

## IMPACT OF THE RUSSIAN TRADE BANS ON LITHUANIAN PORK SECTOR

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Over the last decade, Lithuanian pork sector faced dramatic changes, where trade relations with Russia had an important role. The research problem is defined as follows: how does the trade ban of Russia, imposed towards live pigs and pork originating from Lithuania, affect price changes on domestic Lithuanian pork market? The research aims at estimating the effects of the trade ban caused by the outbreak of the swine fever in Lithuania and providing proposals on situation development. The aim is achieved by analysing the transmission of price changes between Lithuanian and Russian pork markets by using the ARDL model. The results indicate a significant decrease in transmission of price changes, both in short- and long-run, from Lithuanian pig prices towards Russian domestic prices during the ‘2011 ban’ regime and further worsening of the situation during ‘2014 ban’ period that was mainly caused by the isolation of the Russian market and lack of export diversification strategy from the Lithuanian side. In Lithuania, high price volatility was not typical during the bans, while negative effects on welfare of farmers were evidenced by reduced trade volumes, which could be improved by biosafety and disease spread reducing measures, reassessing trade regulations and partners’ network.

*Keywords:* agriculture, trade ban, export, supply chain, pork.

*JEL Codes:* C22, Q11.

### 1. Introduction

Over the last decade, Lithuanian pork sector faced dramatic changes. In 2004, Lithuania became a member of the European Unions (EU), and the common agricultural market brought new survival challenges for the domestic pig farming. Starting from 2006, the strong interest of Russia in bilateral trade with Lithuania became obvious after the remarkable export growth of pig farming commodities from Lithuania. According to Statistics Lithuania, export of live pigs of the local origin accounted only for 34.9% in 2006. However, the share of Russia in the structure of live pigs’ export surged to 90.3% in 2009.

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As a result, Russia was treated as an important trade partner in the pig farming sector. However, the multiple interruptions of trade (in a form of trade bans), related to the outbreaks of Classical and African swine fevers in Lithuania, and the follow-up Russian import ban for the most of the EU agricultural commodities in 2014, had worsened the prospects of the Lithuanian commercial pig farms with the highest share of pig population.

Although the role of Russia as the Lithuanian trade partner is recognized as significant, the academic research on trade bans omitted this niche and the estimation of the impact of Russian bans on pig farming commodities has not attracted necessary attention of scholars. However, the impact of Russian bans and animal diseases on the development of prices in the pig farming sector was investigated in other countries. For example, Dillen (2015) studied a potential impact of the Russian import ban on EU agricultural sectors, including pork, with AGLINK-COSIMO model and concluded that impact was limited due to earlier trade ban caused by African swine fever outbreak. Paparas (2018) demonstrated that outbreaks of diseases in beef and poultry industries had an impact on the development of prices in the pork industry. Costa (2015) analysed the impact of beef disease on the development of meat industries and found that it influenced the development of prices along the supply chain, and even the removed Russian ban in 2007 did not change a negative export price development of actual price compared to forecasted one in the pork industry. Boulanger (2017) investigated the short-run impact of Russian ban imposed in 2014 on the most important agricultural commodities (including pork and poultry meat) of the EU and other countries using GTAP model and found the evidence of small changes in market prices, quantities, and trade due to previous ban caused by the outbreak of disease in pork industry. However, studies above often use aggregated data and have a particular interest only in the impact of economic sanctions, while Lithuanian agriculture faced multiple trade bans from Russia, and the effects of these trade restrictions were not investigated.

The *research problem* is defined as follows: how does the trade ban of Russia, imposed towards live pigs and pork originating from Lithuania, affect price changes on domestic Lithuanian pork market? The *object* of this study is a spatial price transmission in the pork market. The *research aims* at estimating the effects of the Russian trade bans imposed towards Lithuania and caused by the outbreaks of Classical and African swine fevers and providing proposals on situation development.

To achieve the aim, we use the Autoregressive Distributed Lag Model (ARDL). This model allows investigating the short- and long-run price transmissions between Lithuanian and Russian pork prices under different trade ban regimes. The study relies on weekly producer price series and covers the period from May 2010 to September 2016.

The paper contributes to the academic and political discourses on trade bans providing arguments for the discussion about advantages and disadvantages of such measures and their impact on the export-orientated small countries. Study enriches research on Russian trade bans focusing on Lithuanian pig farming case.

The structure of the paper is set as follows. First, the review of scientific research investigating the aftermaths of trade bans, imposed by Russia, is provided, and the main directions of the research are identified. Second, the details on the methodological development, the applied ARDL model, and data are provided. Third, the results of the empirical research on the spatial price transmission are discussed. Finally, the main conclusions and political implications are introduced.

## **2. The research on trade bans imposed by Russia in the agricultural sector**

The academic research investigating the impact of the previous Russian bans is modest and covers three main directions. The first group of researchers focuses on the estimation of the impact of the Western countries' economic sanctions of 2014 and the countermeasures of Russia on global trade and selected markets of agri-food commodities. For example, Kapsdorferová (2016), Boulanger (2015), Dillen (2015), Smutka (2016) focus the academic research on the aftermaths of trade bans in the EU and Russia. Kutlina-Dimitrova (2017) additionally investigates the impact on Australia, Canada, and Norway, the paper of Venkuvienė (2015) focuses on Central and European Countries, while the study of Fedoseeva (2016) concentrates only on the effects of trade bans in German-Russian trade relations.

The level of academic research sophistication varies from studies relying on the analysis of the most important indicators allowing to measure the impact of introduced bans to the application of multiple regression models or complex econometric modelling (for example, computable general equilibrium or recursive partial equilibrium models). Most of the conducted studies underline the negative impact of sanctions on Russian economy as trade bans were led by the reduced competition, the depreciation of rubles and inflation, the increase of transaction costs, but researchers argue that imposed trade bans could improve the national food security of Russia in the immediate future. According to Liefert (2015), trade bans affected different levels of the supply chains and worsened the situation of both producers and consumers of agri-food commodities. Researchers also conclude that the Russian ban did not have a tremendous impact on the EU economy as most of the producers managed to find alternative markets; however, the impact on the certain sectors of the European agriculture and the situation of individual countries differed remarkably.

The second group of studies covers the estimation of the national policy measures and the impact of trade bans on domestic food prices in the selected supply chains of agri-food commodities. For example, Djuric (2015; 2015a; 2016) study Serbian case focusing on wheat market and the supply chains of bread and pig meat, the study of Götz (2016) investigates the effects of the Russian ban and unfavourable weather on Ukrainian wheat market. This research direction relies on econometric models empowering estimation of vertical or spatial price transmission and provides some useful knowledge for political implications.

The first and the second groups of the academic research estimate the impact of the trade bans, which were imposed due to socio-economic, political or geopolitical goals. However, trade bans could be used to guarantee food safety, animal health, and welfare, protecting the domestic market from crop diseases. For example, trade bans imposed by Russia in 2009, 2011, and 2014 were protecting domestic Russian market from Classical and African swine fever, which were detected on Lithuanian pig farms. Another example is an import ban on Polish meat in 2005 explained by food safety concerns as there was a suspicion that the contaminated meat from the third countries could be sold as Polish production (Forsberg, 2009). The study of Cenusa (2014) identifies similar motives to introduce trade bans on agri-food commodities in Moldova, Ukraine, and Georgia.

Unfortunately, the main academic research related to Russia explains the spread of diseases, risk factors, and control, while economic issues and the impact on domestic and international trade does not attract necessary attention. However, the examples of similar academic research could be found for the other countries. As a rule, such food safety or disease-driven research cases often focus on changes of the structure of the domestic consumption or export/import (Felt, 2011; Mattson, 2005; Mutondo, 2009; Niemi, 2008; Taha, 2013) and welfare changes in a vertical supply chain of the selected agri-food commodities (Brorsen, 2002; Hassouneh, 2009; Niemi, 2006). This paper will contribute to the scarce academic research on the aftermaths of the disease-driven trade bans of Russia and will provide the case of the Lithuanian pork market.

### **3. Research methods**

In this paper, we use the Autoregressive Distributed Lag Model (Pesaran, 1999; 2001) to investigate the short-run and long-run price transmission between Lithuanian and Russian pork prices (Equation).

$$y_t = \beta_0 + \beta_1 y_{t-1} + \dots + \beta_k y_{t-p} + \alpha_0 x_t + \alpha_1 x_{t-1} + \dots + \alpha_q x_{t-q} + \varepsilon_t.$$

The autoregressive part of the model refers to the fact that  $y_t$  is partially explained by its own lagged values ( $y_{t-p}$ ). In this case,  $y$  refers to the pig producer prices on the Russian domestic market. Also, it accounts for the lagged value of the explanatory variable ( $x_{t-q}$ ), which in this case refers to the domestic Lithuanian pig producer prices.  $\beta_0$  is the constant, while  $\alpha$  and  $\beta$  are coefficients of the equation. Finally, the  $\varepsilon_t$  is the disturbance term. Thus, the main advantage of this model is that it relies on the bound testing methodology, which allows for co-integration testing between the price series that are stationary and non-stationary, and it allows for estimating both long- and short-run relationships between prices.

Data used for the analysis are average weekly pig producer prices in Lithuania (i. e. carcass meat purchase prices at Lithuanian enterprises), expressed in EUR/100 kg (Fig. 1), and average weekly pig producer prices in Russia (EUR/100kg). Both

price series account for the period from May 2010 until the end of September 2016 (330 observations).

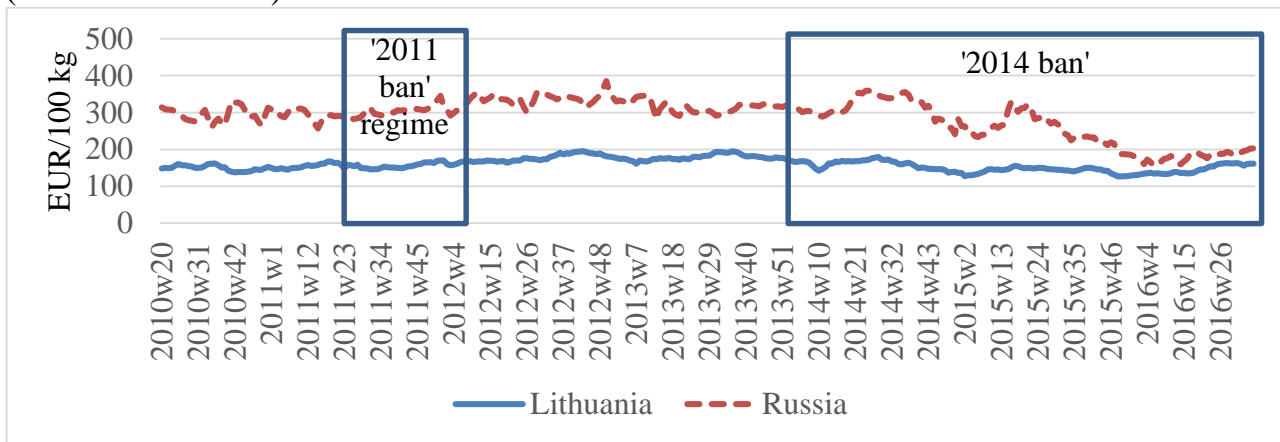


Fig. 1. Average weekly pig producer prices in Lithuania and Russia (EUR/100 kg), 2010–2016

Source: state enterprise ‘Agricultural Information and Rural Business Centre’ (Lithuania) and IKAR (Russia), own illustration.

We account for different regimes in order to capture the effects of the Russian pork import ban implemented in 2011. Thus, we account for the ‘free trade’ regime and ‘2011 ban’ regime that accounts for the period from June 2011 to February 2012 (Fig. 1). Although the embargo for the live animals was longer, this period was selected for the analysis, because the conducted analysis of export indicators showed that during this period Lithuanian pork sector readjusted the structure of export. During the ‘2011 ban’ regime period pork sector also had faced some restrictions towards export of meat of swine, and, in fact, an uninterrupted export flow of meat started only in February 2012 (Fig. 2).

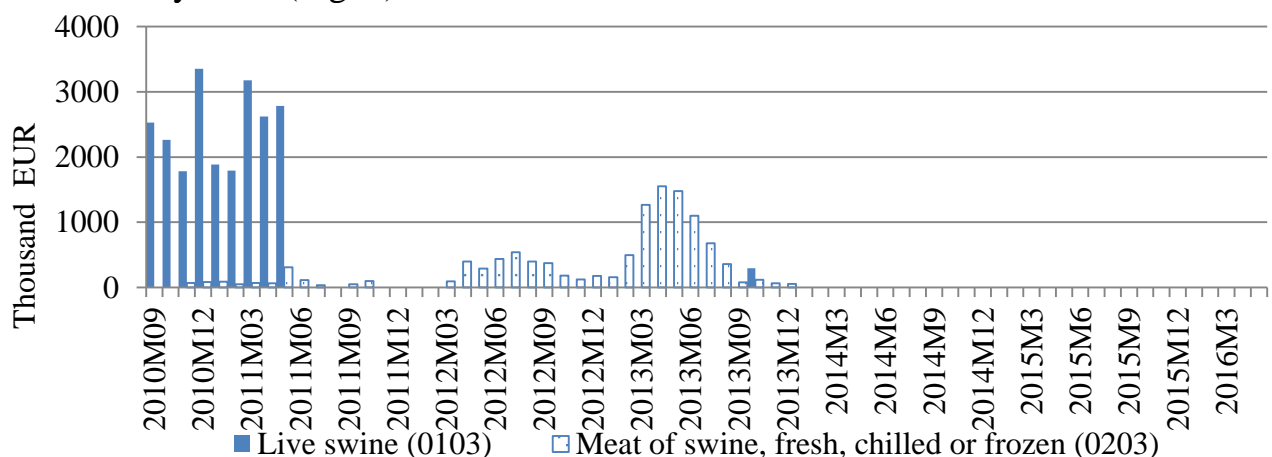


Fig. 2. Export of live swine and pork meat of Lithuanian origin to Russia, 2010–2016  
Source: Statistics Lithuania, own illustration.

We separately used ARDL to estimate the price transmission during the ‘2014 ban’, which had started at the beginning of 2014 due to Russian embargo towards the

EU countries on the selected pig farming commodities, caused by African swine fever, and later was replaced by Russian import ban on a list of agricultural commodities.

Fig. 1 shows that during the whole analysed period prices on Lithuanian market did not demonstrate strong price volatility, while price fluctuations on the Russian market were less predictable. The visual comparison of the ‘2011 ban’ and ‘free trade’ regimes does not show a significant difference in the co-movement of Lithuanian and Russian price series. However, ‘2014 ban’ is characterised by remarkable changes on the Russian market. At the beginning of this period, we observe the behaviour of price series similar to ‘free trade’ regime. Later, the strong price growth and fluctuations are replaced by the consistent decline of the price. Finally, we observe the co-movement of price series again, but the trade ban resulted in a remarkable decrease of the price gap between Lithuanian and Russian prices.

#### 4. Research results

The results of the Augmented Dickey-Fuller test (Dickey, 1979) indicate that both price series contain unit root under the set regimes, except Russian price series under ‘free trade’ regime (Table 1).

Table 1. Results of ADF test for Lithuanian and Russian price series

Exogenous: Constant ‘Free trade’ regime	Lithuanian price series		Russian price series		Test critical value (5% level)
	LPRICELT Lag Length: 0	Prob.*	LPRICERU Lag Length: 2	Prob.*	
ADF test statistic	-1.52	0.52	-3.02	0.03	-2.88
Exogenous: Constant ‘Free trade’ regime	D(LPRICELT) Lag Length: 0	Prob.*	D(LPRICERU) Lag Length: 1	Prob.*	Test critical value (1% level)
	ADF test statistic	-10.95	0.00	-10.66	0.00
Exogenous: Constant ‘2011 ban’ regime	Lithuanian price series		Russian price series		Test critical value (5% level)
	LPRICELT Lag Length: 0	Prob.*	LPRICERU Lag Length: 1	Prob.*	
ADF test statistic	-1.41	0.57	-2.54	0.12	-2.94
Exogenous: Constant ‘2011 ban’ regime	D(LPRICELT) Lag Length: 0	Prob.*	D(LPRICERU) Lag Length: 0	Prob.*	Test critical value (1% level)
	ADF test statistic	-8.23	0.00	-4.37	0.00
Exogenous: Constant ‘2014 ban’	Lithuanian price series		Russian price series		Test critical value (5% level)
	LPRICELT Lag Length: 2	Prob.*	LPRICERU Lag Length: 0	Prob.*	
ADF test statistic	-2.18	0.21	-1.00	0.75	-2.88
Exogenous: Constant ‘2014 ban’	D(LPRICELT) Lag Length: 0	Prob.*	D(LPRICERU) Lag Length: 0	Prob.*	Test critical value (1% level)
	ADF test statistic	-8.81	0.00	-11.09	0.00

Automatic lag length selection is based on SIC: ‘free trade’ and ‘2014 ban’ maxlag = 13, ‘2011 ban’ maxlag = 9. \* MacKinnon (1996) one-sided *p*-values.

Source: own calculation.

The results of the ADF test show that none of the price series is integrated of order I(2). Thus, the ARDL bounds test for co-integration could be used to prove the presence of a long-run co-integration relationship between Lithuanian and Russian pig producer prices. The results of the ARDL bounds test show that the value of  $F$ -statistic is higher than the critical value of I(1) bound at a 10% significance level. Thus, under this condition, we can reject  $H_0$  and argue that there is a long-run relationship between Russian and Lithuanian prices.

The errors of the model are tested for the presence of serial correlation and heteroscedasticity, where all two tests could not reject the  $H_0$  hypothesis of no serial correlation and heteroscedasticity. Thus, all preconditions for estimating the long-run and short-run price transmission parameters were fulfilled.

The price transmission results before 2014 indicate almost perfect transmission of price changes from the Lithuanian pig market towards the Russian market in the long run for the ‘free trade’ regime (Table 2). This result is not surprising considering that the Lithuanian prices are almost equal to the EU reference price, and considering that the EU had the biggest share in Russian pork import.

Table 2. Main ARDL (3,0) model results of price transmission between Lithuanian and Russian markets

	‘Free trade’ regime	‘2011 ban’ regime
Slope (long-run)	1.12*	1.23**
Speed of adjustment	–0.07*	–0.05*

Note: \*<1% significance level; \*\*<5% significance level.

Source: own calculation.

Concerning the short-run price transmission, our results indicate negative and very low speed of adjustment for the ‘free trade’ regime (–0.07). This means that the short-run deviations from the price equilibrium are adjusted by the Russian pig producer prices only of about 7% in one period.

For the ‘2011 ban’ regime, our results show a reduced transmission of price changes in the long run. This result indicates that the export ban has a negative effect on market integration. Furthermore, the results of the short-run price transmission show a further reduction of speed of adjustment from –0.07 in the ‘free trade’ regime to –0.05 in the ‘2011 ban’ regime. This result indicates that Russian producers tend to react less on external (international) price changes during the period of the export ban.

The slope coefficient follows general logic and confirms that trade bans distort relationships between price series in the long-run. Results show that trade restrictions contribute to the increase of the slope and the decline of significance. During ‘free trade’ regime the long-run coefficient accounted for 1.12 and was significant at the level of 1%, trade restrictions due to Classical swine fever resulted in change up to 5% significance level, and the slope amounted to 1.23.

The estimated cointegrating equation for ‘free trade’ regime was specified as follows:

$$D(\text{LPRICERU}) = 0.38 * D(\text{LPRICERU}(\text{Lag } 1)) - 0.32 * D(\text{LPRICERU}(\text{Lag } 2)) - 0.10 * D(\text{LPRICELT}) - 0.02 * (\text{LPRICERU} - (1.12 * \text{LPRICELT}(\text{Lag } 1) + 0.11 * \text{BAN2011}(\text{Lag } 1)) - 0.07 * (\text{COINTEGRATED\_EQUATION}(\text{Lag } 1)).$$

According to estimation results of ARDL model, dummy variables  $D(\text{LPRICELT})$  and  $D(2011\text{BAN})$  do not pass 5% significance level. However, the long run coefficients of Lithuanian price and trade ban variables, which are used to calculate speed of adjustment of the equilibriums, are significant at less than 5% significance level.

The individual estimation of the ‘2014 ban’ period shows that most of the coefficients of the ARDL (3,0) model are non-significant. Results confirm the negative impact of African swine fever and Russian embargo on market integration. The research shows that Lithuanian pig producer prices cannot be used explaining changes on Russian market starting from 2014. However, Fig. 1 illustrates that since 2014 the development of producer price on Russian market overcomes different development stages and in 2016 returns to co-movement with Lithuanian producer price, which is closely linked to the EU reference price. This situation challenges for more detail investigation of the longer period post-2014.

## 5. Conclusions

1. The analysis of the long-run price transmission indicates that the Russian export ban towards Lithuanian pig farming commodities exports caused a reduction in transmission of price changes, in the long run, indicating that two markets became less integrated. Furthermore, our results indicate a reduction in the speed of adjustment, i.e. the Russian pig producers were less responsive to international price changes during the period of the ‘2011 ban’ compared to the ‘free trade’ regime conditions. The ‘2014 ban’ period shows the further worsening of the market integration.

2. Trade bans contributed to the high price volatility on the Russian market and affected producers’ welfare due to the decrease of domestic producer price. Reduced competition, through market insulation, could cause significant welfare loss for Russian consumers. In the case of Lithuania, export bans imposed from the main trade partner caused significant changes in the domestic market where traders had to make fast decisions on exporting their products to the other markets. However, the loss of the main trade partner had no significant impact on domestic producer price volatility and resulted in a slight decrease in producer price, compared to the ‘free trade’ regime.

3. The effects on Lithuanian farmers’ welfare were mainly evidenced by reduced trade volumes due to outbreaks of diseases in pork sector. This problem could be solved by improving biosafety measures on farms and introducing related measures in order to protect farms from the spread of diseases, revising policy of trade restrictions towards domestic and foreign markets. The diversification of trade partners’ network in Lithuanian pork sector could be a useful strategy protecting do-



mestic pig farming from trade bans originated from dominant partners, especially in cases which are not related to market protection from animal diseases.

4. Overall, our results indicate that trade restrictions cause significant disruptions in market integration and transmission of price changes, which is of great importance especially for the deriving of reliable forecasting models. Results suggest that regime-based forecasting models, mapping important evolution stages in the development of time series, could provide more reliable results for decision-making.

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## **RUSIJOS PREKYBOS DRAUDIMŲ POVEIKIS LIETUVOS KIAULININKYSTĖS SEKTORIUI**

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### **Santrauka**

Pastarąjį dešimtmetį Lietuvos kiaulienos sektoriuje įvyko dramatiški pokyčiai, kuriems svarbų vaidmenį turėjo prekybos santykiai su Rusija. Tyrimo problema: kaip Rusijos prekybos draudimas importuoti lietuviškos kilmės gyvas kiaules ir kiaulieną paveikė kainų pokyčius Lietuvos kiaulienos rinkoje? Tikslas – įvertinus Rusijos prekybos draudimo, atsiradusio dėl kiaulių maro, poveikį Lietuvos kiaulininkystės sektoriui, pateikti siūlymus dėl situacijos gerinimo. Tikslui pasiekti taikomas autoregresinis paskirstomasis atsilikimo modelis (ARDL), kuris leidžia analizuoti kainų pokyčių perdavimą prieš ir po Rusijos draudimo. Tyrimo rezultatai rodo, kad 2011 m. prekybos draudimo režimo laikotarpiu yra reikšmingas kainų pokyčių perdavimo mažėjimas iš lietuviškų kainų į rusiškas vietines kainas trumpalaikėje ir ilgalaikėje perspektyvoje, o 2014 m. prekybos draudimas dar labiau pablogino situaciją dėl Rusijos rinkos izoliacijos ir eksporto diversifikacijos strategijos nebuvimo Lietuvoje. Neigiamas poveikis ūkių gerovei stipriausiai pasireiškė ne staigiais kainų svyravimais, o sumažėjusiomis prekybos apimtimis, todėl siūloma spręsti problemą gerinant biosaugos priemonių situaciją ūkiuose ir taikant ligos patekimo į ūkius riziką mažinančias priemones, peržiūrint prekybos draudimo taisykles bei diversifikuojant partnerių tinklą.

*Raktiniai žodžiai: eksportas, kiauliena, prekybos draudimas, tiekimo grandinė, žemės ūkis.  
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