The effects of trade policy on domestic dairy market: the case of Russian food import ban on regional cheese market integration in Russia

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Abstract:

We study the effects of Russia's food import ban implemented in August of 2014 on the Russian dairy market based on the price transmission and price dispersion approach. Cheese is the only dairy product for which domestic production has significantly increased since the implementation of the import ban whereas cheese imports have strongly decreased. Results show that for most of the regional price pairs under study, cointegration of cheese prices between producing and consuming regions has substantially increased with the import ban. In 29 out of the 39 price pairs cointegration emerged after the implementation of the import ban. Furthermore, in 5 price pairs the degree of long term price transmission and speed of adjustment improved significantly during the import ban regime. Moreover, the dispersion of cheese prices between consuming metropoles and cheese producing regions has significantly increased. The export ban, reduction in import level of cheese and milk, and increase in agricultural price index has affected the dispersion significantly. We conclude that in spite of the observed reinforced integration of regional markets, the market efficiency in general has not increased necessarily by the boosted domestic cheese trade.

Acknowledegment: This study was conducted within the STARLAP project, financially supported by the German Ministry of Food and Agriculture (BMEL) through the Federal Office for Agriculture and Food (BLE).

JEL Codes: Q02, F15

#1853

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Keywords: market efficiency, import ban, cointegration, price transmission, price dispersion

1 Introduction

Russia plays an important role in the global food security. It is already one of the largest producers and exporters of the crops such as wheat, barley and sunflower seed worldwide, and has huge potential for further increase in the list of potential exported food products. Russia's enormous agricultural land of more than 200 million ha (FAO, 2016) and its favorable climate with high level of rainfall provide good opportunities for the production of agri-food products. Moreover, Russia alone accounts for more than 40% of all chernozem (black earth) soil around the globe (FAO, 2001, 2006). In spite of its excellent natural conditions, Russia was one of the world's largest food importing countries up until the mid of 2014, importing the major share of the dairy, meat and fish products, as well as fruits and vegetables consumed domestically. In the

case of dairy products, the share of imports in the domestic consumption reached over 40% in 2013 (CLAL, 2017).

To mobilize the unrealized production potential in the agri-food sector, the Russian government introduced an agricultural import substitution policy which comprises two elements. On the one hand, the government has launched comprehensive agricultural subsidization programs to attract investments in agricultural production. In addition, the government has restricted agricultural imports by various instruments to protect domestic agricultural production against international competition. Ultimately this policy aims to increase self-sufficiency level for most of the food products and even more, to become one of the largest exporters of those products worldwide (Götz & Djuric, 2016).

Especially, agricultural producers were supported within the 2006 National Project for the development of Agro-industrial Complex, which was later transformed into Agricultural Development Program 2008 – 2012, to Food Security Doctrine of 2010 and Agricultural Development Program of 2013 – 2020 (DONLAND, 2010; USDA, 2010, 2012).

Imports were restricted by import taxes, non-tariff barriers and even an import ban, which was implemented in August 2014 in the context of the Ukrainian crisis. The import of dairy products was particularly affected by this import ban up to around 80% of all dairy imports which were previously imported from the sanctioned countries (Boulanger, Dudu, Ferrari, & Philippidis, 2016).

In this paper we aim to assess how efficient the Russian dairy market is functioning, a question which has not been addressed in the literature before. Following a price transmission and price dispersion modelling approach, we attempt to identify and measure the effects of the Russian food import ban of August 2014 on the Russian dairy market. Our hypothesis is that the food import ban has positively affected the domestic regional price integration on one side and increased the regional price dispersion on the other side in the Russian dairy sector. With the implementation of the food import ban, importing regions of Russia substituted dairy imports from international markets by imports from domestic dairy producer regions. Therefore, domestic dairy trade increased with the implementation of the Russian import ban, strengthening regional integration in Russian dairy market.

We measure spatial price integration during free trade and restricted trade (imports) by employing the Johansen cointegration and VECM approach to weekly consumer price series from January 2008 to December 2016. Furthermore, following the price integration, the bivariate price dispersion between all market pairs in the first part are estimated before and after the import ban of 2014. Finally, possible factors which can affect the bivariate price differences between Moscow metropole and cheese producing regions is tested with a panel model.

The paper is structured as follow: section 2 provides the overview of the Russian dairy sector and external trade of dairy products, section 3 provides the review of the main literature on regional price integration and price dispersion. The overview of the methodology and data used in the study are described in section 4 and the empirical results are presented in section 5. Finally, the discussion and conclusion are presented.

2 Dairy Sector of Russia

2-1 Production

During transformation, milk production in Russia has decreased (**Figure 1**), mainly due to a significant drop in the number of cows **(Figure 2**). While the annual milk production reached to 55 million tons in 1990, current levels amount to only 30 million tons. However, milk production has not notably changed during the import ban.

Figure 1 around here

Figure 2 around here

Milk producers are categorised to households, large agricultural enterprises[1] and farms and individual entrepreneurs. At the beginning of the 1990s production of milk was highly dominated by agricultural enterprises. However, their share has steadily decreased until 1999, with farm households becoming the largest producers of milk since then **(Figure 3**).

Figure 3 around here

[1] The Russian word for this organization is “Сельскохозяйственные организации” which used to be called “Selkhoz”.

Concurrently, butter production has (**Figure 4**) dropped dramatically between 1990 and 2000, and could not really be recovered since then. Moreover, an increase in butter production was not observed after the implementation of import ban in 2014.

The opposite is true in the case of cheese production (**Figure 4**). Unlike, cheese production has dropped by nearly two times between 1990 and 1995, and has steadily recovered since then. In 2006 cheese production reached the levels of 1990. Since 2013 cheese production has risen dramatically and continued to grow even during the import ban.

Figure 4 around here

The production of skimmed milk powder (SMP) and whole milk powder (WMP) has been decreasing significantly during the last decade. In 2010 alone, the production of both milk powders dropped by more than two times. While production of WMP has not changed substantially since 2010, production of SMP increased by around 200% during 2010 to 2014, but has constantly decreased since then. In 2016, the production level of WMP and SMP was 42 and 63 thousand tons. respectively (USDA, 2017).

Milk processing is highly concentrated and dominated by few large enterprises. While the two largest companies, Danone and PepsiCo, jointly accounted for 18.14% of total milk processing in 2015, the same year, top 10 companies jointly processed 30.7% of all milk around Russia (RussianDairy, 2016).

Figures 5 and 6 present the largest domestic cheese exporting and importing regions, respectively[2]. While exports by almost all regions have increased since 2014, the opposite is true in the case of Moscow Oblast (**Figure 5**). Similarly, cheese import regions (**Figure 6**) have increased their imports from domestic markets since 2014. The highest growth in domestic imports is observed for Smolensk (78%). Saint Petersburg (22%) and Samara (18%). Presumably because of their higher dependence on the European cheese and relatively lower level of local production.

Figure 5 around here

Figure 6 around here

[2] The internal regional trade data are used for these figures.

2- 2 Trade pattern

The import of dairy products met two major turmoil. The custom union between Russia and Belarus and Kazakhstan in 2010 and import ban of 2014. The Food Import Ban seems to have had different effects on different types of dairy products as it was observed in the production data. The import of raw milk products and butter has more or less been replaced by the imports from Belarus after the ban of 2014 **(Figures 7 and 8)**. As a result, total import of butter and milk since the introduction of the import ban had not changed much.

Figure 7 around here

Figure 8 around here

However, in the case of cheese, the picture is completely different **(Figure 9)**. Total imports of cheese dropped dramatically since the import ban and is currently at the level of nearly two times lower than it was before the ban. The share of European countries in total import of cheese was extremely high and imports from Belarus were not enough to compensate for such a huge drop in imports.

Figure 9 around here

Imports of both SMP and WMP has increased dramatically since 2007, by nearly 2.5 times and almost two fold, respectively. While imports of SMP and WMP from European Union have been decreasing since 2010 and even totally stopped after 2014, imports of both products from Belarus have skyrocketed, with even higher rates. The share of Belarus in the import structure of SMP and WMP is huge. However, this share has decreased significantly in 2016 by nearly 18% and about half for SMP and WMP respectively (USDA, 2017). It must be added that a minor increase in import of dairy products by Belarus from EU can be observed in the trade data. However, the import of fresh milk products (HS Code 401) increases dramatically by Belarus from EU since 2014 **(Figure 10)**. In 2016 Belarus has exported more than 300 thousand tons of raw milk products (without counting for cheese, butter and milk powder) to Russia and imported more than 100 thousand tons of the same commodity from EU. This trend was not there before 2014. It seems that Belarus covers part of its raw milk shortages by milk import from EU to export the dairy products to Russia.

Figure 10 around here

To sum up, the import substitution strategy of Russia did not have any significant impact in the case of milk and butter, as production and self-sufficiency have not improved since 2014. However, the opposite is true in the case of cheese, where self-sufficiency level increased by almost 20%. **Therefore, in our further analysis we concentrate only on cheese, as it is by far the major dairy product for which import substitution strategy seems to have remarkable effect.**

3 Literature Review

Price transmission

Our paper contributes to the literature on the degree of market integration in spatially separated markets (Alexander & Wyeth, 1994; Goodwin & Piggott, 2001). The degree of market integration is one of the common ways to indicate market efficiency (Faminow & Benson, 1990; Goodwin, Grennes, & McCurdy, 1999; Goodwin & Schroeder, 1991). Study techniques are mainly built on the law of one price (Sanogo & Amadou, 2010). which is an important component of almost all of the international trade models (Officer, 1986). In an efficient market with well-developed transportation and storage infrastructure, regional price differences should at most be equal to the costs of trade between the trading regions. The prices in two trading regions tend to co-move in the long run, with price shocks transmitting from one region to the other (ASCHE et al., 2004; Goodwin, 1992; Van Campenhout, 2007).

One of the pioneering cointegration models were introduced by Engle & Granger (1987). Despite of its popularity among researchers, Engle & Granger approach is subject to a number of serious limitations, such as: a) cointegration considerations are restricted to pair-wise comparisons; b) one of the two prices must be designated as exogenous; c) potential for small sample biases in parameter estimates; and lastly d) E&G approach does not have well defined limiting distributions and therefore direct testing of hypothesis is not possible (ASCHE et al., 2004; Banerjee et al., 1986; Goodwin, 1992; Hall, 1986). A more powerful approach for cointegration test, introduced by Johansen (1988), can be a good alternative in this regard (Alexander & Wyeth, 1994). Johansen's approach can be used for the multivariate cointegration analysis (Goodwin, 1992). It also allows the generation of test statistics with exact limiting distributions

which makes the straightforward hypothesis testing possible (ASCHE et al., 2004; Frank Asche, Bennear, Oglend, & Smith, 2012; Søren Johansen & Juselius, 1990). Moreover, the restriction for one price to be designated as exogenous can be relaxed, which is especially important when the two prices illustrate two-way causality, as it is the case with the data used in this study. Therefore, Johansen cointegration approach is used in current work to analyze the regional price integration of dairy products before and after the import ban.

Studies on the effects of trade policies on domestic consumer prices are rare (e.g. Diao & Kennedy, 2016; Djuric & Götz, 2016; Nogues, 2014; Wong, 2014), especially on transition countries like Russia (e.g. Götz et al., 2016; Götz et al., 2013; Welton, 2011). One such study is conducted by Götz et al. (2013). Analyzing the effects of wheat export restrictions in Russia and Ukraine during the world food crisis. Götz et al. (2013) find that export restrictions reduced the degree of price transmission with the world market during the world food crisis. Similar finding was observed by Nogues (2014), where he could not observe any significant impact of export restrictions on lowering domestic consumer prices in the case of Argentine.

Price dispersion

In this research, we also contribute to price dispersion which has attracted the attentions in the agricultural market study especially in developing countries. There are different meanings for price dispersion. Generally, it refers to price differences between two markets or price difference which can be observed for the same commodity in the same market. Market power and imperfect competition are considered to be the main causes of price dispersion by many scholars (Wang, 2017). The availability of price dispersion among commodities such as irrigation water in segregated spot water markets (Jaghdani & Brümmer, 2016; Yoskowitz, 2002) or fish quota markets (Newell et al., 2005) is a recognised phenomenon. In addition, the existence of price dispersion even for homogenous products which is less expected is among the most replicated findings in empirical economics (Anania & Nisticò, 2014). Aker (2010) has studied the effects of mobile phone introduction on price dispersion in grain markets in Niger. She has used the panel econometrics and bivariate price difference between different markets. The results show that the mobile phone introduction has increased the information availability and reduced the price dispersion by 10-16 percent. Anania & Nisticò (2014) have studied the price dispersion among 14 perfectly homogenous food items in 437 stores located in different towns Calabria, Italy.

They conclude the heterogeneity between retailers and consumers are two important factors on observed price dispersion. Cerasa & Buscaglia (2017) have used the hedonic pricing to test the convergence of coffee prices in EU market. In contrast to the convergence hypothesis, the results show significant price dispersion in this market. Andersson, Bezabih & Mannberg (2017) have followed the (Aker, 2010) approach to find the possible effects of availability Ethiopian Commodity Exchange (ECX) and its connected warehouses on price dispersion of coffee at local level. They find price dispersion reduction as a result of ECX availability.

The effect of trade policy on domestic price dispersion on agricultural commodity is an area which is not studied yet. Therefore, beside the possible effect of market integration, we have studied the price dispersion in this study.

4 Methodology and Data

4-1 Price transmission

In this study we use Johansen cointegration test and Vector Error Correction Model (VECM) to test the effects of trade policy on spatial market integration in Russian dairy market. Most of the market integration analysis were built upon the concept of the law of one price, which can be expressed as follows:

$$p_t^i = a + \beta p_t^e + \varepsilon_t$$

where p_t^i is the price in the importing region, p_t^e is the price in the exporting region and β is the coefficient of the long term equilibrium. Prices in two regions are equal if $a = 0$ and $\beta = 1$, which is the strict version of the law of one price. If $a \neq 0$ and $\beta = 1$, the two prices have proportional relationship and their levels differ due to the factors such as transportation cost. This is the weak version of the law of one price. This regression however cannot be used when series are non-stationary, in which case cointegration techniques are advised (Ardeni, 1989; Asche, Bremnes & Wessells, 1999; Ghosh, 2003). Long term dynamics in price relationships can be extracted from cointegration models and it can be empirically specified in the form of the basic vector error correction model (VECM) specified as:

$$\Delta lnp_t = \alpha\beta' lnp_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta \ln p_{t-i} + \varepsilon_t$$

where lnp_t is a vector of the natural logarithms of n prices at time t. α and β are the vectors of parameters for the speed and degree of long-run price transmission respectively and Γ_i is a matrix of parameters for the short-run relationship.

4-2 Price dispersion

To assess the effect of trade policies on price performance and price dispersion, we follow Aker (2010) and Andersson et al. (2017) by using panel model approach. The price difference between markets j and k at month t is defined as $Y_{jk} = |P_{jt} - P_{kt}|$. We have tested the effect of trade policies on $Y_{jk,t}$. As empirical evidence indicates that trade policy in Russia has reduced the size of imports, we use the quantity of imports as an effective proxy for policy implementation. Additionally, since the cheese was mainly imported from EU and Belarus, the RUB/EUR exchange rate is also considered as proxy regressors. The average European Gouda cheese is selected to represent international cheese price. The regression model is given as

$$Y_{jk} = \beta_0 + X_{jk,t}\lambda + \alpha_{jk} + \theta_t + \epsilon_{jk,t}$$

Where $X_{jk,t}$ is the vector of variables that affect the price dispersion, α_{jk} are market-pair fixed effects and θ_t are time fixed effects. To capture the dynamics of price dispersion, we use the first difference equation:

$$\Delta Y_{jk} = \beta_0 + \Delta X_{jk,t}\lambda + \delta D_t + \epsilon_{jk,t}$$

D_t is a dummy for testing the shock from the trade ban 2014. This dummy is added as the first difference of imported commodities at the monthly intervals cannot reflect the effect of ban at least for a short period. The model is tested for the existence of fixed and random effects.

4-3 Data

Our analysis of regional cheese market integration is conducted for regions of Russia comprising cheese producing as well as cheese consuming regions. Among those the largest producing regions are Voronezh oblast, Bryansk oblast, Omsk oblast, Adygea republic, Pskov oblast, Tatarstan republic, Ryazan oblast, Rostov oblast, Moscow oblast and Udmurt Republic (Figure 5). The largest cheese consuming regions are Moscow city, Krasnodar krai, St. Petersburg, Sverdlovsk oblast, Samara oblast and Smolensk oblast (Figure 6). The analysis is based on 39

regional price pairs each consisting of the price series of a cheese exporting and a cheese importing region.

We use the natural logarithms of weekly consumer prices of solid and soft rennet cheese for the period from January 2008 to December 2016, comprising 460 observations for each price series (MilkNews 2017). This type of cheese is produced domestically and also imported from international markets. The Chow breakpoint test (Chow, 1960) suggests the existence of the structural break in long-run equilibrium in August of 2014 for all of the price pairs (Table 3). Thus the date of the structural break coincides with the date of the implementation of the Russian food import ban.

We account for the structural break in our modelling approach by distinguishing a "free trade" regime (January 2008 to July 2014) and an "import ban" regime (August 2014 to December 2016) in the price transmission as well as the price dispersion modelling approach. This regime-switching framework allows identifying the possible effects of the import ban on the degree of market integration. The parameters of the "free trade" and the "import ban" regime are estimated based on 336 and 124 observations, respectively (Table 1).

Table 1 around here

As price dispersion has been analyzed descriptively and analytically, both weekly and monthly price interval are used[3]. Primarily, the weekly price dispersion is used for descriptive analysis of price dispersion before and after the import ban in line with price transmission study. Furthermore, the price dispersion is investigated econometrically based on monthly price series in order to make it possible to include the quantity of cheese imports, which is available only on a monthly frequency. The monthly price series is constructed by selecting the end of the months prices of weekly price data used in the price transmission analysis. We further include monthly cheese and milk import to Russia, exchange rate, and monthly changes on total agricultural price index (inflation) as explanatory variables in our model approach. The time period underlying this analysis is January 2008 to December 2016.

Table 2 shows the descriptive elements of the dependent and independent variables in price dispersion model (not transformed). As it will be explained in the results, only the bivariate price

[3] Data source: MilkNews (2017)

dispersions between Moscow city and its cheese providers is selected. Some transformation are used on some of the data series for model estimation. The exchange rates and import levels are transformed to logarithms. Furthermore, the explanatory variables are included as first difference with the exception of the agricultural price index.

Table 2 around here

5. Results and Discussions

5.1. Price transmission

The vast majority of the analyzed price pairs were not cointegrated, when we conducted the test on the whole time frame under study. To estimate the effects of the import ban, we split the data into "free trade" and "import ban" sub-periods and conducted cointegration tests separately for each sub-period. The Chow breakpoint test (Chow, 1960) supported the existence of the structural break in the long-run equilibrium in August of 2014 (the starting period of the import ban). The degree of price transmission and speed of adjustment were then estimated for cointegrated price pairs using VECM, during both "free trade" and "import ban" regimes. Results suggest that 29 out of the 39 price pairs were not cointegrated during the "free trade" but became cointegrated afterwards, during the "import ban" regime (Table 3). The remaining 10 price pairs were already cointegrated before the import ban was implemented. Half of these price pairs illustrate higher integration (increased price transmission and speed of adjustments), whereas the rest half became less integrated (decreased price transmission and speed of adjustments or no cointegration) during "import ban" regime. The results of the z-test (PATERNOSTER, BRAME, MAZEROLLE & PIQUERO, 1998) suggest that the changes in price transmission and speed of adjustment parameters between "free trade" and "import ban" regimes are statistically significant[4] (Table 4).

Overall, out of the 39 price pairs, we have 34 cases were integration emerged or improved and 5 cases were integration disappeared or worsened.

[4] Only in the case of "Sverdlovsk oblast – Tatarstan Republic" price pair, the z-test of the price transmission parameters was not significant, due to similar betas in both regimes. However, the difference in the speed of adjustment was positive and statistically significant.

Table 3 around here

Table 4 around here

While the highest degree of price transmission during the "import ban" regime were observed between the pairs like Moscow city and Bryansk oblast (1.12) and between Samara oblast and Tatarstan Republic (1.15), the highest speed of adjustment account to pairs like Sverdlovsk and Pskov oblasts (0.29) and Samara oblast and Tatarstan Republic (0.27).

Saint Petersburg and Tatarstan Republic are among the regions for which cheese markets became weaker integrated in regional markets during the "import ban" regime. For example, we find market integration decreasing during the import ban regime for two out of five price pairs involving Tartastan and three out of seven price pairs involving Saint Petersburg compared to the time period when trade was possible.

Moreover, the average degree of price transmission (0.51) and speed of adjustment (0.06) in Saint Petersburg in the "import ban" regime is considerably low, compared to other consumer regions (Table 5).

Table 5 around here

We assume that the decrease in market integration in Tartastan can be explained by the decrease in Tartastan's cheese exports during the import ban. In particular, regional exports of cheese by Tatarstan decreased by nearly 30 percent from 2014 to 2016 (**Figure 11**). This might have resulted in weaker co-movements of the cheese prices in importing regions with the prices in Tatarstan.

Figure 11 around here

Before the import ban was implemented. Saint Petersburg was mainly a cheese importing region and cheese was primarily imported from the bordering countries like Estonia and Finland. According to media reports, despite the import ban against those European countries. Estonian and Finnish cheese continued to be supplied in Saint Petersburg even after the import ban was

implemented[5]. Therefore, cheese price in Saint Petersburg remained influenced by cheese imports which explains the decrease in integration with other regional cheese markets in Russia.

5-2 Price dispersion

Table 6 shows the weekly price dispersion ($|P_{jt}-P_{kt}|$) between the same pairs used in price cointegration. The same weekly pairs are used for this estimation. The results of these tables show that the pairwise price dispersion has increased generally after the ban. This increase was extreme for Moscow City and Sverdlovsk Oblast on one side and their cheese providing region on the other side. As a result the Moscow city is selected for price dispersion model estimation.

Table 6 around here

As it was explained in methodology part, the price dispersion and its explanatory variables can show systematic dynamic structure. Therefore the first difference of logarithmic forms are used for this estimation. Table 7 shows the results of panel estimation for fixed effect and random effect models of price dispersion. As it was expected, the fix effect has been eliminated through first difference.

Table 7 around here

The results of table 6 show that increase in monthly import of cheese and milk decreases the price dispersion. Additionally, the increase on monthly agricultural price index can increase the price dispersion at lower magnitude. The dummy variable for import ban period was also significant. It must be mentioned that the import ban has multiple effects that can directly be captured by dummy variable. The unexpected results from the regression are the sign of Russian Rubble devaluation and the increase in European cheese price. It seems that currency devaluation (more Rubble for each USD) has negative effect on monthly price dispersion. The same thing

[5] Even after the ban, Estonian and Finnish cheese were supplied in the markets around Saint Petersburg. Also cheese from those countries could be ordered through various internet shops. Transporting of goods through border by individuals, with the purpose of self-consumption is not banned, and as a result it become the main way for citizens of Saint Petersburg to import cheese and other food products from Estonia and Finland during the import ban. Moreover, Narva, Estonian city which borders with Saint Petersburg, in the first half of 2017 was again ahead of Tallin for the amount and volume of Tax Free deals registered, which include food products as well (BumagaMedia, 2015; DELFI, 2017; Inosmi.ru, 2016; Vedomosti, 2016).

has happened for the effect of international prices. However, the both effects which can increase the general price of cheese can reduce the supply-demand gap. Nevertheless, the strong not negligible effects of these two factors need more research on this relation. No effects is recognised from changes in Belarusian Rubble.

Generally speaking, the increase in price cointegration between domestic cheese markets especially for a city like Moscow does not show increase in market efficiency directly. The available price dispersion shows that the supply demand gap in this metropole is not really covered by domestic supply.

7 Conclusion

In this paper we have investigated the effects of the Russian food import ban of 2014 on the spatial integration in the Russian dairy market following the Johansen cointegration and VECM approach on one side and price dispersion approach on the other side. We have used the consumer cheese prices to represent the Russian dairy market since cheese so far is the only dairy item that was significantly affected by the import ban. While the production of cheese increased by about 20 percent, the imports dropped by around 40 percent since the introduction of the import ban.

Our results suggest that the Russian dairy market became more integrated during the "import ban" regime. After the implementation of the import ban, Russian market was mainly dominated by locally produced cheese, which led prices in domestic importing and exporting regions to co-move. In 29 out of the 39 price pairs we observe an emergence in cointegration between major cheese importing and cheese exporting regions. In addition, in 5 price pairs the degree of long term price transmission improved significantly, whereas for remaining 5 pairs cointegration disappeared or price transmission parameters decreased significantly during the "import ban" regime.

The highest price transmission during the "import ban" regime were observed between the pairs like Moscow city and Bryansk oblast and between Samara oblast and Tatarstan Republic. In contrast, the price pairs that include Saint Petersburg on average demonstrated lowest price transmission levels during the "import ban" regime. Despite the food import ban cheese from

Estonia and Finland was supplied in supermarkets in Saint Petersburg which explains the on average relatively low integration with other regional cheese markets in Russia. Furthermore, cointegration of the prices in Tatarstan Republic with the prices in other consuming regions decreased in 3 price pairs out of 5, which can possibly be explained by a notable decrease in the level of exports from Tatarstan between 2014 and 2016. We also found increased market integration reflected by the increase in the speed of adjustment parameter for 5 out of 10 price pairs. The highest speed of adjustment account to pairs like Sverdlovsk and Pskov oblasts and Samara oblast and Tatarstan Republic.

In order to check the efficiency of dairy market of Russia and effects of import ban, beside market cointegration, we have studied the effects of import ban on price dispersion between major cheese producing (exporters) and cheese consuming regions (importers). The results show that the extreme dispersion has happened between Moscow city and Sverdlovsk Oblast as major inland metropolitans (not on the border) and the major cheese producing regions. The Moscow city has been selected and the bivariate price dispersion and price dispersion variable was regressed on potential factors which can affect the price dispersion beside import ban. The results show that the import ban has increased price dispersion between metropolitan city such as Moscow and cheese producing regions. We find substantially lower price dispersion for other major consuming cities with lower population on the western borders of Russia. The reduction in level of import and increase in general price level of agricultural commodity increases the price dispersion. The negative effects of increase in international prices and devaluation of Rubble are non-expected part of the price dispersion analysis which will be studied precisely in the future.

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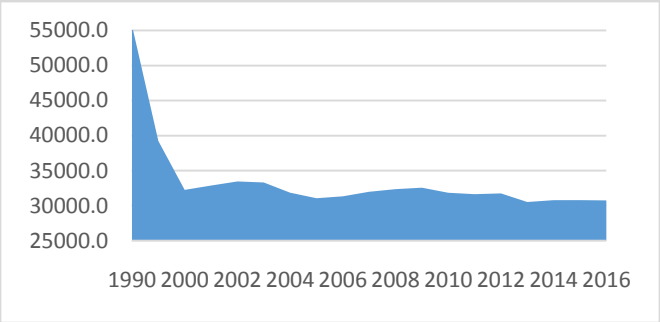
Figures and tables

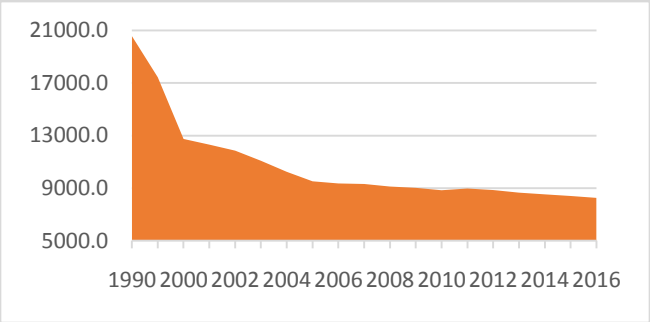
Figures:

Figure 1: Milk production. thousand tons



Source: own illustration. data: Rosstat

Figure 2: Number of cows. thousand heads



Source: own illustration. data: Rosstat

Figure 3: Production of milk by different types of producers (thousand tons)

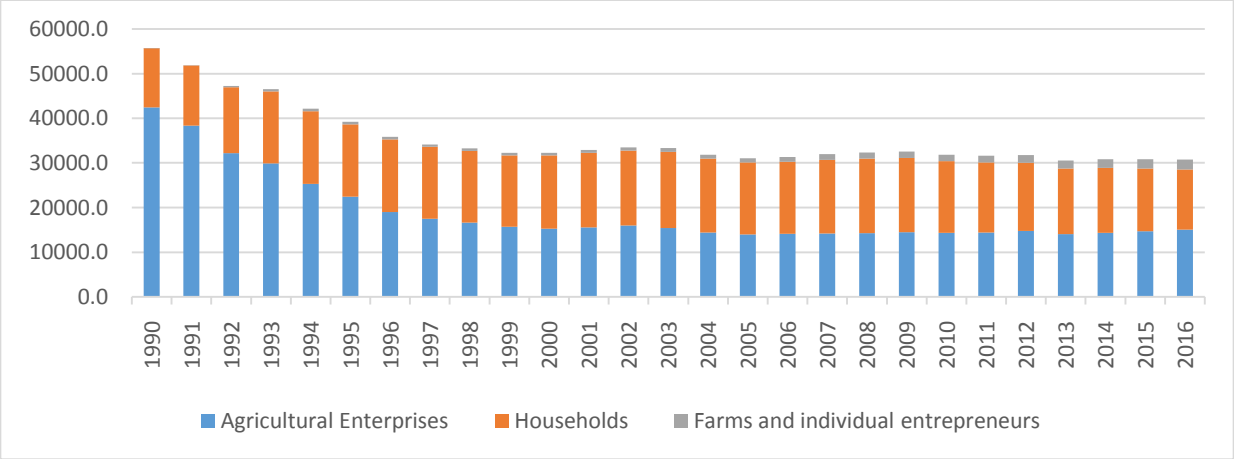


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Figure 4: Butter and Cheese production (thousand tons)

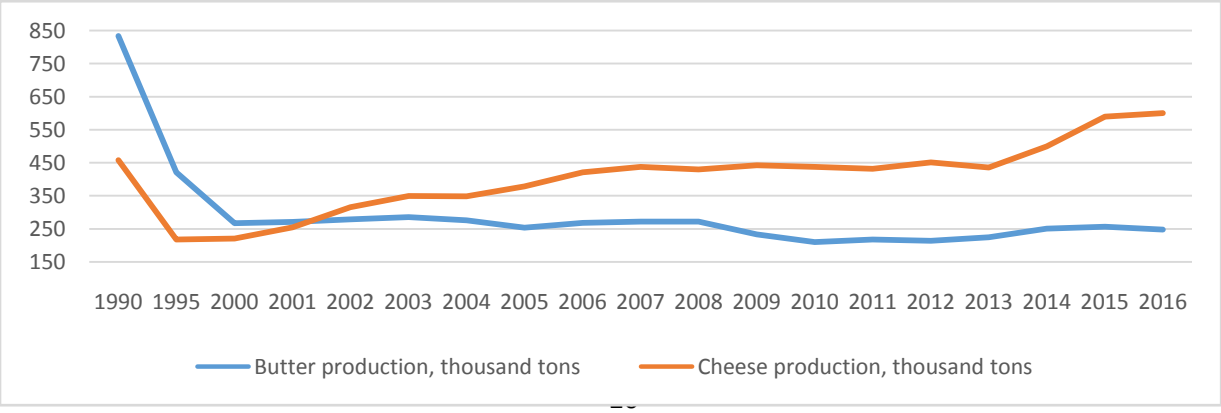

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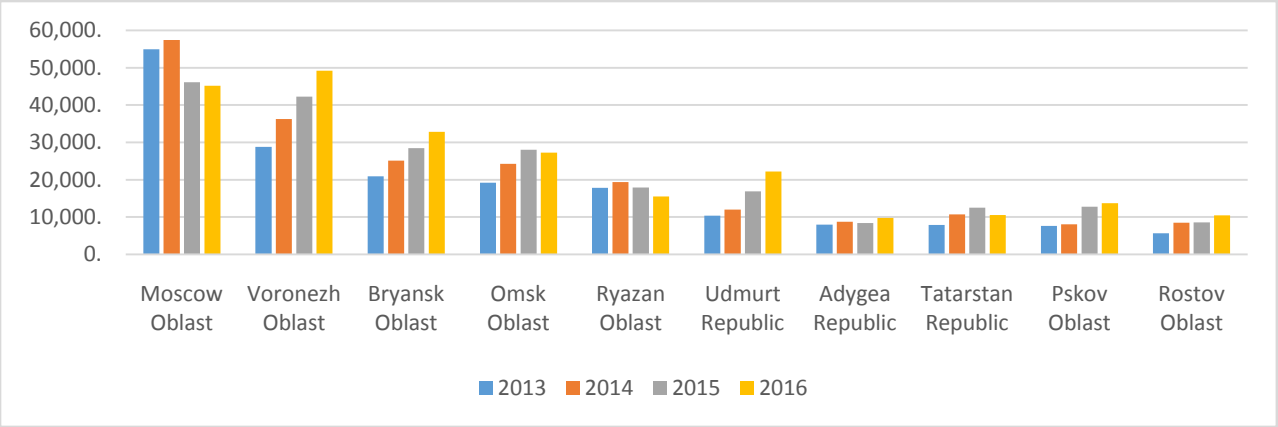
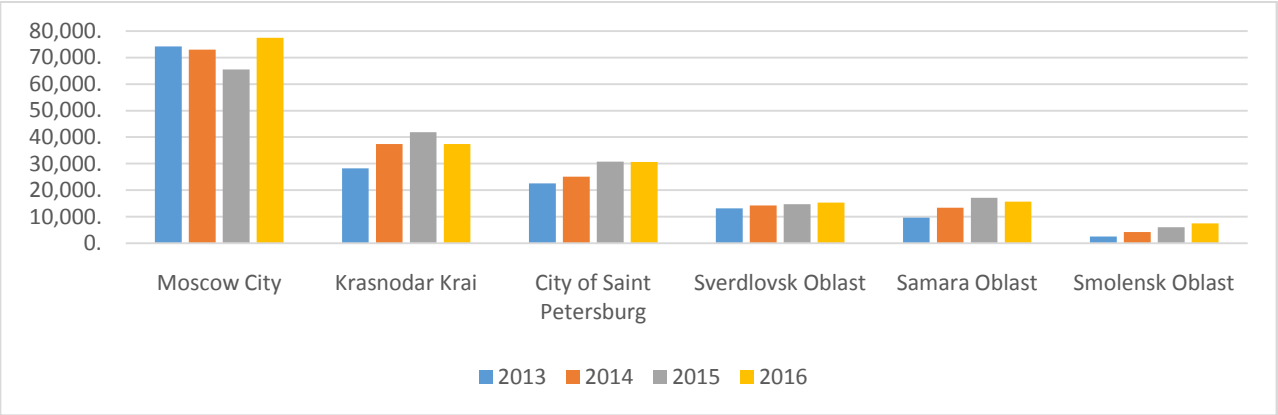
Figure 5: Top Regional Exporters, tons



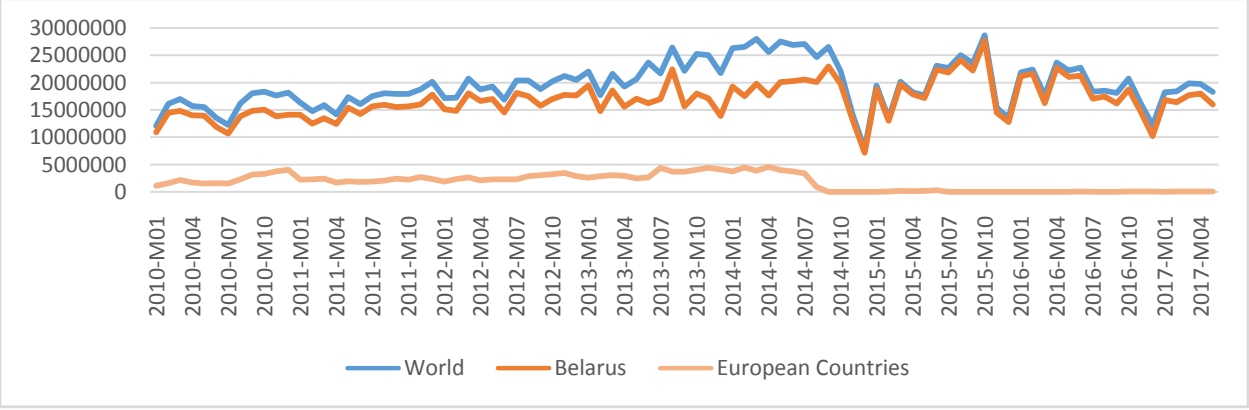
Source: own illustration. data: Rosstat

Figure 6: Top Regional Importers, tons



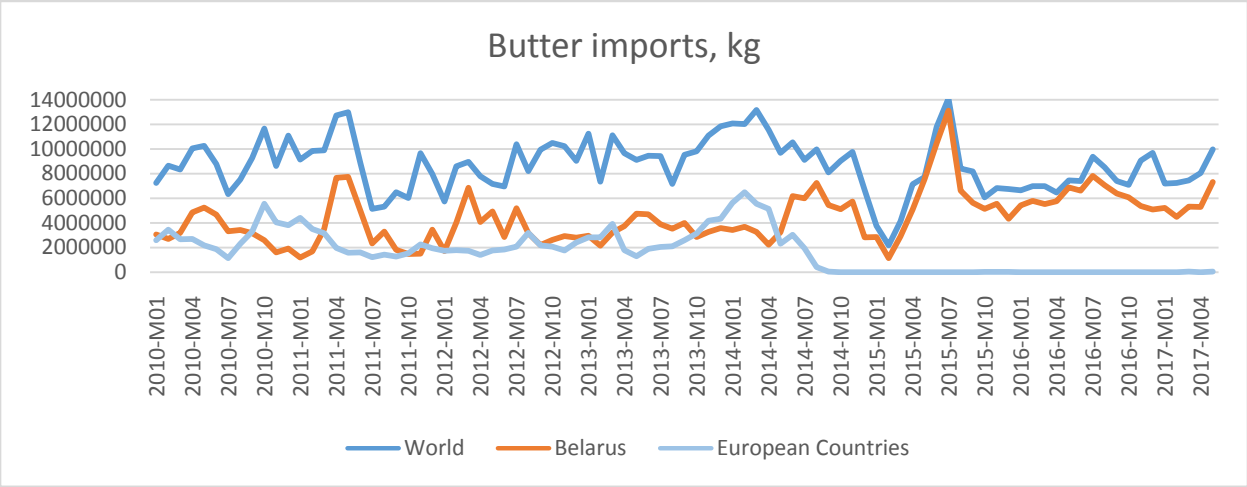
Source: own illustration, data: Rosstat

Figure 7: Milk imports, kg



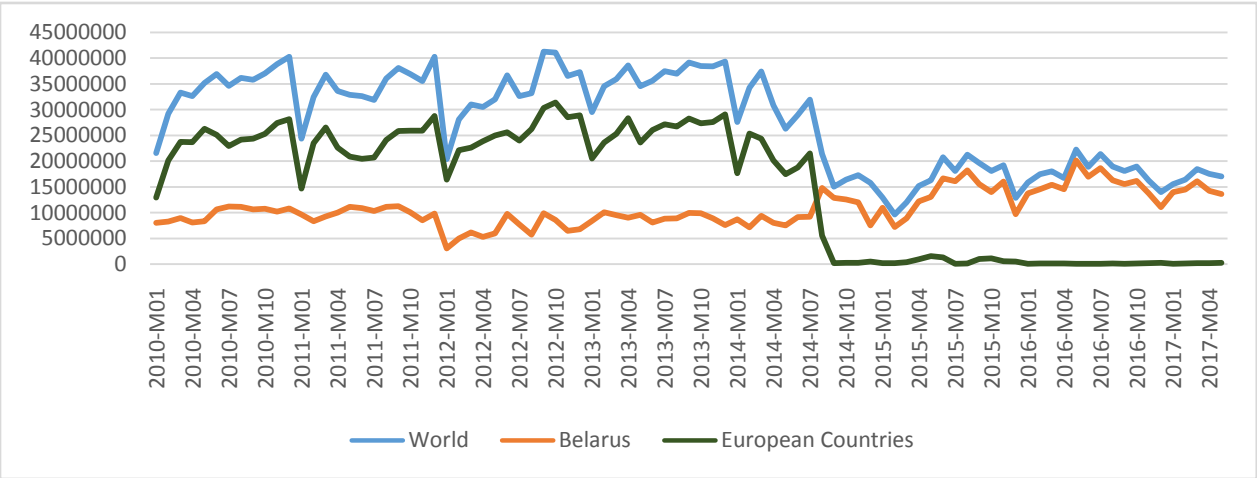
Source: own illustration, data: Trademap

Figure 8: Butter imports, kg



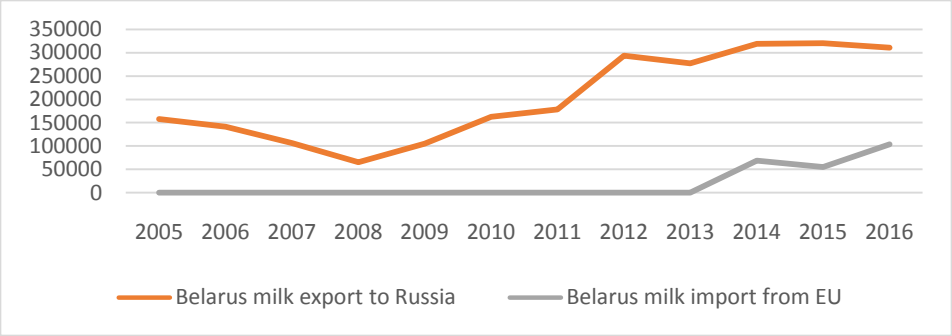
Source: own illustration, data: Trademap

Figure 9: Cheese imports, kg



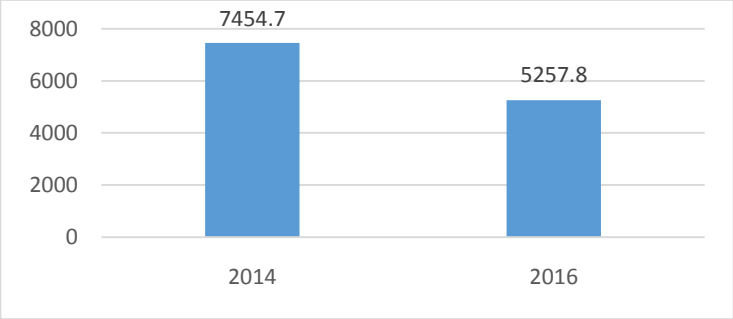
Source: own illustration, data: Trademap

Figure 10: Belarus fresh milk products import and export (tons)



Source: own illustration, data: Trademap. Eurostat

Figure 11: Regional net export of cheese (tons), Tatarstan



Source: own illustration, data: Rosstat

Tables:

	# of observations in each region	Mean	Stdev	Max	Min
Total	460	293.93	84.05	598.41	159.64
Free trade	336	251.67	42.56	424.58	159.64
Import ban	124	408.44	58.29	598.41	281.75

Table 1: Descriptive statistics of the average cheese prices in 16 regions under study. roubles/kg

Source: own estimations

Table 2: Descriptive statistics for panel estimation and source of the monthly cheese prices for Moscow and its cheese providers and model regressors.

		mean	sd	min	max	Source of data
Dependent variable (price	Moscow City - Voronezh Obl (RUB)	87.14	41.58	30.5	164.99	Milk News
	Moscow City - Bryansk Obl (RUB)	91.05	43.77	43.9	177.4	

difference pairs in panel)	Moscow City - Omsk Obl (RUB)	104.26	63.5	17.93	234.58	
	Moscow City - Adygea Rep (RUB)	59.08	24.36	11.73	114.85	
	Moscow City - Pskov Obl (RUB)	50.29	21.3	11.45	98.9	
	Moscow City - Tatarstan Rep (RUB)	110.11	48.17	50.08	209.09	
	Moscow City - Ryazan Obl (RUB)	99.04	48.87	37.27	193.6	
	Moscow City - Rostov Obl (RUB)	88.13	40.47	41.18	167.84	
Regressors	Dummy for ban	0.27	0.45	0	1	
	Agricultural price index (%)	-0.51	1.75	-6.3	2.8	Rosstat
	EUR-Ruble exchange rate	48.69	13.22	34.49	82.39	
	Total monthly milk import in 1000 ton	17.1	6.14	6.27	28.64	TradeMap. Eurostat
	Total cheese import in 1000 ton	30.91	10.03	9.63	47.9	TradeMap. Eurostat
	EU Gouda cheese price (Euro/100 kg)	298.25	40.28	217.94	381.97	EU website

Table 3: Estimated parameters for regional cheese market cointegration

№	Pairs (Importer - Exporter)	Johansen Cointegration Test. p-value			Chow-test. p-value (08/2014)
		Whole period (01/2008 - 12/2016)	Free Trade (01/2008 - 08/2014)	Import Ban (08/2014 - 12/2016)	
1	Moscow City - Voronezh Obl	0.613	0.678	0.001	0.000
2	Moscow City - Bryansk Obl	0.049	0.092	0.008	0.000
3	Moscow City - Omsk Obl	0.033	0.092	0.000	0.000
4	Moscow City - Adygea Rep	0.104	0.279	0.010	0.000
5	Moscow City - Pskov Obl	0.458	0.810	0.005	0.000
6	Moscow City - Tatarstan Rep	0.004	0.007	0.001	0.000
7	Moscow City - Ryazan Obl	0.233	0.495	0.001	0.000
8	Moscow City - Rostov Obl	0.001	0.070	0.000	0.047
9	Krasnodar Krai - Bryansk Obl	0.504	0.812	0.003	0.000
10	Krasnodar Krai - Tatarstan Rep	0.038	0.041	0.411	0.000
11	Krasnodar Krai - Moscow Obl	0.815	0.719	0.011	0.002
12	Krasnodar Krai - Rostov Obl	0.169	0.799	0.005	0.002
13	St Petersburg - Voronezh Obl	0.452	0.780	0.045	0.000
14	St Petersburg - Bryansk Obl	0.043	0.015	0.024	0.000
15	St Petersburg - Omsk Obl	0.161	0.311	0.032	0.000
16	St Petersburg - Tatarstan Rep	0.086	0.098	0.042	0.000
17	St Petersburg - Moscow Obl	0.102	0.340	0.009	0.000
18	St Petersburg - Ryazan Obl	0.269	0.372	0.071	0.000
19	St Petersburg - Rostov Obl	0.081	0.015	0.152	0.000
20	Sverdlovsk Obl - Voronezh Obl	0.901	0.935	0.061	0.000
21	Sverdlovsk Obl - Omsk Obl	0.192	0.236	0.000	0.000
22	Sverdlovsk Obl - Adygea Rep	0.280	0.468	0.001	0.000

23	Sverdlovsk Obl - Pskov Obl	0.497	0.605	0.014	0.000
24	Sverdlovsk Obl - Tatarstan Rep	0.002	0.016	0.001	0.001
25	Sverdlovsk Obl - Ryazan Obl	0.653	0.600	0.049	0.000
26	Sverdlovsk Obl - Rostov Obl	0.124	0.153	0.031	0.000
27	Samara Obl - Voronezh Obl	0.831	0.954	0.007	0.000
28	Samara Obl - Bryansk Obl	0.105	0.354	0.038	0.000
29	Samara Obl - Omsk Obl	0.284	0.348	0.011	0.000
30	Samara Obl - Udmurt Rep	0.370	0.242	0.047	0.000
31	Samara Obl - Tatarstan Rep	0.049	0.049	0.000	0.000
32	Samara Obl - Moscow Obl	0.223	0.588	0.011	0.000
33	Samara Obl - Ryazan Obl	0.452	0.676	0.001	0.000

Source: own estimations

Table 3-continue: Estimated parameters for regional cheese market cointegration

№	Pairs (Importer - Exporter)	Johansen Cointegration Test. p-value			Chow-test. p-value (08/2014)
		Whole period (01/2008 - 12/2016)	Free Trade (01/2008 - 08/2014)	Import Ban (08/2014 - 12/2016)	
34	Smolensk Obl - Voronezh Obl	0.723	0.937	0.019	0.002
35	Smolensk Obl - Udmurt Rep	0.889	0.802	0.065	0.000
36	Smolensk Obl - Adygea Rep	0.318	0.651	0.022	0.000
37	Smolensk Obl - Pskov Obl	0.086	0.225	0.040	0.000
38	Smolensk Obl - Moscow Obl	0.202	0.235	0.042	0.000
39	Smolensk Obl - Rostov Obl	0.059	0.229	0.000	0.000

Source: own estimations

Table 4: Estimated price transmission parameters

№	Pairs (Importer - Exporter)	Degree of price transmission			Speed of adjustment		
		Free Trade	Import Ban	z-test	Free Trade	Import Ban	z-test
1	Moscow City - Voronezh Obl	-	0.94		-	0.15	
2	Moscow City - Bryansk Obl	0.85	1.12	1.65	0.02	0.05	2.42
3	Moscow City - Omsk Obl	0.34	0.58	1.76	0.01	0.11	3.47
4	Moscow City - Adygea Rep	-	0.81		-	0.16	
5	Moscow City - Pskov Obl	-	0.70		-	0.20	
6	Moscow City - Tatarstan Rep	0.76	0.60	-1.68	0.07	0.03	-2.08
7	Moscow City - Ryazan Obl	-	0.85		-	0.15	

8	Moscow City - Rostov Obl	0.77	0.89	1.71	0.02	0.11	2.59
9	Krasnodar Krai - Bryansk Obl	-	0.82		-	0.11	
10	Krasnodar Krai - Tatarstan Rep	0.88	-		0.02	-	
11	Krasnodar Krai - Moscow Obl	-	0.87		-	0.21	
12	Krasnodar Krai - Rostov Obl	-	0.85		-	0.06	
13	St Petersburg - Voronezh Obl	-	0.41		-	0.09	
14	St Petersburg - Bryansk Obl	0.92	0.44	-3.30	0.08	0.04	-1.67
15	St Petersburg - Omsk Obl	-	0.39		-	0.05	
16	St Petersburg - Tatarstan Rep	0.96	0.48	-2.14	0.06	0.03	-1.75
17	St Petersburg - Moscow Obl	-	0.56		-	0.08	
18	St Petersburg - Ryazan Obl	-	0.79		-	0.09	
19	St Petersburg - Rostov Obl	0.99	-		0.05	-	

Source: own estimations

Table 4-Continue: Estimated price transmission parameters

№	Pairs (Importer - Exporter)	Degree of price transmission			Speed of adjustment		
		Free Trade	Import Ban	z-test	Free Trade	Import Ban	z-test
20	Sverdlovsk Obl - Voronezh Obl	-	0.82		-	0.20	
21	Sverdlovsk Obl - Omsk Obl	-	0.69		-	0.15	
22	Sverdlovsk Obl - Adygea Rep	-	0.88		-	0.18	
23	Sverdlovsk Obl - Pskov Obl	-	0.86		-	0.29	
24	Sverdlovsk Obl - Tatarstan Rep	0.78	0.78	-0.05	0.03	0.14	2.29
25	Sverdlovsk Obl - Ryazan Obl	-	0.90		-	0.08	
26	Sverdlovsk Obl - Rostov Obl	-	0.94		-	0.05	
27	Samara Obl - Voronezh Obl	-	0.86		-	0.09	
28	Samara Obl - Bryansk Obl	-	0.87		-	0.08	
29	Samara Obl - Omsk Obl	-	0.44		-	0.08	
30	Samara Obl - Udmurt Rep	-	0.92		-	0.13	
31	Samara Obl - Tatarstan Rep	0.99	1.15	1.71	0.03	0.27	3.79
32	Samara Obl - Moscow Obl	-	0.57		-	0.06	
33	Samara Obl - Ryazan Obl	-	0.94		-	0.20	
34	Smolensk Obl - Voronezh Obl	-	0.99		-	0.05	
35	Smolensk Obl - Udmurt Rep	-	0.35		-	0.02	
36	Smolensk Obl - Adygea Rep	-	0.72		-	0.11	
37	Smolensk Obl - Pskov Obl	-	0.74		-	0.22	
38	Smolensk Obl - Moscow Obl	-	0.73		-	0.07	
39	Smolensk Obl - Rostov Obl	-	0.86		-	0.08	

Source: own estimations

Table 5: The average price transmission coefficients of major consuming and producing regions

	Degree of price transmission	Speed of adjustment
Moscow city - producing regions	0.81	0.12
Krasnodar krai - producing regions	0.84	0.12
St Petersburg - producing regions	0.51	0.06
Sverdlovsk oblast - producing regions	0.84	0.16
Samara oblast - producing regions	0.82	0.13
Smolensk oblast - producing regions	0.73	0.09

Source: own estimations

Table 6: Discriptive results of bivariate price dispersion ($|P_{jt}-P_{kt}|$)

Consume region	Production region	Average		SD		Before ban		After ban	
		Before ban	After ban	Before ban	After ban	Min	Max	Min	Max
City of Moscow	**Voronezh Oblast**	**66.74**	**143.76**	**25.84**	**15.18**	30.41	113.12	107.16	164.99
	Bryansk Oblast	**67.22**	**156.96**	**14.86**	**24.39**	41.27	97.48	90.77	177.4
	Omsk Oblast	**71.17**	**195.08**	**31.71**	**30.89**	14.75	143.29	133.21	234.98
	Republic of Adygea	**47.38**	**90.63**	**14.97**	**14.78**	11.73	82.64	55.9	117.97
	Pskov Oblast	**42.48**	**72.78**	**15.4**	**19.18**	11.45	73.13	30.96	102.25
	Republic of Tatarstan	**84.22**	**180.28**	**19.8**	**27.51**	48.53	126.99	122.27	209.09
	Ryazan Oblast	**73.55**	**168.89**	**24.23**	**23.79**	36.28	126.15	117.27	193.6
	Rostov Oblast	**66.41**	**147.73**	**17.3**	**20.7**	39.73	109.23	104.73	168.32
Krasnodar Krai	Bryansk Oblast	11.46	20.1	7.87	9	0.09	30.56	0.27	34.22
	Republic of Tatarstan	27.61	43.41	9.1	14.12	8.61	53.11	11.97	73.03
	Moscow Oblast	9.73	9.11	6.12	5.4	0.05	23.66	0.04	19.21
	Rostov Oblast	10.09	12.59	6.49	6.1	0.03	25.67	0.05	27.41
City of Saint Petersburg	Voronezh Oblast	18.32	16.73	11.77	16.68	0.04	47.22	0.46	65.8
	Bryansk Oblast	18.79	23.74	5.47	11.2	5.13	31.44	3.01	54.52
	Omsk Oblast	24.39	61.86	15.1	10.88	0.03	64.87	35.91	76.88
	Republic of Tatarstan	35.8	47.06	7	9.78	18.68	50.06	24.11	63.15
	Moscow Oblast	11.22	16.3	6.98	8.69	0.05	27.52	1.69	33.44
	Ryazan Oblast	25.15	35.67	11.1	10.38	0.2	46.95	18.01	57.34
	Rostov Oblast	17.99	14.54	6.84	12.15	6.06	38.28	0.04	44.23
Sverdlovsk Oblast	**Voronezh Oblast**	**39.99**	**99.41**	**26.14**	**7.96**	0.32	87.57	82.74	122.2
	Omsk Oblast	**44.4**	**150.73**	**31.53**	**20.91**	0.4	118.76	105.5	173.47
	Republic of Adygea	**20.86**	**46.28**	**15.08**	**7.07**	0	60.88	23.9	64.55
	Pskov Oblast	**21.1**	**28.43**	**10.11**	**10.18**	0.02	47.96	2.8	45.54

	Republic of Tatarstan	**57.43**	**135.93**	**18.49**	**18.22**	28.7	102.78	96.32	153.93
	Ryazan Oblast	**46.76**	**124.55**	**24.93**	**16.24**	5.3	99.93	82.63	151.08
	Rostov Oblast	**39.62**	**103.39**	**19.42**	**13.39**	4.69	84.7	74.36	130.47
Samara Oblast	Voronezh Oblast	16.02	9.91	8.99	6.52	0.02	36.57	0.41	31.15
	Bryansk Oblast	13.49	14.43	9.1	8.38	0.03	39.24	0.63	35.93
	Omsk Oblast	19.83	50.92	13.76	13.4	0.11	52.76	23.52	75.07
	Udmurt Republic	15.61	17.69	11	11.16	0.1	38.16	0.53	37.85
	Republic of Tatarstan	29.25	36.12	11.21	8.7	0.52	54.5	14.85	55.4
	Moscow Oblast	7.2	16.98	5.54	12.54	0.01	23.53	0.02	39.49
	Ryazan Oblast	18.72	24.74	11.04	8.07	0.01	38.94	5.14	47.68
Smolensk Oblast	Voronezh Oblast	9.55	11.34	5.53	8.01	0	24.12	0.24	54.47
	Omsk Oblast	13.64	61.68	8.73	14.46	0.16	43.06	32.02	85.83
	Udmurt Republic	10.63	28.18	8.9	13.45	0.03	33.04	2.29	48.12
	Republic of Adygea	16.94	42.77	11.67	10.97	0	41.64	19.52	64.05
	Pskov Oblast	21.3	60.63	8.56	7.97	1.73	47.9	43.95	82.42
	Moscow Oblast	7.17	8.45	5.43	5.59	0.01	23.96	0.06	23.87
	Ryazan Oblast	10.64	35.49	6.05	7.74	0.04	26.79	15.65	51.6
	Rostov Oblast	4.71	14.33	4.07	5.17	0.01	16	4	27.1
Source. Own estimation									

Table 7: the results of panel estimation for fixed effect and random effect models of price dispersion

	Fixed effect	Random effect
(Intercept)	-	1.031(0.214)***
Dummy for ban	1.239(0.400)**	1.239(0.400)**
Agricultural price index (%)	0.216(0.103)*	0.216(0.103)*
EU-Ruble exchange rate (first difference of logarithm transformation)	-24.751(3.873)***	-24.751(3.872)***
Total monthly milk import in 1000 ton (first difference of logarithm transformation)	-5.282(0.939)***	-5.282(0.938)***
Total cheese import in 1000 ton (first difference of logarithm transformation with two lags)	-3.223(1.116)**	-3.223(1.116)**
EU Gouda cheese price Euro/100 kg (first difference of logarithm transformation)	-19.430(5.660)***	-19.430(5.658)***
R-Squared:	0.109	0.107
Adj.R-Squared:	0.095	0.101
Observations	856	856
DF	826	833
Note: Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1		

In () standard deviation
Source: own calculation