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RESEARCH ARTICLE

Assessing the Short-term Effect of Exchange Rate Liberalisation on Food Import Prices: The Regression Discontinuity in Time Employed for Russian Food Markets in 2014

Daria Loginova[*]

Agroscope, Socioeconomics, Tänikon 1, Ettenhausen, Switzerland

Abstract: This study summarises the main agricultural policies in Russia during 2014 and uses a sharp regression discontinuity design over time and data from the International Trade Centre to estimate the short-term effects of exchange rate liberalization in November 2014 on import prices in Russian food markets. The sharp regression discontinuity design over time allowed an export analysis of the short-term causal effects of the intervention on food import prices and distinguished the effect of exchange rate liberalisation between product groups and from other interventions without using data from control regions, products and suppliers. Significant upward shifts in import prices were found for pig products, fish and cheese.

Keywords: Exchange rate liberalization; Food import price; Sharp regression discontinuity over time; Russia

1. Introduction

Exchange rate policies are used for regulating the economies and gaining macro-stability and economic development [1,2]. Exchange rate liberalisation is often followed by a short-term increase in the volatility of exchange rates [3], which may destabilise international trade [4-6] and prices [7]. Estimating the effects of exchange rate policies on food prices is hampered by the complexity of applied agricultural policies, diversity at the level of market protection, quality and consumer preferences, seasonality and weather conditions. The effects of rouble depreciation on the Russian agricultural sector have often been mentioned in the studies of other interventions on Russian food markets in 2014—permanent food bans in February, sanctions, the food embargo and the rouble crisis [8-10]. Most of these studies discuss the possible contribution of rouble depreciation (Figure 1) to trade; however, these studies leave this effect unassessed. As Kiselev, Shagaida, Uzun and

*Corresponding Author:
Daria Loginova,
Agroscope, Socioeconomics, Tänikon 1, Ettenhausen, Switzerland;
Email: daria.loginova@agroscope.admin.ch

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Tyll, among others, pointed out, Russian rouble depreciation in 2014 could cause changes in Russian domestic food prices [11-13]. Therefore, more attention should be paid to analysing the effect of exchange rate liberalisation on food prices in Russia in the autumn of 2014.

The hypothesis of the present study is that the exchange rate liberalisation in Russia in 2014 destabilised food import prices in the short term and that these effects were diverse across product groups. This hypothesis is consistent with previous research (see the studies in Section 2 and Appendix A). Therefore, the empirical strategy of the present study is to examine the food and trade policy in Russia in 2014 and to distinguish the effect of exchange rate liberalisation on food import prices from other policies.

To quantify the short-term effect of the exchange rate regime change on the stability of food import prices in the Russian food markets in 2014, the present study processes disaggregated food import price data issued by the International Trade Centre [14] and applies a sharp robust regression discontinuity design (RDD; [15-17]). The key assumption for using the RDD in this study is that prices observed close to the time of exchange rate liberalisation will be perfectly comparable, except that some prices experience floating exchange rates (treatment group) while others experience regulated exchange rates. Following the definition of treatment effect in RDD, 'price stability' in the present study is understood as the absence of significant price discontinuity (treatment effect) at the time of the intervention.

Background information on food policies in Russia and a review of previous studies are presented in Section 2. The data and the procedure for assessing the intervention are described in Section 3. Section 4 provides the results, and Section 5 concludes the study.

2. Agricultural Policy and Market Interventions in Russia in 2014

Production growth and self-sufficiency were political goals in Russia long before the trade restrictions and crisis in 2014. Investments in agriculture from 2003 to 2005 provided reinforcements for agricultural producers in sectors where large-scale agriculture was efficient—namely, in the Russian pork, poultry and grain sectors [18,19]. The Russian food policy has aimed to maintain self-sufficiency and food security since 2010 (Doctrine, approved by Presidential Decree N120 of 30.01.2010 and N20 of 21.01.2020 [20,21]). Moreover, before 2020, Russian food security was defined as import independence [12,22]. Only in 2020 did the Doctrine redefine food security in Russian legislation as physical and economic access to food.

On 13 January 2014, Russia started issuing licences for the import of dairy whey, cattle, pork and poultry within the established tariff quotas for 2014 (Russian Government Regulations N1259 and N1260 of 26.12.2013). From 27 to 31 January 2014, various permanent trade restrictions were imposed on selected countries and foods, namely fish imports from Vietnam, various products from Australia, Austria, Belgium, Bulgaria, China, Estonia, Germany and Italy, and various products from several selected enterprises in Austria, Canada, China, Moldova, Paraguay and the USA [23]. By the end of January 2014, Russia closed its market to EU live pigs, pork and other related products (called the pork ban in the present article). The pork ban was investigated in the literature by, among others, Cheptea, Gaigné, Götz and Jaghdani [9,24] using structural gravity and DCC-MGARCH models, respectively. De facto, in the fifth week of 2014, Russia per-

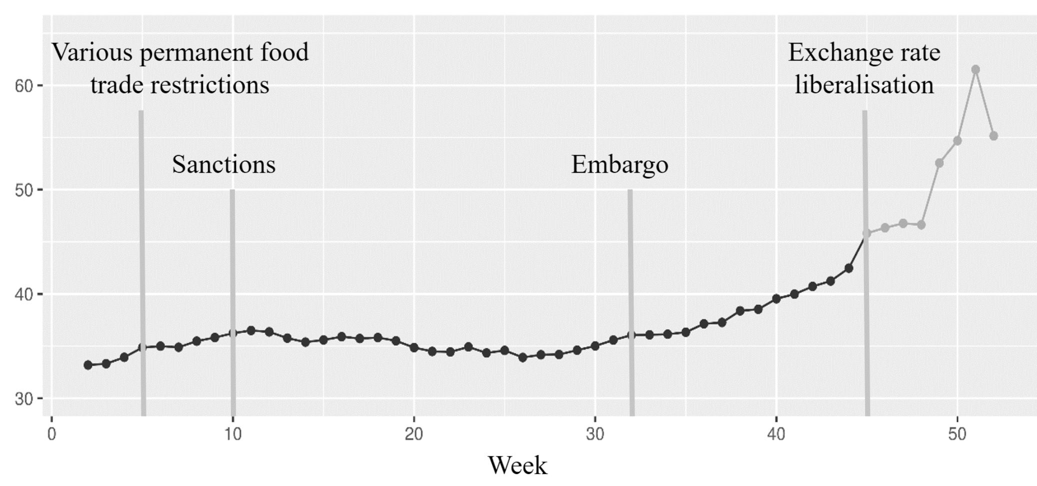

Figure 1. The average weekly RUB/USD exchange rate in 2014.

manently banned various food imports. These permanent bans might lead to trivial decreases in import volumes and, therefore, increases in prices. The causal identification and assessment of these effects are hampered by a variety of restrictions.

International economic sanctions were imposed on Russia starting in March 2014 and were further tightened throughout 2014 [8]. These decisions were related to the situations in Ukraine and Crimea and did not target food markets. However, in August 2014, the president of the Russian Federation introduced the food embargo as an 'anti-sanctions' measure. Studies claim that, through the food embargo, the government restricted physical and economic access to affordable food in domestic markets [12,22], which had negative consequences for real household incomes in Russia [25-29]. Generally, not all countries that supported the sanctions and not all food imports were immediately banned under the embargo. After the introduction of the embargo, some imports were substituted; for instance, beef imports from the EU were substituted with frozen beef from Brazil [30]. After the embargo, milk was supplied mostly by Belarus, and vegetables and fruits were supplied by central and western Asian countries [14]. Later, production volumes increased. In 2015, Russia still represented 0.2% and 2% of the world's agricultural export and import volumes, respectively [31]. Both the sanctions and the embargo were prolonged each year for the following year. Therefore, the embargo and sanctions have been a topic of great interest in the literature since their imposition.

Many previous food and trade studies have investigated and quantified only the embargo and not the other shocks of 2014. In particular, they analysed and quantified the effects from the perspective of the trade losses of ex-trade partners because a wide range of countries were affected and good-quality trade data were available [32-37]. Studies on embargo effects are still emerging and contribute to the literature on the quantified effects of food bans [9,10,38-41].

In parallel to the aforementioned policies, the Russian rouble to US dollar (RUB/USD) exchange rate has increased sharply since July 2014 and since 1 November 2014 has become free-floating by the decision of the Central Bank of the Russian Federation [42]. The further development of the exchange rate and its extreme volatility were later addressed as the Russian rouble crisis in 2014. Dreger and Wang, among others, agreed that, in addition to being impacted by the oil price, the rapid depreciation of the Russian rouble in the autumn 2014 was an outcome of the trade disruptions [43,44]. However, Russian food imports accounted for only 7.5% of total Russian imports and less than 3% of total Russian trade [14]. Therefore, food imports could not have significantly affected exchange rates. Rutland pointed out that the sharp decline of the Russian rouble in autumn 2014 followed an expansion of sanctions on the financial sector in mid-September and a continuous decrease in oil prices [8]. The works that focused on exchange rate effects on agricultural prices in 2014 (e.g. [45,46]) studied only trade prices in the grain and potato markets with VAR models. Sinyakov [47] studied the impact of exchange rate liberalisation on producers but made conclusions about agricultural prices only at the sectoral level. The low number of studies may also be explained by the limited applicability of the many popular approaches to price investigation in the case of many interventions in Russian food markets in 2014 (see Appendix A). Meanwhile, exchange rates are widely regarded as one of the most influential factors of agricultural prices [48], such as resource prices, stocks, market conditions, policies, supply and demand [49].

3. Materials and Methods

3.1 Data

In this article, the studied import price in food markets is a quantity-weighted average of suppliers' prices. Thus, the exclusion of one or several suppliers because of a loss of competitiveness, trade permission or seasonal production does not lead to the withdrawal of price data. Trade information (prices in Russian roubles and volumes in kilograms) for this study was obtained from the International Trade Centre [14], and the average weighted exchange rate is available at the Central Bank of the Russian Federation. Data on the exchange rate are available daily, whereas import prices are documented only monthly. Thus, no variations in import prices in Russian roubles at a higher frequency were implicitly assumed. The weekly frequency of data allows for the exclusion of weekend effects and the accurate investigation of interventions. In the Russian market, prices in Russian roubles are obtained by multiplying prices in foreign currencies according to exchange rates at the time of import. As the most used currency in Russian trade in 2014 was the US dollar, this study investigates the clear effect of interventions in prices in US dollars. Using the weekly aggregated exchange rate allowed the converting of monthly import prices in Russian roubles back to weekly prices in US dollars, thus obtaining the weekly prices for imports in Russian markets. This convertation may create a price measurement error, as agricultural markets operate on a weekly or even daily frequency. However, the direction, relative size, and statistical significance of the discontinuities in the prices will remain a good indication of the short-term policy effects.

The present study investigates fresh, dried and frozen unpreserved foods, including 166 animal products and 114 types of roots, vegetables and fruit, defined by 10-digit Harmonised System (HS) codes without missing data for the 2012-2014 period. This disaggregated level of trade prices defines the traded products by tariff line. For these tariff lines and for each of the 52 weeks in a year, there is an import price in Russian roubles and in US dollars, totalling 29,120 observations for each studied year. The prices were deflated to the 2014 level to enable price comparisons between years. Next, the data were grouped into 560 sets of import prices by tariff line and currency, with further standardisation to the average price level in 2014 within each set. The standardisation of prices allows the preservation of any existing seasonality in prices and a comparison of the prices and price discontinuities between products. To avoid seasonal patterns in prices, all standardised prices were tested for seasonality by tariff line using the *tbats* model of the *forecast* package in R [50]. This package performs a seasonality test for weekly data. The resulting range of products excluded 19 tariff lines due to seasonality.

The present study assigned each of the 261 tariff lines without seasonality to one of the product groups (see the details in Section 4 and Appendix B), described in Table 1. As the exchange rate liberalisation happened 7 weeks before the end of 2014, the descriptive statistics show the average price levels during 7 weeks before and after the exchange rate policy change for each of the studied food groups. The levels of prices and standardised prices increased in Russian roubles (RUB), while the prices in US dollars (USD) decreased for some product groups. The study employs econometric analysis to consider the trends in the data.

3.2 Method

The aim of this study was to identify the short-run effect of the exchange rate policy change in 2014 on food import price stability in Russian markets. The date of the exchange rate liberalisation, 1 November 2014 [42], was used as a cut-off point for the effect estimations. To assess discontinuities in the prices for each product at the time of the intervention, the present study uses RDD, which aims to imitate the experimental context at the cut-off to evaluate the treatment effect locally for the subpopulation at the threshold [16,51]. The *rdrobust* function of the R package *rdrobust* was employed to implement conventional local polynomial point estimators to calculate robust average treatment effects at the cut-off point [17].

Table 1. Descriptive statistics of the average food import prices in Russia in 2014 during the 7 weeks before and after the exchange rate liberalisation.

Product Group	USD				RUB			
	Price levels		Standardised price		Price levels		Standardised price	
	Before	After	Before	After	Before	After	Before	After
Berries	2.2	2.4	98.1	99.2	88.6	123.4	100.8	132.6
Bovine and beef	7.0	6.7	101.6	98.0	281.1	348.8	105.3	131.1
Buttermilk and butter	2.5	2.3	95.2	85.1	98.2	119.1	99.6	115.3
Curd and cheese	5.6	5.6	91.8	94.0	224.0	291.5	95.5	126.2
Fish	7.1	7.1	98.4	96.6	285.8	365.2	102.0	129.3
Fruits and nuts, long storage	3.3	3.6	97.5	101.3	131.9	186.7	100.7	135.7
Fruits, fresh	1.3	1.3	89.5	93.6	51.3	69.5	93.1	126.0
Milk and cream	2.1	1.7	95.2	75.9	84.5	86.5	100.2	102.5
Pigs and pork	4.6	4.7	109.1	109.1	184.1	243.4	111.9	144.2
Poultry	2.4	2.1	113.2	96.9	96.7	106.5	117.0	129.1
Seafood	9.8	11.2	102.4	102.7	391.7	583.4	105.7	136.8
Vegetables and mushrooms, perishable	1.3	1.3	90.8	89.9	51.0	67.4	94.4	121.2
Vegetables and peas, long storage	1.4	1.4	93.3	94.8	57.5	70.3	96.7	127.5

Formally, $Y_{t,j,g}$ (also addressed as $Y_{i,g}$ in the present study) defines the standardised import prices of interest at time $t = 1...T$ and for tariff lines $j = 1...M_g$ within the consistent product groups $g = 1...G$; the index i is introduced to capture the information about time t and a tariff line j of each observation①. The treatment cut-off (or threshold) $\bar{x}$ is the week of the intervention, and X_i is a running variable that counts the number of weeks to reach week $\bar{x}$. Therefore, the running variable was assigned to time, and RDD in the present study may be called RDD in time (RDiT), as abbreviated by Hausman and Rapson [52]. The observations after treatment introduction cannot remain in pre-treatment conditions without exchange rate liberalisation. For this reason, the analysis is based on the sharp RDD rather than the fuzzy RDD, which would be appropriated in the case of non-compliance with treatment.

The treatment D is a binary variable equal to 1 if $X_i \geq 0$ (treated phase, i.e. liberalised exchange rates) and 0 otherwise (untreated phase, i.e. regulated exchange rates). The exchange rate liberalisation was not driven by the same confounders as food import prices and might not have affected the traded volumes, as those could be provided by other suppliers (see Section 2). Importers could not manipulate the assignment to the exchange rate regimes (this is important for locally randomized treatment in RDD, see the discussion by Lee and Lemieux [53]). Therefore, exchange rate policy change is assumed to be an exogenous treatment of prices.

A positive bandwidth h is the number of weeks before or after the time of the intervention. Therefore, the restriction $-h \leq \bar{x} \leq h$ defines the window of the estimation, which is always balanced in this study and always covers an equal number of comparable observations in the treated and untreated phases. A set of assumptions is required to conduct estimations in time. The lengths of the bandwidths in RDD should follow the localisation assumption: the windows of the estimations must cover a small period with equal expectations for pre-treatment covariates. In addition, the estimation windows should be narrow enough to exclude the effects of other interventions. To fulfill these assumptions, the sum of the bandwidths for the pair of neighbouring interventions cannot exceed the number of weeks between these interventions. In the context of the present study, there were only 13 weeks between the embargo and the exchange rate liberalisation and only 7 weeks between the exchange rate liberalisation and the extension of the embargo to Ukraine. This study, therefore, uses the bandwidths from the minimal $h = 3$ to the maximum $h = 7$ and tests for one common optimal (by mean square error) bandwidth for the treatment effect estimator②. All the effect estimations are then relevant in the short term covered by the window of estimation, the optimal bandwidth is preferential and the second best bandwidth is $h = 3$. The narrower window of the estimation allows for better comparability of the observations around the threshold and reduces *spillover effects*, i.e. the potential bias in the effect estimates if the previous interventions had stronger effects on the non-treated window than on the treated window. Using the narrow window of estimation allows for reducing the difference between the earliest and the latest observations in terms of possible effects of previous interventions.

An RDD should not be conducted with less than 100 observations for each estimation to rely on asymptotics [16,52]. To ensure the required number of observations for the chosen values of h, the present study gathered the 261 tariff lines without seasonality into consistent product groups $g = 1...G$ (Appendix B), providing around 100 observations for each estimation. To concentrate the tariff-line levels of a standardised price around their average within the selected window and to consider the possible discontinuities (or effects) from previous interventions, the tariff-line fixed effects β_j were included in the function. Grouping the tariff lines into product groups and using fixed effects on standardised variables allows the concept of RDiT to be moved towards RDD with a lot of sampling of random units③.

For each product group, RDD uses a narrow estimation window around the cut-off and builds p-order local polynomials used to construct the point estimator (and a q-order local polynomials used to construct the bias correction) for the observations before week $\bar{x}$ and for the observations after week $\bar{x}$. For each product group g, the *rdrobust* function of the *rdrobust* R package used $Y_{i,g}$, X_i, h, p, q to produce the assessment of the effect of the intervention (a weighted average treatment effect) $\hat{\tau}_g$. The magnitude and the significance of $\hat{\tau}_g$ were the interest of the present

① Calonico et al. [17] use index i for random observations from a large population. Each price in the present study is a quantity-weighted average of suppliers' prices for tariff line j and time t (see 'Data' section). In addition, the studied prices were selected from a large population according to data completeness within tariff lines during the period 2012-2014. Therefore, in this study, additional tests on randomness of observations with index i were required and conducted for studied groups and estimation windows (Appendix D). The results of these tests show that most correlations of tariff lines and most correlations of observations within tariff lines do not exceed the bandwidth of white noise.

② As advised by Lee and Lemieux [51], the present study employs the 'uniform' kernel function (rectangular kernel) and tests the specification with a variety of bandwidths, instead of trying out different kernels that are more difficult to interpret.

③ See also Appendix D for the results of the tests on correlations within and between tariff lines.

study. The sharp RDD calculates the effect estimate as follows:

$$\tau = \lim_{x \to \bar{x}^{(+)}} (\mathbb{E}[Y_i(1) | X_i = x]) - \lim_{x \to \bar{x}^{(-)}} (\mathbb{E}[Y_i(0) | X_i = x]), \quad (1)$$

where $Y_i(1)$ and $Y_i(0)$ denote the potential outcomes with and without treatment, respectively, and the local polynomials used to construct the point estimators are denoted as $\mathbb{E}[Y_i(0) | X_i = x]$ for the observations before week $\bar{x}$ and $\mathbb{E}[Y_i(1) | X_i = x]$ for the observations after week $\bar{x}$. Furthermore, $x \to \bar{x}^{(+)}$ and $x \to \bar{x}^{(-)}$ means approaching the threshold $\bar{x}$ from above and below in terms of values of x. In other words, the method builds the functions before and after the cut-off point, calculates the expected values of these functions infinitely close to the cut-off point and delivers the difference between these values. The key question while building these polynomials is a choice of the value p. Lee and Lemieux [53] argued that using low-order polynomials may result in biased results in the RDD designs. However, this argument was produced for the data without a time component in a running variable. This study used a polynomial of the first order (linear trend, $p = 1$, $q = 2$) following the assumption that the clouds of prices developed linearly shortly before and after the week of intervention. This assumption is more likely to be satisfied in practice compared to the alternative scenarios, namely quadratic, cubic or higher-order polynomial price trends over time. The higher-order polynomials reach infinite values much faster than linear trends. As each price is a market equilibrium identifier and this study uses grouping, the narrow estimation windows and both the standardisation and fixed effects across tariff lines, the assumption that the food import prices would evolve linearly may be most plausible among other alternatives of the design④.

This study assumes the absence of cross-observation effects on each outcome (the assumption of no interference) and that the correlations are considered with a linear approximation and fixed effects in the clouds of observations. The assumption of consistency (no treatments at the cut-off, except for the studied treatment) is met, as other trade regulations were not introduced in the same week as the exchange rate policy changed. Another interpretation of the consistency assumption, namely, 'no such changes in weather and emissions from other industries that may change at the same time as the policy change', as advised by Hausman and Rapson [52] (p. 7), is met in the present study, as prices with the seasonality were excluded from the sample and other food and trade policies were not found to be implemented during the period of estimation. The exchange rate liberalisation in Russia in 2014 was introduced on a Saturday, so issues regarding mid-week policy activations (e.g. Loginova, D [54]) could be avoided. The described data processing allowed the collection of the minimum number of observations around the cut-off to meet the identifiability and positivity assumptions. The unconfoundedness assumption is assumed to hold locally around the threshold, as the intervention and the outcome prices did not have observable common confounders.

Significant price discontinuities may occur periodically at the start or end of the harvest season. Therefore, the present study carries placebo estimations (see the discussion by Hausman and Rapson [52]) for the week that contains the same day and month (1 November) in a previous year (Appendix C), when such active trade and monetary policies were not performed. The placebo tests resulted in mostly insignificant coefficients for all the studied product groups.

4. Results

4.1 Descriptive Evidence

For descriptive evidence, the period-averaged standardised data for tariff lines within product groups observed three weeks before and three weeks after the intervention are visualised in the violin plots in Figure 2. The three lines in the plots mark the first, second (median) and third quartiles, while the shape illustrates the kernel probability density of the data. Prices are depicted separately for the periods before and after the exchange rate liberalisation in two currencies: Russian roubles (RUB) and US dollars (USD).

Differences in the shapes of corresponding plots in different currencies are driven only by weekly currency effects. The graph shows a slight upward shift in import prices and a higher magnitude of most prices after the intervention. The concentration of standardised prices in the 50%-150% range shows that many import prices in Russia were far from the yearly average before and after exchange rate liberalisation. The diversity of plot shapes justifies the RDD estimations for the various products separately. The magnitude of price fluctuations justifies the usage of tariff line fixed effects.

④ In the setting of this study, $M_g > 2h + 1$ for most product groups g and bandwidths h, which means that we are dealing with panel data rather than time series. The only exception is the 'Pigs and pork' product group that contains only 11 tariff lines; therefore, it also has only 77 observations for h = 3 and 99 observations for h = 4, which are slightly fewer than recommended. Modelling prices using time polynomials of order higher than 1 is not widely accepted among statisticians. Lower-order polynomials reduce the power of RDD, but allow modelled price to behave similar to real price over time, which means that real prices are unlikely to change to infinite values as high-order polynomials do.

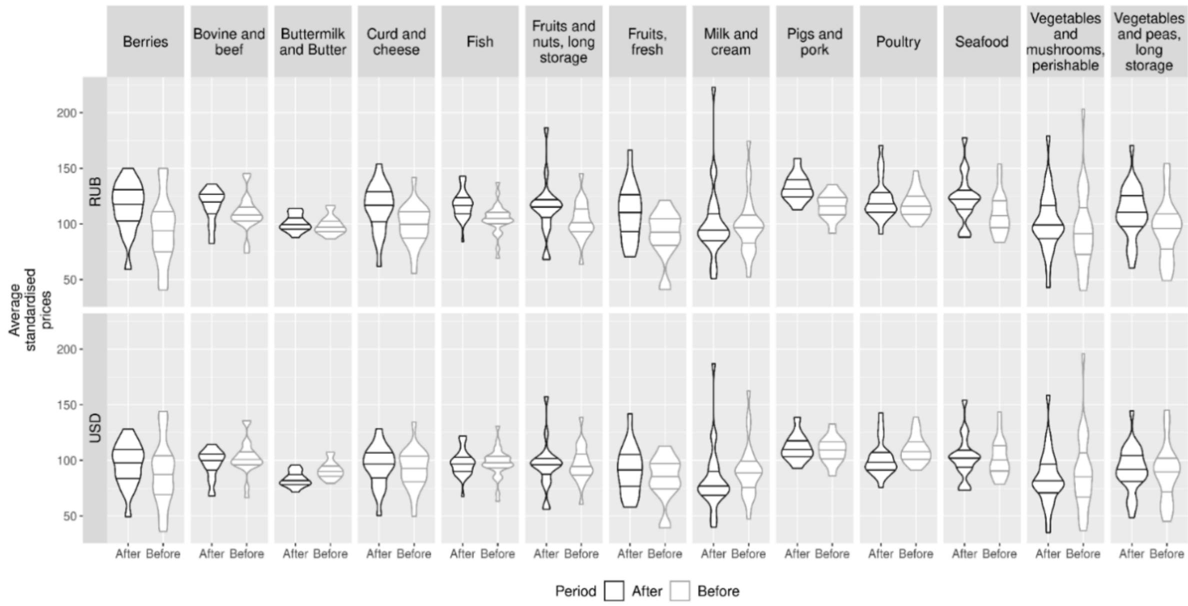

Figure 2. Violin plots for the average standardised food import prices in Russia in 2014, 3 weeks before and after the exchange rate policy change.

4.2 RDD Estimation Results

This study employed RDiT to estimate the short-term effects of the exchange rate policy change on food import prices in Russia in 2014. Table 2 presents the information on the RDiT and the estimates obtained for the different bandwidths. The number of observations for each estimate is equal to $M_g * (2h + 1)$ and increases with the higher number of tariff lines M_g included in product group g and the wider bandwidth h. In the present study, the number of observations for the optimal bandwidth is above 100 for all products except 'pigs and pork'. The number of observations used for the RDiT ranges from 77 to 420 per product group, which can be considered rather low. Therefore, the results should be interpreted with caution. This section provides the interpretation of the estimates obtained by RDiT with optimal bandwidths and discusses the robustness of the effects (the significance and magnitude) across different bandwidth values. Placebo tests are presented in Appendix C.

The significant estimations show that the exchange rate liberalisation led to import price increase for several product groups. The prices of pig products, fish and fresh fruit in US dollars increased by 8.2 p.p., 5.5 p.p. and 12.9 p.p., respectively. These effects were twice as strong in Russian roubles, according to the same specification performed on standardised monthly invariant prices in Russian roubles. In addition, the exchange rate policy change resulted in sharp increases in the prices of curd and cheese (by 11.7 p.p.), berries (by 15.1 p.p.) and long storable fruits and nuts (by 3.7 p.p.), but only in Russian roubles. The RDiT has shown that the policy effects depend on the currency of studied prices and have smaller magnitude than the average difference in price levels before and after the intervention (Table 1). The price volatilities in the food groups of berries, milk and perishable vegetables were high in the studied period; therefore, the potential shift in the prices of milk and perishable vegetables after exchange rate liberalisation was insignificant.

The robustness of the estimations was checked using various bandwidths. For pig products, fish and curd (and cheese), the effect estimations had the same sign and were statistically significant across most bandwidth choices. Insignificant effects across various bandwidths were observed for poultry, milk and cream, buttermilk and butter and perishable vegetables. The prices of these products did not experience significantly stronger policy effects as compared with their volatilities. For vegetables and berries, the significance of the effect on prices decreased with wider bandwidth. For other product groups, the effects might be even more ambiguous. The comparison of the magnitudes of the estimations for various bandwidths within each product does not allow concluding about any tendency. Nevertheless, placebo tests presented in Appendix C did not reveal any significant effect for the same method conducted for the threshold on 1 November 2013 (except weakly significant discontinuity for fish [h = 5], which may be neglected).

Table 2. Descriptive statistics of the average food import prices in Russia in 2014 during the 7 weeks before and after the exchange rate liberalisation.

Robust discontinuity estimation ($\hat{\tau}$) on weekly observations (obs.) in percentage points to the average price level in 2014.

				$\hat{\tau}$(standard error)									
Product	Number of tariff lines and optimal h	Number of observations		h = 3		h = 4		h = 5		h = 6		h = 7	
		optimal h	h = 7	USD	RUB	USD	RUB	USD	RUB	USD	RUB	USD	RUB
Bovine and beef	20 and 3	140	300	0.1(4.7)	6.9(5.2)	–1.9(4.9)	1.9(5.4).	–5.9(5.8).	–3.2(6.3)**	–4.2(5.9)	–3.3(6.4)	–4.8(5.8)	–1.7(6.3)
Pigs and pork	11 and 3	77	165	8.2(5.6)*	16.8(5.6)**	7.2(5.2).	12.7(5.2)**	3.8(5.5)*	8.3(5.5)***	5.8(5.7)	8.2(5.6)**	4.7(5.7)	9.5(5.6)*
Poultry	23 and 4	207	345	–2(4.3)	4.8(4.8)	–2(4.7)	2.4(5.3)	–1.9(5.6)	1.7(6.2)	0.2(5.8)	2(6.3)	–1.2(5.6)	2.6(6.1)
Fish	28 and 3	196	420	5.5(3.4)*	13(3.6)***	4.3(3.3)*	9(3.5)***	2(3.5)**	5.8(3.7)***	3.9(3.5)	5.8(3.7)***	3(3.5)	7(3.7)*
Seafood	18 and 4	162	270	6(6.3)	13.6(7.1).	4.2(6.6)	8.6(7.4)*	1.1(8.3)*	4.43(9)**	3(8.7)	4.5(9.4).	2.2(8.4)	6(9.1)
Milk and cream	25 and 5	275	375	–3.3(7.8)	1.9(8.9)	–2.2(8.6)	1.3(9.8)	–0.8(9.4)	2.3(10.7)	0.9(9.5)	2.5(10.7)	–0.6(9.3)	2.5(10.4)
Buttermilk and butter	16 and 3	112	240	–3.2(2.6)	2.2(2.9)	–5.5(2.7)	–2.9(3)	–4.8(3.2).	–3(3.6)	–2.3(3.4)*	–2.2(3.7)	–3.2(3.3)	–1.1(3.6)
Curd and cheese	20 and 4	180	300	8.1(6).	15.8(6.7)*	6.7(6.6).	11.7(7.6)**	3.9(7.8)*	7.9(8.8)***	5.6(7.9)	7.9(8.8)*	4.8(7.7)	9.2(8.5)
Vegetables and mushrooms, fresh	24 and 3°	168	360	0.9(8.9)	6.8(9.7)	–2.5(9.1)	0.1(9.9)	–3.6(10.3)	–2(11.2)	–1.2(10.6)	–1.3(11.4)	–1.7(10.4)	0.4(11.2)
Vegetables and peas, long storage	24 and 3°	168	360	8.4(6.8)	15.8(7.6)*	5.7(7.3)	9.9(8.2)*	7.3(9.1)	10.7(10).	10.2(9.4)	11.7(10.3).	9.3(9.2)	12.9(10)
Berries	17 and 4	153	255	12.8(8.9).	21.1(9.7)*	10(9.4).	15.1(10.5)*	16(10.6)	20.1(11.7)	19.8(10.9)	21.8(11.9)	18.5(10.6)	22.7(11.5).
Fruits, fresh	16 and 3°	112	240	12.9(7.8)*	20.6(8.8)*	10.5(8).	15(9)**	13.6(9.2)	17.2(10.1).	16.7(9.4)	18.4(10.3).	15.6(9.2)	19.5(10.1).
Fruits and nuts, long storage	18 and 4	162	270	4.1(6.8)	11.2(7.7)	0.3(7.7)	3.7(8.8)*	–2.2(9.4)	0(10.5)*	0.2(9.7)	0.5(10.7)	–0.2(9.3)	2.5(10.2)

Notes: ***, **, * and . denote p-values less than 0.001, 0.01, 0.05 and 0.1, respectively. 3° - means that the optimal bandwidth was below 3 and, therefore, the study uses the minimum bandwidth h = 3. The product 'Vegetables and peas, long storage' includes categories of frozen and dried crops, as well as products that may be stored during a year after harvest until the next harvest (root vegetables and cabbage). The vegetable category also includes tomatoes, peas, beans and mushrooms. More details on the grouping are presented in Appendix 4.2. The prices for tomatoes, cucumbers, peppers and apples were the maximum prices across the corresponding seasonal tariff lines for these products. Within the time windows, no other interventions take place.

4.3 The Benefits and the Limitations of the Study

In contrast to other studies (see Section 2), the RDiT in the present study quantifies a price discontinuity at the time of the intervention by using observations of only a few weeks before and after the intervention. As a before-and-after analysis under quasi-experimental assumptions, the applied RDiT offers five main improvements compared with other techniques. First, RDiT takes trends into account when measuring discontinuities in the outcomes. RDiT performed with the R package *rdrobust* allows for relatively easier customisation of the properties of the expected polynomials compared with other statistical approaches. Second, RDiT enables statistical justification of the estimation window by using additional internal functions for optimal bandwidth selection. This tool is useful for interpreting the results, especially when the effect estimates and their significance are not stable across different estimation windows. Third, RDiT enables the evaluation of policies under conditions such as the Russian markets in 2014, when the time window in which a single policy effect can be estimated is extremely narrow. Whereas most methods cannot provide causal estimates of the effects under such conditions, RDiT benefits from this situation because it relies mainly on observations that are close to the time of the intervention. Fourth, RDiT enables the effect estimates for specific interventions when the researcher has limited ability to obtain a control group. This advantage reduces the data and matching routines and is key for obtaining effect estimates in many cases when the control group is not available. Finally, RDiT allows for a causal interpretation of the results, which is becoming increasingly important in policy evaluation studies.

Most of the limitations of this study relate to the data. The trade data do not allow for precisely distinguishing between the traded products by quality, although the presented method already allows comparisons of the effect estimates for products of different quality. The second limitation relates to the available data frequency, which is lower than required for this analysis but was corrected in this study by converting between the currencies. Despite a potential error in price measurement after price conversion, the RDiT found significant discontinuities at the time of the policy intervention in 2014 and showed no significant discontinuities in placebo tests. Thus, there is no violation of the RDD, and one can at least infer the significance and relative size of the effects. The third limitation of this study concerns the number of observations used for each estimate in this study, which ranges from 77 to 420 per product group and may be considered low by practitioners. The number of observations in this study was limited by (a) the window of estimation, which should be as narrow as possible, and (b) the possibilities of mixing food tariff lines in such a way that they remain comparable within a product group. Therefore, this study used estimation windows with more observations, presented the results for many bandwidth options and highlighted the best possible estimates (with optimal bandwidth) given the available data. Nevertheless, the results should be interpreted with caution. The fourth limitation of the study is that the possible correlations in the clouds of observations were neglected by the applied RDiT when creating the polynomials for estimation. The correlations between the observations were tested in Appendix D. These tests did not reveal any critical violations of the RDD for narrow windows. Fifth, while the narrow optimal window allows for a causal interpretation of the results, the estimates of short-run effects do not take into account the consequences of exchange rate liberalisation such as market panics and other medium-run effects that may occur after the studied period. These effects are beyond the scope of this study. Finally, the use of linear trends in this study follows the tradition of price modelling with other modelling tools. The possibility of using higher-order polynomials in RDiT requires more statistical studies in the future.

5. Discussion and Conclusions

The main message of the present study is that the exchange rate liberalisation (1 November 2014) in Russia in 2014 triggered several significant discontinuities in food import prices. These discontinuities ranged from +3 to +21 percentage points to the average price level in 2014, and these effects varied depending on the studied currency. Pig products, fish and cheese experienced significant policy effects in import prices, while poultry, milk and cream, buttermilk and butter and perishable vegetables did not. Berries, milk and perishable vegetables experienced high volatility during the studied period; therefore, the relatively weaker discontinuities in prices that could potentially be introduced by exchange rate liberalisation were insignificant. The results of this study suggest that many food import prices increased after exchange rate liberalisation, but do not suggest that the stronger rouble would move prices back to pre-2014 levels. Instead, the method of the present study provides an ex-post product-by-product estimation of the short-term effects of the intervention on prices and does not have major predictive power.

Previous studies that described the events of 2014 in Russia also revealed food price destabilisation in Russian markets. However, the models used for previous estimations did not allow distinguishing the effects of trade bans and currency policy on food prices (Section 2). Consequently, all the final effects were interpreted as the effects of the embargo and sometimes explained with Russian rouble depreciation without precise quantitative evidence of exchange rate policy liberalisation. Exceptions are, for instance, Loginova and Irek [55], who examined only meat markets and were rather focused on vertical price transmission than on price stability, and also Loginova and Mann [56], who studied price stability in the long term and in conditions of various agricultural institutions. The present study attempted to fill this gap for Russian food import prices, and the setting used in the present study was valuable for assessing the effects of the intervention far enough (in time) from other interventions.

Few food import prices in Russia experienced seasonality patterns; however, most producer and consumer prices did not pass RDiT assumptions because of seasonality. For series without seasonality, the approach in a present study may help to solve many interventions' short-term causal effect estimation tasks in times of change, because ensuring non-overlapping estimation windows and grouping the series by clear criteria are often much easier in practice than searching for and adopting a control group. Future studies should also attempt to benefit from using more frequent and disaggregated data compared to this study, because the higher amount of observations would allow for more reliable results.

This paper summarises the policies in Russian agricultural sector in 2014 and examines the impact of exchange rate liberalisation on food import price stability. The exchange rate growth significantly increased the prices of several products in Russia in 2014. The study advises policymakers to be cautious in terms of exchange rate regulation and to expect structural changes in agricultural trade when exchange rates experience extremes. This means that decisions taken regarding exchange rates should consider their potential impact on food security. The presented technique of effect estimation is useful for policymakers, decision makers and businesspersons, especially for short-term market risk analysis in times of change.

Conflict of Interest

There is no conflict of interest.

References

[1] Wickham, P., 1985. The choice of exchange rate regime in developing countries: A survey of the literature. International Monetary Fund: Washington, D.C.

[2] Guzman, M., Ocampo, J., Stiglitz, J., 2018. Real exchange rate policies for economic development. World Development. 110, 51-62. DOI: https://doi.org/10.1016/j.worlddev.2018.05.017

[3] Mussa, M., 1986. Nominal exchange rate regimes and the behavior of real exchange rates: Evidence and implications. Carnegie-Rochester Conference Series on Public Policy. 25, 117-214. DOI: https://doi.org/10.1016/0167-2231(86)90039-4

[4] Hooper, P., Kohlhagen, S., 1978. The effect of exchange rate uncertainty on the prices and volume of international trade. Journal of International Economics. 8(4), 483-511. DOI: https://doi.org/10.1016/0022-1996(87)90001-8

[5] Baldwin, R., Krugman, P., 1989. Persistent trade effects of large exchange rate shocks. Quarterly Journal of Economics. 104(4), 635-654. DOI: https://doi.org/10.2307/2937860

[6] Bussiere, M., 2013. Exchange rate pass-through to trade prices: The role of nonlinearities and asymmetries. Oxford Bulletin of Economics and Statistics. 75(5), 731-758. DOI: https://doi.org/10.1111/j.1468-0084.2012.00711.x

[7] Dornbusch, R., 1987. Exchange rates and prices. American Economic Review. 77(1), 93-106.

[8] Rutland, P., 2014. The impact of sanctions on Russia. Russian Analytical Digest. 157, 17. Available from: http://prutland.faculty.wesleyan.edu/files/2015/07/PR-Sanctions-RO.pdf

[9] Cheptea, A., Gaigné, C., 2020. Russian food embargo and the lost trade. European Review of Agricultural Economics. 47(2), 684-718. DOI: https://doi.org/10.1093/erae/jbz032

[10] Bělín, M., Hanousek, J., 2021. Which sanctions matter? Analysis of the EU/Russian sanctions of 2014. Journal of Comparative Economics. 49(1), 244-257. DOI: https://doi.org/10.1016/j.jce.2020.07.001

[11] Kiselev, S., Strokov, A., Zhorova, M., et al., 2015. Russia's agro-industrial complex under conditions of sanctions and the need to ensure food security. Available from: http://www.vniiesh.ru/documents/document_20648_Kiselev.pdf (in Russian)

[12] Shagaida, N., Uzun, V., 2016. Food embargo and choice of priorities. Voprosy Ekonomiki. 7, 93-105. DOI: https://doi.org/10.32609/0042-8736-2016-7-93-105

[13] Tyll, L., Pernica, K., Arltová, M., 2018. The impact of economic sanctions on Russian economy and the RUB/USD exchange rate. Journal of International

Studies. 11(1), 21-33.
DOI: http://dx.doi.org/10.14254/2071-8330.2018/11-1/2

[14] Trade Data [Internet]. International Trade Centre (ITC). [cited 2022 Feb 9]. Available from: https://www.trademap.org

[15] Thistlewaite, D., Campbell, D., 1960. Regression-discontinuity analysis: An alternative to the ex-post facto experiment. Journal of Educational Psychology. 51(6), 309-317.
DOI: https://doi.org/10.1037/h0044319

[16] Imbens, G., Lemieux, T., 2008. Regression discontinuity designs: A guide to practice. Journal of Econometrics. 142(2), 615-635.
DOI: https://doi.org/10.1016/j.jeconom.2007.05.001

[17] Calonico, S., Cattaneo, M., Titiunik, R., 2015. 'rdrobust': An R package for robust nonparametric inference in regression-discontinuity designs. The R Journal. 7, 38-51.
DOI: https://doi.org/10.32614/RJ-2015-004

[18] Serova, E., 2016. Agro-holdings: Vertical integration in agri-food supply chains in Russia. Global supply chains, standards and the poor: How the globalization of food systems and standards affects rural development and poverty. Wallingford: UK.

[19] Shagaida, N., Uzun, V., Gataulina, E., et al., 2017. Elaboration of approaches for depicting the priorities of Russian agriculture development. SSRN Journal.
DOI: https://dx.doi.org/10.2139/ssrn.3071505

[20] Presidential Decree N120 of 30.01.2010 [Internet]. Doctrina prodovolstvennoy besopasnosti. [cited 2022 Feb 9]. Available from: http://www.consultant.ru/document/cons_doc_LAW_96953

[21] Presidential Decree N20 of 21.01.2020 [Internet]. Doctrina prodovolstvennoy besopasnosti. [cited 2022 Feb 9]. Available from: https://www.garant.ru/products/ipo/prime/doc/73338425

[22] Shagaida, N., Uzun, V., 2015. Food security: Problems of assessing. Voprosy Ekonomiki. 5, 63-78.
DOI: https://doi.org/10.32609/0042-8736-2015-5-63-78

[23] Customs Calendar for the First Quarter of 2014 [Internet]. ConsultantPlus; 2014. [cited 2022 Feb 9]. Available from: http://www.consultant.ru/document/cons_doc_LAW_156324

[24] Götz, L., Jaghdani, T. (editors), 2017. Russia's agricultural import substitution policy: Price volatility effects on the pork supply chain. 57th Conference of German Association of Agricultural Economists (GEWISOLA 2017); 2017 Sep 13-15; Weihenstephan, Germany. p. 1-14.
DOI: https://doi.org/10.22004/ag.econ.262003

[25] Sedik, D., Lerman, Z., Shagaida, N., et al., 2018. Handbook of international food and agricultural policies. Vol. 1: Policies for agricultural markets and rural economic activity. World Scientific Publishing: Singapore. pp. 433-460.

[26] Wegren, S.K., 2014. Russia's food embargo. Russian Analytical Digest. 157, 8-12. Available from: https://www.files.ethz.ch/isn/186842/Russian_Analytical_Digest_157.pdf

[27] Wegren, S., 2014. The Russian food embargo and food security: Can household production fill the void? Eurasian Geography and Economics. 55, 491-513.
DOI: https://doi.org/10.1080/15387216.2014.992449

[28] Wegren, S., 2016. Food policy in Russia. Reference Module in Food Science. 1-5.
DOI: https://doi.org/10.1016/B978-0-08-100596-5.03331-X

[29] Wegren, S., Nilssen, F., Elvestad, C., 2016. The impact of Russian food security policy on the performance of the food system. Eurasian Geography and Economics. 57, 671-699.
DOI: https://doi.org/10.1080/15387216.2016.1222299

[30] Schierhorn, F., Meyfroidt, P., Kastner, T., et al., 2016. The dynamics of beef trade between Brazil and Russia and their environmental implications. Global Food Security. 11, 84-92.
DOI: https://doi.org/10.1016/j.gfs.2016.08.001

[31] Uzun, V., Fomin, A., Loginova, D., 2018. Position of Russia on the world agro-food map. International Agricultural Journal. 1(361), 68-76.
DOI: https://doi.org/10.24411/2587-6740-2018-11016

[32] Dillen, K., 2015. The Russian ban on EU agricultural imports: A bilateral extension of AGLINK-COSIMO. 29th Conference of International Association of Agricultural Economists (IAAE 2015); 2015 Aug 9-14; Milan, Italy. p. 1-24.
DOI: https://doi.org/10.22004/ag.econ.211574

[33] Boulanger, P., Dudu, H., Ferrari, E., et al., 2016. Russian roulette at the trade table: A specific factors CGE analysis of an agri-food import ban. American Journal of Agricultural Economics. 67, 272-291.
DOI: https://doi.org/10.1111/1477-9552.12156

[34] Uzun, V., Loginova, D., 2016. Russian food embargo: Minor losses in western countries. Russian Economic Developments. 9, 32-37.
DOI: http://dx.doi.org/10.2139/ssrn.2842146

[35] Gohin, A., 2017. On the economic costs of the Russian embargos on food products. Revue d'économie

politique. 127, 71-91.
[36] Kutlina-Dimitrova, Z., 2017. The economic impact of the Russian import ban: A CGE analysis. International Economics and Economic Policy. 14, 537-552. DOI: https://doi.org/10.1007/s10368-017-0376-4
[37] Fedoseeva, S., Herrmann, R., 2019. The price of sanctions: An empirical analysis of German export losses due to the Russian agricultural ban. Canadian Journal of Agricultural Economics. 67, 417-431. DOI: https://doi.org/10.1111/cjag.12194
[38] Banse, M., Duric, I., Götz, L., et al., 2019. From the Russian food import ban to free trade from Lisbon to Vladivostok—Will farmers benefit? Journal of International Studies. 12, 20-31. DOI: https://doi.org/10.14254/2071-8330.2019/12-4/2
[39] Liefert, W., Liefert, O., Seeley, R., et al., 2019. The effect of Russia's economic crisis and import ban on its agricultural and food sector. Journal of Eurasian Studies. 10(2), 119-135. DOI: https://doi.org/10.1177/1879366519840185
[40] Kadochnikov, P., Knobel, A., Chentsov, A., 2019. Assessment of import substitution due to the trade embargo in Russia, 2014-2016. Economic Policy. 14, 8-33. DOI: https://doi.org/10.18288/1994-5124-2019-1-8-33
[41] Volchkova, N., Kuznetsova, P., 2019. How much do counter-sanctions cost: Well-being analysis. Journal of the New Economic Association. 43, 173-183. DOI: https://doi.org/10.31737/2221-2264-2019-43-3-9
[42] Exchange Rate Regime of the Bank of Russia [Internet]. Central Bank of the Russian Federation [cited 2022 Feb 9]. Available from: https://www.cbr.ru/eng/dkp/exchange_rate
[43] Dreger, C., Kholodilin, K., Ulbricht, D., et al., 2016. Between the hammer and the anvil: The impact of economic sanctions and oil prices on Russia's ruble. Journal of Comparative Economics. 44, 295-308. DOI: https://doi.org/10.1016/j.jce.2015.12.010
[44] Wang, Y., Wang, K., Chang, C., 2019. The impacts of economic sanctions on exchange rate volatility. Economic Modelling. 82, 58-65. DOI: https://doi.org/10.1016/j.econmod.2019.07.004
[45] Burakov, D., 2016. Oil prices, exchange rate and prices for agricultural commodities: Empirical evidence from Russia. Agris On-line Papers in Economics and Informatics. 8(2), 33-47. DOI: https://doi.org/10.7160/aol.2016.080203
[46] Yugay, S., Götz, L., Svanidze, M. (editors), 2020. Exchange rate pass-through and wheat prices in Russia. 60th Conference of German Association of Agricultural Economists (GEWISOLA 2020), 2020 Sep 23-25; Halle, Germany. DOI: https://doi.org/10.22004/ag.econ.305595
[47] Sinyakov, A., Chernyadyev, D., Sapova, A., 2019. Estimating the exchange rate pass-through effect on producer prices of final products based on micro-data of Russian companies. Zhournal Novoi Ekonomicheskoi Associacii. 41(1), 128-157. DOI: https://doi.org/10.31737/2221-2264-2019-41-1-5
[48] Balcombe, K., 2009. The Nature and Determinants of Volatility in Agricultural Prices [Internet]. MPRA Paper, 24819. Available from: https://mpra.ub.uni-muenchen.de/24819/
[49] Newbery, D., Stiglitz, J., 1981. The theory of commodity price stabilization. A study in the economics of risk. Clarendon Press: Oxford.
[50] De Livera, A., Hyndman, R., Snyder, R., 2011. Forecasting time series with complex seasonal patterns using exponential smoothing. Journal of the American Statistical Association. 106(496), 1513-1527. DOI: https://doi.org/10.1198/jasa.2011.tm09771
[51] Huber, M., 2019. An Introduction to Flexible Methods for Policy Evaluation [Internet]. FSES Working Papers, 504. [cited 2022 Feb 9]. Available from: http://doc.rero.ch/record/326900/files/WP_SES_504.pdf
[52] Hausman, C., Rapson, D., 2018. Regression Discontinuity in Time: Considerations for Empirical Applications [Internet]. NBER Working Paper Series, 23602. [cited 2022 Feb 9]. Available from: https://doi.org/10.3386/w23602
[53] Lee, D., Lemieux, T., 2010. Regression discontinuity designs in economics. Journal of Economic Literature. 48(2), 281-355. DOI: https://doi.org/10.1257/jel.48.2.281
[54] Loginova, D., Portmann, M., Huber, M., 2021. Assessing the effects of seasonal tariff-rate quotas on vegetable prices in Switzerland. Journal of Agricultural Economics. 72(2), 607-627. DOI: http://dx.doi.org/10.1111/1477-9552.12424
[55] Loginova, D., Irek, J., 2022. Russian meat price transmission and policy interventions in 2014. Agricultural and Food Economics. 10, 2. DOI: https://doi.org/10.1186/s40100-021-00208-1
[56] Loginova, D., Mann, S., 2022. Institutional contributions to agricultural producer price stability. Agricultural and Food Economics. 10, 12. DOI: https://doi.org/10.1186/s40100-022-00219-6
[57] Anania, G., Nisticò, R., 2014. Price dispersion and seller heterogeneity in retail food markets. Food Policy. 44, 190-201.

DOI: https://doi.org/10.1016/j.foodpol.2013.12.004
[58] Castellari, E., Moro, D., Platoni, S., et al., 2018. Retailers' strategies and food price dynamics: Evidence from dairy scanner data. Food Policy. 74, 212-224. DOI: https://doi.org/10.1016/j.foodpol.2017.12.005
[59] Kim, H., Ward, R., 2013. Price transmission across the U.S. food distribution system. Food Policy. 41, 226-236. DOI: https://doi.org/10.1016/j.foodpol.2013.05.006
[60] Arize, A., Shwiff, S., 1998. Does exchange-rate volatility affect import flows in G-7 countries? Evidence from cointegration models. Applied Economics. 30(10), 1269-1276. DOI: https://doi.org/10.1080/000368498324887
[61] Diamandis, P., Drakos, A., 2011. Financial liberalization, exchange rates and stock prices: Exogenous shocks in four Latin America countries. Journal of Policy Modeling. 33(3), 381-394. DOI: https://doi.org/10.1016/j.jpolmod.2010.11.004
[62] Bahmani-Oskooee, M., Huynh, T., Nasir, M., 2021. On the asymmetric effects of exchange-rate volatility on trade flows: Evidence from US-UK commodity trade. Scottish Journal of Political Economy. 68(1), 51-102. DOI: https://doi.org/10.1111/sjpe.12257
[63] Barrett, C., 1999. The effects of real exchange rate depreciation on stochastic producer prices in low-income agriculture. Agricultural Economics. 20(3), 215-230.
[64] Lechner, M., 2010. The relation of different concepts of causality used in time series and microeconometrics. Econometric Reviews. 30(1), 109-127. DOI: https://doi.org/10.1080/07474938.2011.520571
[65] Roth, J., 2019. Pre-test with Caution: Event-study Estimates after Testing for Parallel Trends [Internet]. [cited 2022 Feb 9]. Available from: https://jonathandroth.github.io/assets/files/roth_pretrends_testing.pdf
[66] Barrett, C., Bellemare, M., 2011.Why Food Price Volatility doesn't Matter [Internet]. Available from: https://www.foreignaffairs.com/articles/2011-07-12/why-food-price-volatility-doesnt-matter

Appendix A

Applicability of the approaches to studying exchange rate liberalisation

As Section 2 describes, Russian markets experienced many interventions in 2014. Most techniques employed on Russian markets in 2014 would depict the effects of the bulk of events but not the effect estimates of exchange rate liberalisation. The panel data models performed on weekly and higher-frequency data allow the decomposition of the price (index) magnitude across a set of characteristics and fixed effects [57,58], which requires highly detailed datasets and a fit of the strong assumptions behind their design. In such a setting, the intervention would be a classifier rather than a cause. Auto regression (AR) models and their modified versions are frequently used for studying prices [59], interdependencies of exchange rate and trade in time [60-62] and the effects of real exchange rate depreciation on prices [63]. However, in the AR design, short-term volatility during the structural change may be treated as an error of the model. In the Russian food markets in 2014, such volatility was observed often enough to violate the AR design.

Causal and experimental methods is a good alternative for complicated time-series methods, when the main question is focused at the time of change (see the discussion by Lechner [64]). However, causal techniques require a control group, which should be comparable to the treated group and consistent with pre-trend assumptions (see the discussion by Roth [65]). A mass treatment effect of exchange rate liberalisation on trade withdraws the opportunity to find untreated import flows for difference-in-differences⑤. The regression discontinuity design appears to be useful for policy effect estimation (see the examples in [53,54]) in the mentioned conditions, as it entails local regression, which requires the available data for Russian markets. The RDD was developed for individual data and requires adoption to study prices in time. How RDiT can be implemented to provide an answer to the research question is described in Section 3. The result is a change in price levels and trends, so that the understanding of price stability in this study is consistent with Barrett and Bellemare's [66] view of the food price issue.

⑤ Regional open data for Russian imports are available only for the three years before the time of requesting the data from the Russian customs services. For difference-in-difference or synthetic control, these data require a control group from comparable neighbouring regions of other countries. Besides increasing complexity, this negates the opportunity to study interest at the country level and violates stable unit treatment value assumption (SUTVA). The prices in the regions around the Russian border do interrelate, as the trade there was intensive and even increased after the trade restrictions towards the EU were implemented. Within Russian data only, the control groups between tariff lines would not be precise, as similar products are traded within the same tariff line. The control groups between trade partners may violate comparability of countries by climate, production, quality and pricing mechanisms.