Sectoral GVC-REER and industry competitiveness in Russia

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Abstract

We use Rosstat's recent publication of Russian Input-Output Tables (Rosstat, 2017) to study possible evidence of the additional explanatory power of sectoral real effective exchange rate adjusted to Russia's participation in global value chains (GVC-REER, (Patel, Wang, and Wei 2017)). These results are opposed to a more conventional measure of industry real exchange rate (Goldberg 2004). Recent literature (Bems and Johnson 2017) stresses the importance of inter-industry linkages and GVC participation for construction of REER on a country or industry level. This is even more important for Russia since it has recently been listed as a country with one of the highest levels of divergence in cost competitiveness across sectors (Patel, Wang, and Wei 2017), prompting on significant sectoral differences in openness and GVC participation.

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1. Introduction

In this study we put our attention to the role of the exchange rate as an instrument of Russian economy's accommodation to negative external shocks associated with a sharp decline in oil prices and rising geopolitical tensions that Russian economy has recently faced, as well as a measure of Russian industries' competitiveness in international trade with respect to structural shifts in the economy.

Since November 2014 the Bank of Russia introduces a floating exchange regime[1]. Despite the fact that an appropriate exchange rate regime allows the economy to adjust to different kinds of macroeconomic fluctuations and smooth consequences of shocks, it could provide some bias for estimation of economy's performance (in particular, on industry and firm level data). It could happen as there is a range of factors which influence real exchange rates, such as import and export prices, interest rates, risk premium and productivity differentials between domestic and foreign economies, etc. From this point of view it seems necessary to use an appropriate deflator for nominal exchange rates (relative prices of exports, industrial producer prices (PPI), consumer price index (CPI), unit labor costs (ULC)). In our baseline estimates we primarily used for our purpose both CPI and PPI, as it is comparable between countries, available for wide range of countries and is available for a large time span.

Real effective exchange rate (REER) seems more relevant if we aim at taking into account the complexity of international trade flows. REER is a popular index, which captures a country's competitiveness on the world markets. It is important to have a measure that reflects country's goods competitiveness compared to import goods, as different level of consumer price origins competitive advantage between similar producers from different countries. Moreover, these fluctuations in real exchange rate produce reallocation effect between and within industries. Use of different weighting schemes for bilateral exchange rates is a debatable question and proper choice of a weighting scheme depends mostly on the application and/or the specific research question (Chinn 2006). There are three main weighting schemes in the literature: bilateral export shares, bilateral import shares, bilateral trade shares.

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[1] The implementation of the floating exchange regime in Russia has been gradual and consisted of three main stages. On the first one, since 1999 it was a managed regime, but then in 2005 the operational bands based on the US dollar and euro basket indicators for currency policy provided some kind of autonomy as the Central Bank implemented foreign market interventions just on its borders. In 2009, the degree of autonomy expanded with the implementing of automatically changed operational band (depending on the foreign market interventions). Since 2010, the Central Bank started to use the interventions for smoothing of excess volatility only. And since November 2014 it implemented floating exchange rate regime that allows the economy to adjust to macroeconomic fluctuations and shocks and smooth external effects.
Bank of Russia https://www.cbr.ru/DKP/exchange_rate/

Goldberg (Goldberg 2004) suggested that "as the differences between country groups are important in computing the weights on currencies used in these real exchange series, the distinctions between particular industries are highly revealing". Introduction of an industry-specific exchange rate gives an even wider variety of REER indices since weights in the industry-specific REER indices differ from weights in the aggregated index. The weights of each partner currency in the industry-specific REER are the shares of that partner in the home country's exports of imports of that specific industry (Goldberg 2004).

The proliferation of the global value chains (Antràs 2015) changes our perception of what is an appropriate way to calculate REER. Recent literature (Bems and Johnson 2017) stresses the importance of inter-industry linkages and GVC participation for construction of REER on a country or industry level.

This is even more important for Russia since it has recently been listed as a country with one of the highest levels of divergence in cost competitiveness across sectors (Patel, Wang, and Wei 2017), prompting on significant sectoral differences in openness and GVC participation.

Historically Russia's participation in GVC is limited to first stages of global value chains. Russia supplies energy and raw materials for manufacturing processes: index of forwarding participation is estimated at 38.7%, while the index of backward participation is about four times less and estimated at 9.36% (Kadochnikov 2015). This brings concerns about diversification of Russia's exports and competitiveness among manufacturing industries (Torvinen and Väätänen 2013).

Following significant depreciation of the Ruble in 2014 Russian manufacturing firms received a cost advantage. Against this background, Russian firms' cost advantage along with acceleration in global economic growth gives a clear opportunity for movement along GVC and the further increase in manufacturing exports.

Hummels et al. (HIY)'s paper (Hummels, Ishii, and Yi 2001) introduce the concept of vertical specialization of trade (or vertical trade), which is defined via three main characteristics. *First*, there is a sequential production process. *Second*, stages of producing goods take place in at least two countries. *Third*, at least one of the partner country imports inputs and use it for intermediate consumption and further export. HIY assume that the intensity of the use of imported inputs in exported and domestically consumed goods are equal and imports are foreign sourced.

Koopman et al. (KWW) (Koopman, Wang, and Wei 2012) highlight that equal intensity means do not take into account "processing export" when the main purpose for import is to use more favorable tariff treatment. Due to different intensity, the aforementioned assumption can lead to estimation errors. Moreover, multi-country trade also limits HIY model. Therefore, KWW develop HIY model with respect to aforementioned limitations. Additionally, Daudin et al. (Daudin et al. 2009) divide international trade into "standard trade" and "value-added trade". Authors highlight that the former may provide overvaluation due to double-counting as it measures trade flows based on their market value when they cross borders. In that sense, it is better to use the latter approach as it is "net of double-counted vertical specialization trade".

Our discussion proceeds as follows: in section two we provide a conceptual framework for our analysis. Data discussion in section three is followed by some preliminary results.

Methodology

We first try to check whether it is necessary to change the existing official methodology for calculating REER via consumer price indices, the results of which are currently published in Bank of Russia's statistics.

First, we compute real exchange rate (RER) for each country[2]. We use PPI, CPI, and ULC as deflators in order to describe the better tool for our purpose. We use a common formula for computing RER for each of the Russian trade partner:

$$rer_t^c = ner_t^c * \frac{deflator_t^c}{deflator_t^{RUS}}$$

where ner_t^c is bilateral nominal exchange rate of country c's currency in terms of domestic currency (Ruble); $\frac{deflator_t^c}{deflator_t^{RUS}}$ is the ratio between corresponding indices (PPI, CPI, or ULC) in foreign country with respect to home country (RUS).

Second, we compute the conventional REER based on the volume of trade between countries, Aggregated Real Effective Exchange Rate (AREER). The shares of export (import) to (from) each partner country c in total Russian export (import) define countries' weights in the aggregated index. The final AREER consists of major trade partners. We assume that a trade partner has a significant impact if its share of export (import or trade) is greater than 0.5%. Figure 7. shows the coverage ratio of trade flows of the major partners compared with the Bank of Russia's data.

[2] The countries with available data for nominal exchange rates. For the rest of trade partners we use US dollars as major currency. For robustness check we also assumed that all trade flows are made in Euro and US dollars. We used only these two currencies for deriving real exchange rates for trade-partners.

Thus, the aggregated real effective exchange is a geometrically weighted average of bilateral exchange rates. The AREER in year t is calculated by the following formula[3]:

$$AREER_t = \prod_{c=1}^{n(t)} (rer_t^c)^{w_t^c}$$

where rer_t^c is bilateral real exchange rate of country c; w_t^c is the weight of country's c currency in the index in period t, $\sum_c w_t^c = 1$; $n(t)$ is time-varying number of major trade partners.

$$w_t^c = \frac{Y_t^c / Y_t * \boldsymbol{I}\,(Y_t^c / Y_t > 0.005)}{\sum_c [Y_t^c / Y_t * \boldsymbol{I}\,\left(Y_t^c / Y_t > 0.005\right)]}$$

where Y_t is a corresponding trade volume measure (export or import) at time t.

For weights based on the overall trade we use the following calculations:

$$w_t^{tc} = \frac{X_t^c / X_t * \boldsymbol{I}\,\left(X_t^c / X_t > 0.005\right) + M_t^c / M_t * \boldsymbol{I}\,\left(M_t^c / M_t > 0.005\right)}{\sum_c \left[X_t^c / X_t * \boldsymbol{I}\,\left(X_t^c / X_t > 0.005\right)\right] + \sum_c [M_t^c / M_t * \boldsymbol{I}\,\left(M_t^c / M_t > 0.005\right)]}$$

where, X_t^c is export from Russia to country c at time t; X_t is total Russian export at time t; M_t^c is import from Russia to country c at time t; M_t is total Russian export at time t.

Taking into account a great divergence between Russian industries, we follow Goldberg (Goldberg 2004) and construct industry-specific real effective exchange rate (IS-REER) with time-varying weights. It seems important as currency volatility may influence industries with different direction and power. In this sense, it becomes necessary to introduce weights based on discrepancies in trade structure of industries. In this case, the index is supposed to be more effective compared with the traditional aggregate trade-weighted exchange rate, as it takes into account industries' competitive advantages raised from the difference in import and export structure.

Similarly, we use three different weighting schemes: export-weighted, import-weighted, and trade-weighted:

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[3] Alexandre Fernando et al. 2009. "Aggregate and Sector-Specific Exchange Rate Indexes for the Portuguese Economy" *Notas Económicas*. ISSN 0872-4733. 30 (Dez. 2009), p. 8-9

IS-REER	Weights
$xrer_t^i = \sum_c (w_{xt}^{ic} * rer_t^c)$	$w_{xt}^{ic} = \frac{X_t^{ic}}{\sum_c X_t^{ic}}$
$mrer_t^i = \sum_c (w_{mt}^{ic} * rer_t^c)$	$w_{mt}^{ic} = \frac{M_t^{ic}}{\sum_c M_t^{ic}}$
$trer_t^i = \sum_c ((0.5 \frac{X_t^{ic}}{\sum_c X_t^{ic}} + 0.5 \frac{M_t^{ic}}{\sum_c M_t^{ic}}) * rer_t^c)$	

where w_{xt}^{ic} is the share of industry i export to a partner-country c in total export; $\sum_c w_{xt}^{ic} = 1$; $xrer_t^i$ is export-weighted Industry-Specific Real Effective Exchange Rate for industry i; w_{mt}^{ic} is the share of industry i import to a partner-country c in total import; $\sum_c w_{mt}^{ic} = 1$; $mrer_t^i$ is import-weighted IS-REER for industry i; $trer_t^i$ is trade-weighted IS-REER for industry i.

Next, we introduce Global Value Chains (GVC) as recent high degree of globalization imposes the necessity of implementation of cross-sectors relations. Patel et al. (Patel, Wang, and Wei 2017) designed the methodology for this purpose.

For better GVC-REER measurement we begin the analysis by identifying the degree of Russia's integration to the global markets. Following HIY, we focus on the "value-added" approach for assessing vertical trade. It provides a better understanding of net trade flows between the original producer and the final consumer. Thus, the total value added is a sum of each industry's difference between its value of production and the value of all inputs utilized in this sector. Cappariello (Cappariello 2012) suggests the following formula for computing the total value added in a country:

$$VA = \sum_i VA_i = \sum_i (Y_i - INT_i) = \sum_i [Y_i - va_i]$$

where Y_i is the value of the production of a sector i; INT_i is this sector's inputs; va_i is the ratio of value added content on sector's production (including compensation of employees, pre-tax profit and rent).

The first approximation of the degree of country's participation in GVCs is the share of domestic value added in gross export (DVA). This measure provides information about the contribution of domestic value added to the industry's export assuming equality of value added for domestic consumed and exported goods.

$$DVA = 1 - Int_{total}/X_{total}$$

where Int_{total} is a total of an imported intermediate consumption goods; X_{total} is a total country's export.

Further, HIY suggest three main measures for evaluating trade flows within vertical trade concept. First, VS shows the share of imported inputs used for producing export goods. HIY calculate the share of imported intermediate consumption goods in total country's export using the following formula:

$$VS = \boldsymbol{uA^M X}/X_{total}$$

where u is a $1 \times n$ vector of 1's; A^M is the $n \times n$ matrix of coefficients for imported intermediate consumption goods (as a share of output in basic prices); $\boldsymbol{X}$ is an $n \times 1$ vector for industry export; X_{total} is a total country's export; n is a number of sectors.

But as this measure does not take into account export goods for intermediate consumption and the value of domestic export in imported goods, it provides a biased estimate of trade flows. So, the authors calculate the value of imported goods used indirectly in producing exported goods. The correction matrix is introduced for this purpose. More general the share of imported intermediate consumption goods in export is computed as follows:

$$VS = \boldsymbol{uA}^M[\boldsymbol{I} - \boldsymbol{A}^D]^{-1}\boldsymbol{X}/X_{total}$$

where $\boldsymbol{I}$ is the identity matrix; A^D is the $n \times n$ domestic coefficient matrix.

The additional source of possible bias is relatively aggregated sector data from Input-Output tables. For instance, positive (negative) correlation between exports and imported inputs/gross output ratio within a sector implies downward (upward) bias of VS when the sector-level data is used.

Second measure, $VS1$, evaluates the country's participation level in the longer value chain, when exported goods are used for intermediate consumption in the partner-country. Third measure, $VS1^*$, evaluates a part of $VS1$ that is further imported back for final consumption in the domestic country. Although, the latter two measures provide more accurate information about international trade, it needs matched bilateral trade flow data with use matrices for all trading partners.

We further use aforementioned newly weighted REERs to receive some empirical evidence of necessity of changing the conventional perception of REER's construction. Following Berthou and Dhyne (2017) we estimate sectors' competitiveness via their exports. We estimate the average response of Russian industries' exports to REER movements. For REER we derive 4 different categories:

- PPI deflator; CPI deflator, ULC deflator.
- REER for the previous period; average REER for two consecutive years.
- The main weighting scheme (import-, export-, or trade-based).
- Conventional aggregated REER; industry-specific REER, and Global Value Chains REER.

For robustness check we consider REER in both current year and with lags. We also control for industry and year (dummies for the first iteration).

$$\Delta \ln V_{it} = \beta \Delta \ln REER_{t-1} + \gamma \Delta \ln FD_{it} + \lambda_i + \lambda_t + \varepsilon_{it}$$

where $\Delta \ln V_{it}$ is yearly variation of industry i's export at time t; $\Delta \ln REER_{t-1}$ is yearly variation of the real effective exchange rate lagged one year; $\Delta \ln FD_{it}$ is a variation of foreign demand in sector i at time t; λ_i, λ_t are industry and year dummies; $\Delta \ln Z_t = \ln Z_t - \ln Z_{t-1}$ for the main explanatory variables.

We use also average value for foreign demand and REER to reduce the noise from yearly variations. Average value for the variable of interest is calculated as follows:

$$\Delta \ln \bar{Z}_t = \frac{1}{2}(\Delta \ln Z_t + \Delta \ln Z_{t-1})$$

We derive foreign demand through the foreign absorption of the trade partners:

$$FD_{it} = \sum_{j \neq c} \frac{V_{cjit}}{V_{cit}} (Y_{jit} + M_{jit} - X_{jit})$$

where $\frac{V_{cjt}}{V_{ct}}$ is a share of bilateral export of industry i from Russia to country j in total Russian export of this sector at time t; Y_{jit} is the total output of country j in sector i at time t; M_{jit} are total imports of country j in sector i at time t; X_{jit} are total exports of country j in sector i at time t.

Data

Table 1 presents the short overview of the main sources for our data. We have a balanced panel dataset since 2000. For each year and each of 25 industries and 149 trade partners we have the following observations: export and import value, nominal exchange rates for 34 currencies, CPI and PPI for the main trade partners, foreign demand for industries calculated via WIOT, wage dynamics for calculating ULC for 9 main countries.

We use nominal exchange rates, consumer price indices (CPI), and major trade partners' weights[4] to evaluate aggregated real effective exchange rate (AREER) for 2000-2013. For each trading partner, we constructed corresponding annual nominal exchange rates provided by the Bank of Russia's statistics. Annual nominal exchange rates are constructed from daily data as a simple geometric mean for each year. We use local currency exchange rates for major partners (74 countries). For the rest 75 countries, we assume US dollar as the main currency. For all countries we use IMF provided CPI, as average annual consumer price index (2010=100%).

[4] We also calculate Real Effective Exchange Rate with weights used by the Bank of Russia to compare with new trade structure.

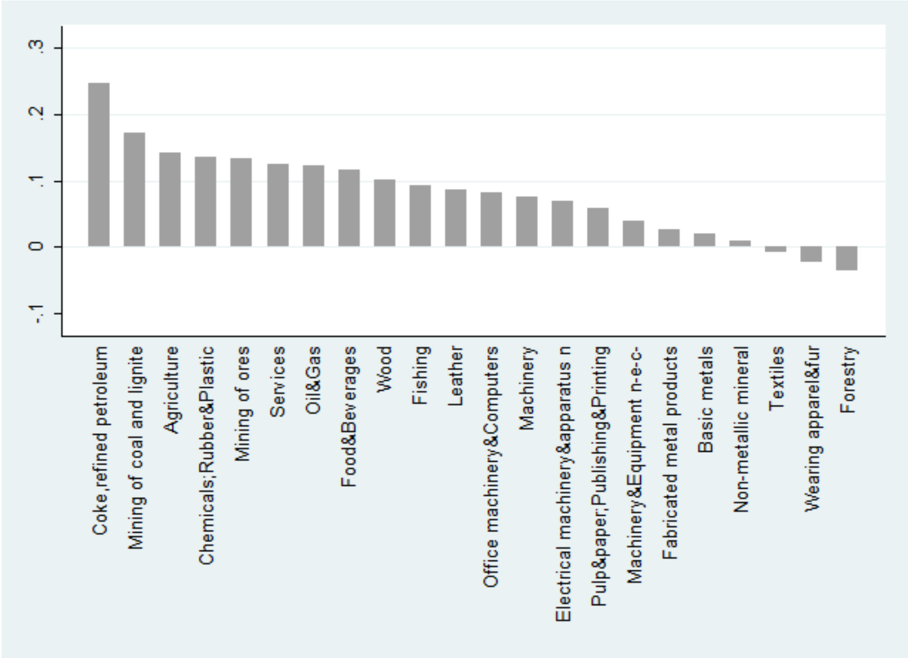
Table 1. Data source and description

Data	Source	Coverage	Description
Nominal exchange rate	Bank of Russia	• 2000-2016; • Daily; • 34 currencies for 74 countries	Construct annual nominal exchange rate as a geometric mean for each year. Use US dollar as a main currency for 174 countries.
Consumer price index	IMF	• 2000-2016; • Annually; • 191 countries	Average annual consumer price, 1999=100%.
Producer Price Index	OECD	• 2000-2016; • Annually; • 35 countries	Annual growth rate.
Unit labor costs	CEIC	• 2000-2016 • Quarterly; • 9 countries	Annual growth rate.
Trade flows	GTAP	• 2000-2013; • Annually; • 135 destination countries; • 21 industries	Export and import by industry and country (except services).
Services trade	Bank of Russia	• 2002-2016; • Annually; • 85 destination countries (+ROW);	Export and import of services
Input-Output tables	World Input-Output Database	• 2000-2014; • Annually; • 59 industries.	Compute foreign demand based on the foreign absorption in trade partners.

Source: authors' compilation.

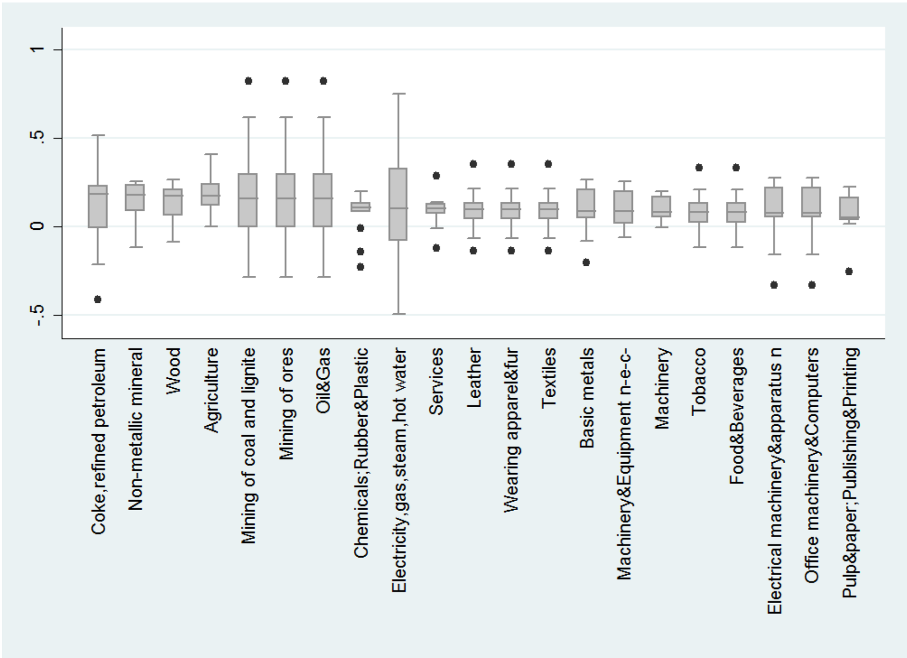
Figure 1 and Figure 2 represent the divergence between Russian industries for the main variables of interest (export value and foreign demand). In line with the export structure of resource-rich countries, mining and coke and refined petroleum products show the highest export values (as a difference in logarithms for two consecutive periods). Traditionally, the lowest export values characterize industries with more significant value added (or higher degree of participation in GVCs). In case of Russia, such industries are textiles, wearing apparel and fur, and forestry.

Figure 1. Export by industry (delta log), average for 2000-2013



Sources: GTAP9 database, Bank of Russia, authors' calculations.

Figure 2. Foreign demand by industry (delta log), average for 2000-2013



Sources: WIOT, authors' calculations.

For deriving the Russian degree of integration into the GVC we also use partly Global Trade Analysis Project (GTAP) database. It is "a global data base describing bilateral trade patterns, production, consumption and intermediate use of commodities and services"[5]. GTAP database covers information across different countries and industries. It uses both national statistical sources and data from various international organizations (such as the World Bank, IMF, UN Statistics). The recent available release of GTAP database covers information for 129 countries and regions and 57 industries for 2011.

Kadochnikov (2015) provides the following estimates of Russian vertical specialization trade for two latest GTAP databases:

Table 2. Vertical trade estimation for Russia, 2007, 2011

	VS, %	VS1, %	VS1*, %
2007	9.36	38.70	2.01
2011	8.06	37.92	1.44

Source: Kadochnikov, 2015

According to the author, general index of Russian level of participation in GVCs in 2007 was about 48.06% with further decrease up to 45.98% in 2011. This drop realized in both backward participation (the share of imported inputs used for production of exported goods) and forward participation (the share of exported domestic goods for intermediate consumption in other countries) levels. The so-called backward participation is measured by VS, while forward participation is estimated via $VS1$. So, Russian 'component participation' dropped by 1.3 p.p during the observed period and reached 8.06%. At the same time, 'goods participation' decrease was less significant and was 0.78 p.p. stabilized on the level of 37.92% in 2011.

In general, the degree of Russian integration into the GVCs is presently insignificant. Despite the fact that more than one third of Russian exports is used for intermediate consumption in other countries ($VS1$), Russia is still far from being the final consumer in GVCs. The share of Russian exports, which is further imported back for final consumption along the chain, was 2.01% in 2007 and diminished down to 1.44% by 2011.

In this paper, we used Input-Output tables published by the Federal State Statistics Service (Rosstat) for 2012-2015 to study possible evidence of the additional explanatory power of sectoral real effective exchange rate adjusted to Russia's participation in GVCs (GVC-REER, (Patel, Wang, and Wei 2017)). The database provides information for exports, as well as domestic and import intermediate consumption for 59 Russian industries.

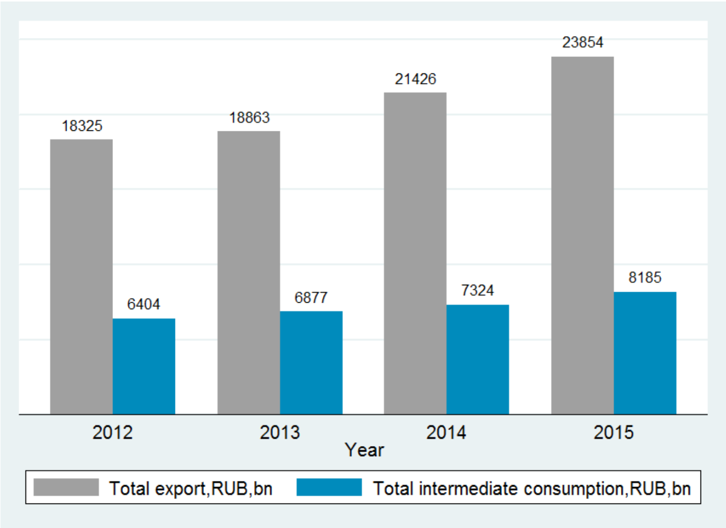
[5] https://www.gtap.agecon.purdue.edu/databases/default.asp

Despite the fact, that this database does not allow us to calculate $VS1$ and $VS1^*$ because it does not cover matching bilateral trade flow data to input-output relation, there are two main reasons for why we decided to focus our attention particularly on it. *First*, the main characteristics of Russian vertical specialization have been thoroughly studied and covered, for instance, in Kadochnikov (2015). *Second*, Rosstat's Input-Output tables provide more recent data for 2012-2015 which is not available for GTAP dataset yet.. Using this information, we are able to follow the dynamics of chosen characteristics and estimate the impact of economic recession in 2015 and 2016 on the competitiveness of Russian industries.

Preliminary results

Russian place in the GVCs

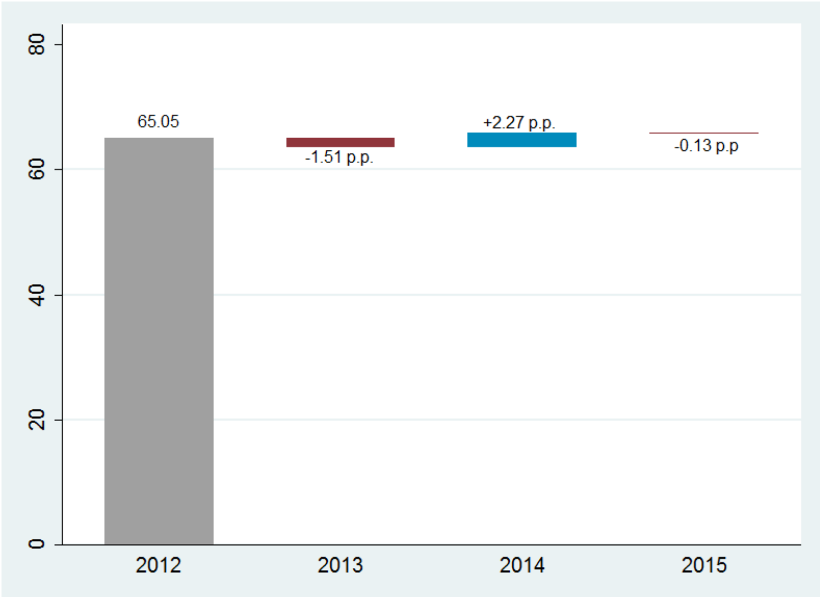
Figure 3. Dynamics of total export and total intermediate consumption over 2012-2015



Sources: Rosstat, authors' calculations.

We first estimated the share of domestic value added in gross export (DVA) for 2012-2015 (Figure 3, Figure 4.). Based on Rosstat Input-Output tables domestic value added in gross export for all industries was 65.05% in 2012 and it has increased up to 65.69% by 2015. The major growth was in 2014 (+2.27 p.p. y/y). This increase coincides with the first wave of sanctions implemented in 2014.

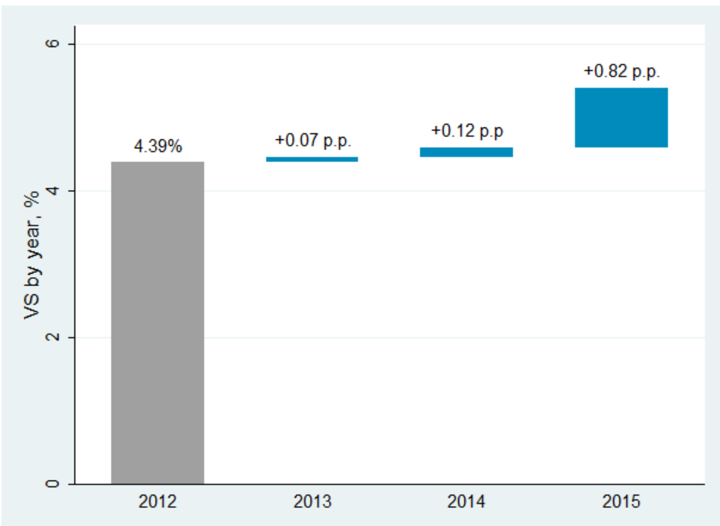
Figure 4. Domestic value added in gross exports, 2012-2015, %



Sources: Rosstat, authors' calculations.

Figure 4 shows respective dynamics for import goods for intermediate consumption (VS). In 2012 it was around 4.4% with further growth up to 5.4% in 2015. Comparing with the results received by Kadochnikov (2015) using GTAP database for 2011, the share of imported inputs used for producing export goods is almost twice less than a year ago. This drop could be explained by differences in the used dataset, as well as by the use of additional correction matrix for domestic goods (A^d). The most significant growth was in 2015 (+0.82 p.p.) when the measure has reached 5.4%. Moreover, this growth was accelerating since 2012.

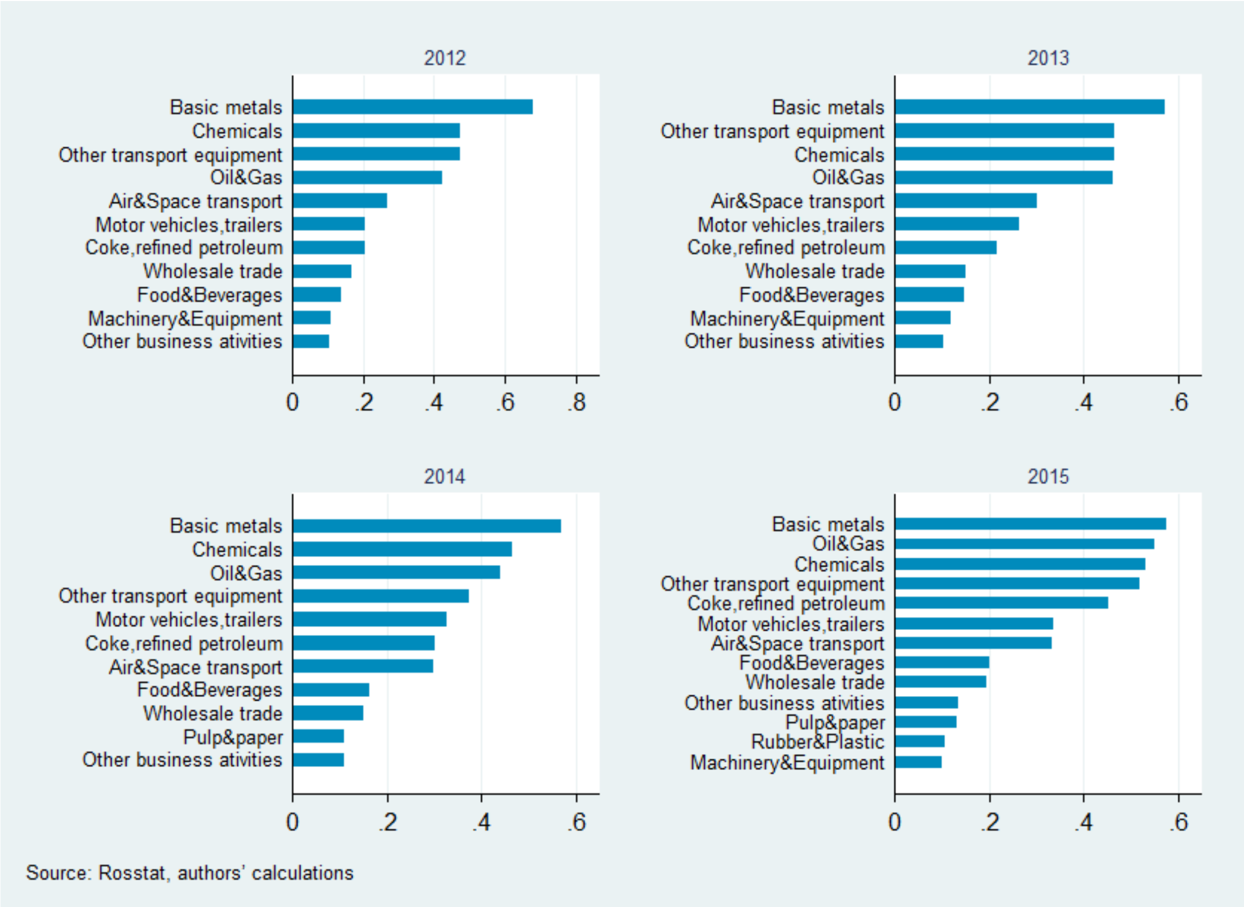
Figure 5. Dynamics of import goods for intermediate consumption (VS) in Russia, 2012-2015



Sources: Rosstat, authors' calculations.

Relatively higher degree of integration to GVCs correspond to such industries like Primary metals; Chemicals; Ships, Aircraft and Spacecraft; Oil and Gas extraction; Air and Space transport; Cars; Coke& Petroleum. Figure 6. represents industries with $VS > 0.1$ %. The higher participation level corresponds to traditional resource-rich sectors and defense. Moreover, in 2015 Rubber and Plastics start to use more imported goods for intermediate consumption.

Figure 6. Dynamics of import goods for intermediate consumption in Russia by industry, 2012-2015

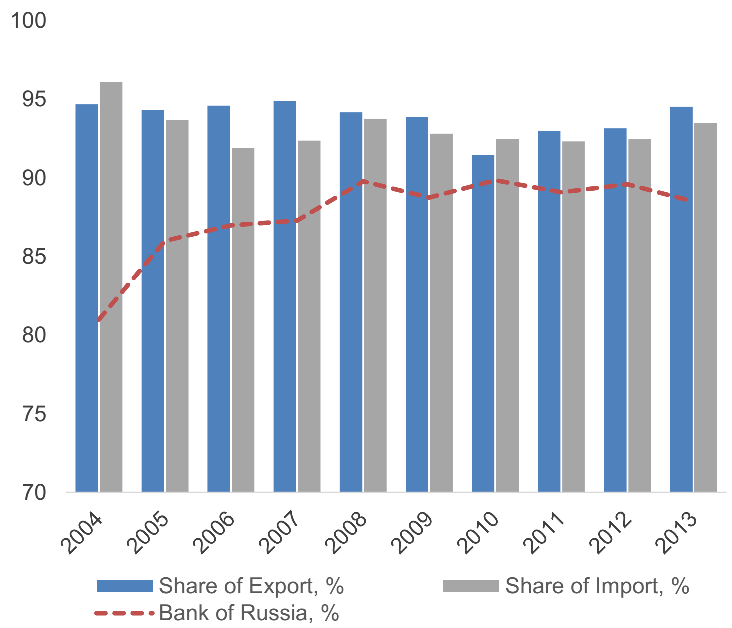


Source: authors' calculations.

The difference among different REER weighting schemes

The real effective exchange rate reflects the value of Ruble against the set of currencies of the main Russian trade partners. The main trade partners are those countries whose trade flows with Russia exceed 0.5%. Figure 7 shows the difference in trade flows coverage taken for constructing conventional REER (Bank of Russia) and new weights for REER (share of export/import). During the whole period the coverage rate exceeds 80% for the conventional weighting scheme. At the same time, new weights cover at least 90% of trade flows during 2004-2013. So, compared with weights used by the Bank of Russia for similar calculations the coverage ratio based on recent trade flows is wider for each year. Moreover, for each period the latter uses trade structure in the particular year, while the Bank of Russia's shares are based on the structure with two-year lag.

Figure 7. Coverage of major trade partners, %



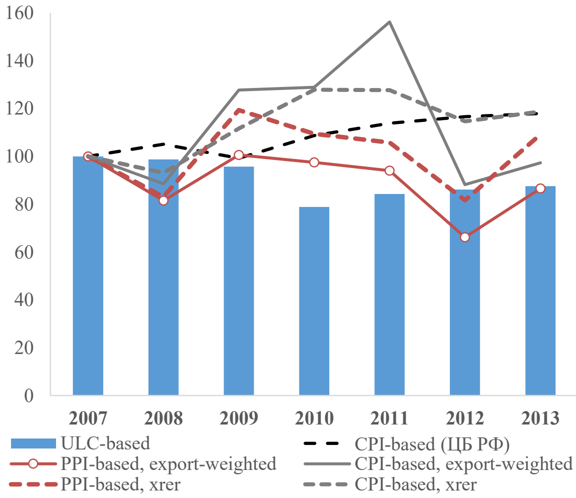
Source: Bank of Russia, Federal Customs Service, authors' calculations

We then constructed real effective exchange rates for 2000-2013 using different weighting schemes and deflators.

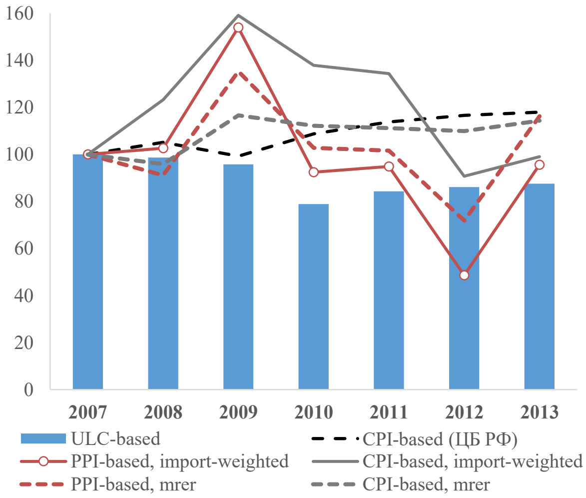
The ULC-based REER is constructed by means of statistical data on unit labor costs covering the manufacturing sectors in Russia, on the one hand, and its major trading partners, on the other hand. The respective estimates of unit labor costs for Russia are derived from Rosstat's sectoral data on output, nominal wages and employment. We use information from national statistical agencies, IMF and CEICDATA to compute similar estimates for Russian trading partners and, eventually, the ULC differential. Due to the problem of data availability, we come up with the ULC estimates for the rest of the world that encompass just 8 major trading partners: euro area, China, United States, United Kingdom, Japan, Turkey, Belarus, Ukraine. We assume that this truncated sample of trading partners generally fits the purpose of our exercise aimed at studying the change of Russian economy's cost competitiveness, as the total share of Russian foreign trade with the countries and country groups listed above is persistently above 70%.

We find empirical evidence for the common drawbacks of using conventional CPI-based real exchange rate indicators, which automatically take into account production costs of both tradable and non-tradable goods, to characterize Russian competitiveness among its major trading partners. Against this background, the real exchange rate of the Ruble calculated via manufacturing unit labor costs advocates for clear gain in competitiveness of the Russian economy during the episodes of 2008-2009 and 2014-2015 currency crises (Figure 2).

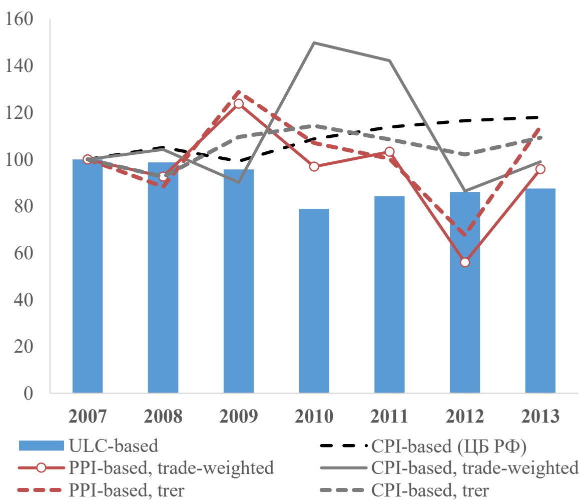
Figure 8. Conventional and newly constructed REERs in Russia, export-weignted



Import-weighted



Trade-weighted



Sources: Rosstat, Bank of Russia, CEIC, IMF International Financial Statistics, authors' calculations.

Consequently, cost competitiveness and widely discussed import substitution may give way to a sustainable revival of the Russian economy that has currently been experiencing substantial structural changes in the tradable and non-tradable sectors. This finding is much less clear in case if we straightforwardly put the real exchange rate of the Ruble through a prism of headline CPI. On top of that, results of our estimation of above-mentioned models introduced in the paper show that specifications employing the time series for the ULC-based REER generally show a much better empirical fit.

Some empirical evidence

We try to find out the most appropriate method of constructing REER to receive a powerful instrument for forecasting Russian industries' competitiveness. At the first stage, we implement Berthou et al.'s (2018) empirical strategy to evaluate the impact of different kinds of REER on industries' export. Table 3 presents the list of variables.

Table 3. List of variables

1	$\Delta \ln \overline{FD_{it}}$	Foreign demand of industry *i* in period *t* (average of delta logs)
2	$\Delta \ln \overline{xREERppi_t}$	Export-based aggregated REER in period *t* deflated by PPI (average of delta logs)
3	$\Delta \ln \overline{xREERcpi_t}$	Export-based aggregated REER in period t deflated by CPI (average of delta logs)
4	$\Delta \ln \overline{xrer\_ppi_t}$	Export-based IS-REER in period t deflated by PPI (average of delta logs)
5	$\Delta \ln \overline{xrer\_cpi_t}$	Export-based IS-REER in period t deflated by CPI (average of delta logs)
6	$\Delta \ln \overline{mREERppi_t}$	Import-based aggregated REER in period *t* deflated by PPI (average of delta logs)
7	$\Delta \ln \overline{mREERcpi_t}$	Import-based aggregated REER in period t deflated by CPI (average of delta logs)
8	$\Delta \ln \overline{mrer\_ppi_t}$	Import -based IS-REER in period t deflated by PPI (average of delta logs)
9	$\Delta \ln \overline{mrer\_cpi_t}$	Import -based IS-REER in period t deflated by CPI (average of delta logs)
10	$\Delta \ln \overline{tREERppi_t}$	Trade -based aggregated REER in period t deflated by PPI (average of delta logs)
11	$\Delta \ln \overline{tREERcpi_t}$	Trade -based aggregated REER in period t deflated by CPI (average of delta logs)
12	$\Delta \ln \overline{trer\_ppi_t}$	Trade-based IS-REER in period t deflated by PPI (average of delta logs)
13	$\Delta \ln \overline{trer\_cpi_t}$	Trade -based IS-REER in period t deflated by CPI (average of delta logs)
14	$\Delta \ln V_{it}$	Export of industry *i* in period *t* (delta logs)

Source: authors' calculations.

Table 4, Table 5, and Table 6 provide preliminary results for the subset of manufacturing industries for 2000-2013. We receive significant positive coefficients for foreign demand ($\Delta \ln \overline{FD_{it}}$) for all specifications. We also find positive and significant impact of the first lag of REERs, both CPI-deflated and PPI-deflated.

Table 4. AREER and IS-REER, 2000-2013, Manufacturing, Export-based

VARIABLES	(1) $\Delta \ln V_{it}$	(2) $\Delta \ln V_{it}$	(3) $\Delta \ln V_{it}$	(4) $\Delta \ln V_{it}$	(5) $\Delta \ln V_{it}$	(6) $\Delta \ln V_{it}$	(7) $\Delta \ln V_{it}$	(8) $\Delta \ln V_{it}$
$\Delta \ln \overline{FD}_{it}$	0.351***	0.330***	0.539***	0.547***	0.667***	0.661***	0.633***	0.781***
	(0.111)	(0.109)	(0.104)	(0.105)	(0.102)	(0.104)	(0.102)	(0.111)
$\Delta \ln \overline{xREERppi}_{t-1}$	0.540***	0.582***						
	(0.0710)	(0.0893)						
$\Delta \ln \overline{xREERppi}_{t}$		-0.0763						
		(0.0883)						
$\Delta \ln \overline{xREERcpi}_{t-1}$			0.210***	0.196**				
			(0.0716)	(0.0861)				
$\Delta \ln \overline{xREERcpi}_{t}$				0.0241				
				(0.0712)				
$\Delta \ln \overline{xrer\_ppi}_{t-1}$					0.295***	0.298***		
					(0.0439)	(0.0488)		
$\Delta \ln \overline{xrer\_ppi}_{t}$						-0.0102		
						(0.0568)		
$\Delta \ln \overline{xrer\_cpi}_{t-1}$							0.483***	0.380***
							(0.0760)	(0.0893)
$\Delta \ln \overline{xrer\_cpi}_{t}$								0.274***
								(0.0911)
Constant	0.0232*	0.0256**	0.0150	0.0139	0.00380	0.00440	0.00009	-0.0172
	(0.0120)	(0.0116)	(0.0119)	(0.0118)	(0.0122)	(0.0122)	(0.0125)	(0.0133)
Observations	12,072							
R-squared	0.007	0.007	0.003	0.003	0.007	0.007	0.006	0.007
Number of id	1,378							

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: authors' calculations.

Table 5. AREER and IS-REER, 2000-2013, Manufacturing, Import-based

VARIABLES	(1) $\Delta \ln V_{it}$	(2) $\Delta \ln V_{it}$	(3) $\Delta \ln V_{it}$	(4) $\Delta \ln V_{it}$	(5) $\Delta \ln V_{it}$	(6) $\Delta \ln V_{it}$	(7) $\Delta \ln V_{it}$	(8) $\Delta \ln V_{it}$
$\Delta \ln \overline{FD}_{it}$	0.700***	0.545***	0.672***	0.641***	0.736***	0.609***	0.702***	0.647***
	(0.102)	(0.0996)	(0.105)	(0.105)	(0.102)	(0.0990)	(0.101)	(0.100)
$\Delta \ln \overline{mREERppi}_{t-1}$	0.358***	0.490***						
	(0.0537)	(0.0578)						
$\Delta \ln \overline{mREERppi}_{t}$		-0.573***						
		(0.0747)						
$\Delta \ln \overline{mREERcpi}_{t-1}$			0.235***	0.895***				
			(0.0811)	(0.117)				
$\Delta \ln \overline{mREERcpi}_{t}$				-0.959***				
				(0.103)				
$\Delta \ln \overline{mrer\_ppi}_{t-1}$					0.414***	0.579***		
					(0.0532)	(0.0595)		
$\Delta \ln \overline{mrer\_ppi}_{t}$						-0.677***		
						(0.0831)		
$\Delta \ln \overline{mrer\_cpi}_{t-1}$							0.755***	1.068***
							(0.117)	(0.146)
$\Delta \ln \overline{mrer\_cpi}_{t}$								-0.768***
								(0.143)
Constant	0.0102	0.00675	0.00320	-0.00675	-0.00991	-0.000637	-0.0199	-0.00567
	(0.0118)	(0.0119)	(0.0131)	(0.0133)	(0.0122)	(0.0119)	(0.0126)	(0.0122)
Observations	12,072							
R-squared	0.006	0.012	0.003	0.010	0.008	0.015	0.006	0.010
Number of id	1,378							

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: authors' calculations.

Table 6. AREER and IS-REER, 2000-2013, Manufacturing, Trade-based

VARIABLES	(1) $\Delta \ln V_{it}$	(2) $\Delta \ln V_{it}$	(3) $\Delta \ln V_{it}$	(4) $\Delta \ln V_{it}$	(5) $\Delta \ln V_{it}$	(6) $\Delta \ln V_{it}$	(7) $\Delta \ln V_{it}$	(8) $\Delta \ln V_{it}$
$\Delta \ln \overline{FD}_{it}$	0.543***	0.468***	0.539***	0.605***	0.681***	0.607***	0.657***	0.596***
	(0.102)	(0.100)	(0.104)	(0.105)	(0.102)	(0.100)	(0.102)	(0.103)
$\Delta \ln \overline{tREERppi}_{t-1}$	0.478***	0.580***						
	(0.0646)	(0.0734)						
$\Delta \ln \overline{tREERppi}_{t}$		-0.341***						
		(0.0927)						
$\Delta \ln \overline{tREERcpi}_{t-1}$			0.147*	0.0654				
			(0.0828)	(0.0890)				
$\Delta \ln \overline{tREERcpi}_{t}$				0.351***				
				(0.0775)				
$\Delta \ln \overline{trer\_ppi}_{t-1}$					0.239***	0.273***		
					(0.0430)	(0.0457)		
$\Delta \ln \overline{trer\_ppi}_{t}$						-0.220***		
						(0.0601)		
$\Delta \ln \overline{trer\_cpi}_{t-1}$							0.581***	0.653***
							(0.0999)	(0.112)
$\Delta \ln \overline{trer\_cpi}_{t}$								-0.243**
								(0.117)
Constant	0.0129	0.0171	0.0201*	0.00828	0.00664	0.0107	0.0001	0.00801
	(0.0118)	(0.0116)	(0.0117)	(0.0119)	(0.0120)	(0.0118)	(0.0122)	(0.0123)
Observations	12,072							
R-squared	0.007	0.009	0.003	0.005	0.005	0.007	0.006	0.006
Number of id	1,378							

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: authors' calculations.

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