whether the exchange rate and its long term volatility have the same impact across countries or its impact is country specific instead. A gravity model is estimated using the Poisson pseudo maximum likelihood (PPML) estimator and two different long term exchange rate volatility measures.

This article contributes to the literature in the following ways. First it provides new product level evidence on the impact of the exchange rate volatility on export. Second, it focuses on a commodity what is relevant in the context of food security. Third, it employs the Poisson pseudo maximum likelihood estimator, which was not used in earlier articles in the product level.

The results indicate that the exchange rate has significant impact on the export in only two countries (Canada and United Kingdom). In contrast, the exchange rate volatility has a significant effect in eight out of ten countries. However, the impact of volatility is insignificant in Russia. This suggests that the volatility does not have a high impact on the profitability of the Russian wheat export. Other factors, such as input prices, weather, and world market prices determine the Russian wheat export volume.

This results highlights, that exchange rate volatility has a different impact in different exporting countries. This is likely the consequence of the characteristics of the wheat production and trade in the different exporting countries, such as the nature of competition, market structure and investment decisions.

6.6 Appendix

Table 6.2: Literature review on the articles investigating the impact of exchange rate volatility on agrifood trade

Author/year	Model	Estimator (by gravity)	Time period	Data frequency	Market	Volatility measure	Result
Langley et al. (2000)	export equation, similar to gravity		01.1990-06.1999	Monthly	Thai poultry export	GARCH	positive impact
Cho et al. (2002)	gravity	OLS	1975-1995	Annual	10 developed countries, aggregate trade, machinery, chemicals, other manufacturing, agriculture	MSTD, PS	biggest negative impact on agriculture
Kandilov (2008)	gravity	OLS	1975-1997	Annual	large number of developing, developed and emerging countries aggregate trade, machinery, chemicals, other manufacturing, agriculture	GARCH	negative impact
Awokuse and Yuan (2006)	export demand equation		1976-2000	Annual	US poultry export	MSTD, ACh, VT	positive impact
Fertő and Fogarasi	gravity equation	OLS, PPML	1999-2008	Annual	6 Central European countries	MSTD	negative impact
Karamera et al. (2011)	gravity equation	OLS	1996-2002	Annual	20 OECD countries, vegetable trade	MSTD, PS	negative and positive
Sheldon et al. (2013)	gravity equation	OLS	1976-1999 for fresh fruit and 1976-2006 for vegetable	Annual	US trade with 30 countries, fresh fruit and vegetable	MSTD, PS	negative impact

Source: Own compilation.

Notes: Annual data, M: Monthly data, MSTD: Moving standard deviation of the exchange rates, PS: Perée and Steinherr measure, GARCH: generalized autoregressive conditional heteroskedasticity model, ACh: absolute percentage change in exchange rate levels, VT: Variance of the spot exchange rate around its trend.

Table 6.3: The included countries and their world market shares in the period of 2002-2009

Importing country	World market share	Exporting country	World market share
Italy	5.39	United States	21.50
Brazil	4.82	France	12.40
Algeria	4.49	Canada	12.30
Japan	4.45	Australia	11.11
Egypt	4.43	Russian	8.48
Spain	4.23	Argentina	6.83
Indonesia	3.56	Germany	4.60
Netherlands	3.19	Ukraine	4.35
Republic of Korea	2.82	Kazakhstan	3.19
Belgium	2.76	United Kingdom	1.95
Nigeria	2.72	Together	86.71
Mexico	2.70	RoW	13.29
Morocco	2.30		
China	2.29		
Philippines	1.96		
Bangladesh	1.86		
Iran	1.71		
Yemen	1.68		
Germany	1.59		
Malaysia	1.52		
United States	1.51		
Turkey	1.38		
Israel	1.22		
Together	66.59		
RoW	33.41		

Source: Own compilation based on FAOSTAT.

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7 SUMMARY, DISCUSSION AND CONCLUSION

7.1 Discussion of the theoretical framework

Traditionally, the international wheat market has been considered as one of the best examples of a market with perfect competition. However recent empirical studies reported on imperfect competition and market power in the internatio nal wheat market. Moreover the impact of the exchange rate and its volatility on the export volume is a central issue, but the empirical findings are inconclusive. The articles on imperfect competition in wheat market are focused on tradetional wheat exporting countries. However non-traditional exporters, like Russia play a growing role in the international wheat market. Consequently the competitive structure of the Russian wheat export, and its main drivers have increasing significance. This thesis is based on three empirical studies and aims to investigate first the competitive structure of the Russian wheat export using two complementing approaches, the pricing to market and the residual demand elasticity, and second the impact of the exchange rate and its volatility on the Russian wheat export volume employing the gravity model. In order to give a sound basis for the empirical research a descriptive analysis of the international and Russian wheat market, and a theoretical summary of the imperfect competition in international trade is provided.

The PTM and the RDE models are complementing approaches. The PTM is able to indicate whether there is price discrimination in a large number of countries, and can examine the impact of the exchange rates on the charged export prices. The RDE model can quantify the extent of market power taking explicitly into account the cost shifters of the competitors and the demand conditions of the respective importing country. However the residual demand elasticity model should be estimated for each importing country separately and has more sophisticated data needs.

There is no clear relationship between the results of the two models. If the PTM model shows the existence of pricing to market in a given importing country, the residual demand elasticity model should indicate market power. However, if the results of the PTM provide evidence of a constant markup, the residual demand elasticity might show that the exporter does not have market power. This can happen if the constant markup streams from quality differences and not from price discrimination. Third, if the PTM model indicates no price discrimination, the RDE model can show the existence of market power. This can be the case if the exporter has market power, but the world market is integrated. In

this case the exporter is not able to exercise price discrimination rather it charges a common markup across countries.

Table 7.1: The relationship between the results of the PTM and residual demand elasticity models

Model	RDE: Market power	RDE: No market power
PTM: no price discrimination	+	+
PTM: constant markup	+	+
PTM pricing to market	+	-

Source: Own compilation.

Notes: +: This result is possible, - this result is not possible.

In order to investigate the impact of the exchange rate and its volatility on the Russian wheat export volume a gravity model is estimated using the Poisson pseudo maximum likelihood (PPML). To avoid that the results depend on the given measure, and to get more robust results, the article employs two measures of exchange rate volatility, the moving standard deviation of the first difference of the logarithmic exchange rate and the Perée and Steinherr measure, both on a 2 years window. This methodology provides robust results, and has modest data needs.

7.2 Summary of the findings

The review of the world and Russian wheat market highlighted that the international wheat trade is growing and Russia has became a dominant player in the world market in the last decade. Furthermore, as there is still high potential in terms of area and yield, further increase in the production and export is expected. However, the logistic infrastructure has to be developed to facilitate the transport and storage of wheat and thus make competitive the wheat produced in remote regions. Beyond this, the prices should remain high in the long term to make profitable the recultivation of out of use land. These arguments suggest that in the short run a significant expansion of wheat production is not possible. This latter has considerable effect on the pricing behaviour of the Russian wheat exporters.

The PTM model was estimated including 25 regularly importing countries in the dataset. Since there is a controversial discussion in the PTM literature whether nominal or real exchange rates are more appropriate to use, the model was estimated using both exchange rates. This was used also as a robustness tests and indicated very similar results. However, it was argued that the nominal exchange rates are more accurate in the wheat market because of the following reasons. First, the inflation is not likely to have a proportionate impact on the wheat

prices, since the production is not continuous and the consumer price index consists of many goods which are not relevant in the case of the wheat production and trade. Second, there is no better deflator (e.g. domestic wheat prices) for all countries available. Third, the adjustment of the exchange rates to the inflation takes time, thus real exchange rates are to investigate long term pricing behaviour. The results for the period of 2002:1-2010:2 indicate pricing to market in six countries: in Algeria, Azerbaijan, Cyprus, India, Italy and Mongolia. The Russian exporters amplify the impact of the exchange rate changes in Algeria, India and Italy, while they offset them in the other three countries. Furthermore, the model indicated more pricing to market in the post export tax period (from 2008 to 2010) than before. This can be explained by the possibility that Russia became an unreliable suppler and had to get the importers back. Furthermore, the prices were high in the post tax period and thus Russia could have charged a significant markup over marginal cost which allowed the exporters to offset the impact of exchange rate changes. Finally, as it was shown before the higher prices induce more often local currency price stabilization.

The residual demand elasticity model was estimated for Egypt, the most important market of Russia and for countries, where Russia has a modest to high import market share. These are Albania, Azerbaijan, Georgia, Greece, Lebanon, Mongolia and Syria. This choice was driven by the assumption that Russia might have market power if it has a high share in the respective market and partly by data availability. The results indicate that Russia has a small market power in three countries, in Albania, Georgia and Greece, while behaves competitively in five countries. The PTM model does not indicate price discrimination in some of these countries. This suggests that Russia charges a common markup across countries and this markup is rather small. This is consistent with the overview of the Russian wheat market which indicates that Russia produces wheat at small costs and further the Russian production can not be expanded in the short run because of infrastructural and investment constraints. In this case the profit maximizing behaviour is to set prices above marginal costs.

Surprisingly, the PTM model indicates pricing to market in Mongolia, but the residual demand elasticity does not provide evidence of market power. This can have the following reasons. First, the exchange rate changes can induce change of the quality composition of the Russian export. For example in the case of an appreciation the Russian wheat becomes more expensive in the Mongolian currency. Thus Mongolia might import the cheaper, less differentiated wheat quality from Russia and buy the higher quality wheat from Kazakhstan. This is plausible since market experts state that generally Kazakhstan exports higher quality and more expensive wheat than Russia. Second, problems with the data

might bias the results and thus indicate no market power also if there is market power in the reality.

Generally, the empirical findings on the competitive structure of the Russian wheat export highlight that the Russian exporters behave rather competitively. This might have the following reasons. First, Russia is a non-traditional exporter and its aim may be to establish its long term market share in the world market and not the short term profit maximization. Second, the government and exporters invested huge amounts in domestic transport and export infrastructure. Thus, they need to ensure the constant demand in order to make these investments profitable. Thus, they do not exercise excessive market power. As it was discussed above, these are consistent with the literature which argues that the pricing behaviour of exporters is influenced by strategic variables as market share and investments. Third, Russia does not produce significant amount of high quality wheat, thus it does not have market power originating from product differentiation. The Russian export belongs to the undifferentiated goods which have more direct substitutes. Consequently, it is easier for the buyer to switch to another seller. Fourth, the past policy actions, the export taxes and the export ban, makes the country to an unreliable supplier. Thus, the exporters have to offer very competitive prices to ensure adequate demand. Moroever Russia ships its wheat mainly in developing countries, which countries might be more price sensitive, or in other words the price has a larger role in their buying decisions than other factors (e.g. quality). This is consistent with other studies which found more PTM in the case of developing importing countries than by affluent countries.

To investigate the impact of the exchange rate and its volatility on the Russian wheat export volume a gravity model was employed. To account for the third country effects, 10 major wheat exporting and 24 major wheat importing countries are considered. Furthermore the inclusion of several exporting countries made it possible to examine whether the exchange rate and its long term volatilety have the same impact across countries or its impact is country specific instead.

The results indicate that the exchange rate has significant impact on the export in only two countries (Canada and United Kingdom). In contrast, the exchange rate volatility has a significant effect in eight out of ten countries. However, the impact of volatility is insignificant in Russia. This suggests that the volatility does not have a high impact on the profitability of the Russian wheat export. Other factors, such as input prices, weather, and world market prices determine the Russian wheat export volume. Thus the monetary policy is can not substantially increase the Russian wheat export, rather other policy tools have to be considered.

7.3 Conclusion and further research

The thesis has the following scientific contributions. The first contribution is that it employed the PTM and RDE concepts on the Russian wheat export. As argued before, it was important to investigate the competitive structure of the Russian wheat exporters because of many reasons. Thereby the aim was to adjust the two models to the characteristics of the wheat export as good as possible. Thus, several model specifications were investigated and the most appropriate was used. Furthermore, the question of nominal and real exchange rate was examined in detail. This latter was neglected mainly in the literature, no comprehensive discussion was found. However, it is important to model the pricing strategies of the wheat exporters. A further contribution was the use of the instrumental variable Poisson pseudo maximum likelihood estimator for the first time to estimate the residual demand elasticity model.

The comparison of these two methodologies enables to get a clearer picture about the competitive structure of the Russian wheat export. Furthermore, the investigation of a specific sector enables to consider the major (institutional) characteristics of the sector which contributes to a better interpretation of the results.

Finally, the impact of the exchange rate and its volatility was investigated on a commodity instead of sector or country. Previously only few commodity works was made and all of them used OLS. Following the literature this thesis used the Poisson pseudo maximum likelihood estimator since the OLS is inconsistent in the presence of heteroskedasticity.

Regarding the contribution of Russia to the food security of the world this thesis might suggest the followings. Russia does not use price discrimination in many countries and its markup is small in other importing countries. Therefore the growth of the Russian wheat export contributes clearly to the food security. Thus the expansion of the Russian wheat export would increase the competition in the world wheat market and reduce the market power of other exporters.

Countries, where price discrimination was found, could increase the competition by diversifying the import sources and increasing the access to market information for the importers. Beyond this, the development of the logistic infrastructure could facilitate the import from a larger number of countries.

Further research might focus on other non-traditional wheat exporting countries like Ukraine and Kazakhstan. They have become also significant wheat exports. The comparison of the competitive structure of the three Black Sea countries would provide a better picture on the pricing strategies in the international wheat market. Moreover as the three countries integrate their wheat market and establish a grain pool the research would indicate whether this would make the

international wheat market less competitive. A further important question is the impact of the Russian wheat export ban in 2010/2011 on the pricing behaviour of the exporters. The thesis was not able to investigate this issue, because the time period after the ban was too short.

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