Counter-sanctions and agricultural dynamics in Russian regions: has acceleration occurred?

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Introduction

The study assesses the impact of Russian counter-sanctions (Russian 2014`s agri-food embargo and government development programs) on agricultural dynamics in Russian regions in 2014-2017 years.

Favorable conditions for the growth of Russian agriculture and food industry have developed since 2014. In addition to embargo and a double ruble devaluation, which strengthened the position of Russian agricultural producers, government expanded agricultural subsidizing by 18% during 2013-2017. At the same time, new constraints for agricultural development have appeared. The first is contracted consumer demand and the general stagnation of the Russian economy due to the double drop in oil prices and EU/US financial sanctions. The second is an increase of production costs due to the strong dependence of Russian agriculture and the food industry on imported machinery, equipment and some intermediate consumption products, reaching up to 80-90% (Tsukhlo, 2016), (Mitin, 2018). As a result, Russian agro producers faced multidirectional incentives.

Only a few papers are devoted to quantitative assessment of the impact of counter-sanctions (Volchkova & Turdyeva, 2016), (Borodin, 2016, 2018), (Svetlov, Yanbykh, & Loginova, 2019), (Skrypnik, Zaytsev, & Ryazanov, 2019). In the latter, estimates were made only for 2014/2015, or for individual markets (meat markets) or regions of Russia. In some works only ex ante scenario calculations are carried out (see (Volchkova & Turdyeva, 2016)). The effects of the counter-sanction policy are modeled either only taking into account the agri-food embargo, or only taking into account the government subsidies. The current literature indicates positive contribution of embargo and subsidies to dynamics of agriculture in the short term (for 2014). But the cumulative effect off all counter-sanctions has not been estimated yet.

Agro-food industry experts (Gataulina, Shagaida, Uzun, & Shishkina, 2019; Serova, 2019; Sizov, 2017) also agree that the combined impact of the 2014`s events have had a positive impact on agriculture, but experts do not provide quantitative estimates.

Thus, a posteriori analysis of the whole counter-sanction period (2014-2017) is currently missing in literature. Moreover, this issue has not been not analyzed on the base of regional data. To fill this gap, we apply difference-in-difference approach using regional data to estimate the effects of counter-sanctions on Russian agricultural dynamics in 2014-2017.

Research strategy

The empirical strategy is based on the difference-in-difference approach (DD) developed by Card (1990) and the use of the generalized synthetic control group (GSCM) developed by Xu (2017) and extending the synthetic control group (Abadie and Gardeazabal 2003; Abadie, Diamond, and Haimmueller 2010). The gross value added (GVA) and its growth rate in an industry are the outcomes. Panel data, where the unit is an industry in a certain region, allows evaluating the effect of the counter-sanctions in a model with fixed effects. The assumptions of the model are as follows:

- unobserved regional and sectoral heterogeneity does not change over time before and after the counter-sanctions imposed. It implies time-invariant sectoral and regional institutional environment, production technologies, and the amount of resources available;
- no other reasons, besides the counter-sanctions, do not affect the difference between the sectors of the two groups during the period of counter-sanctions.

This is consistent with the so-called parallel trend assumption. In particular, it follows that annual shocks equally affect all sectors. This assumption is quite strong, since agriculture (especially crop production), unlike other industries, is affected by droughts, floods and other climatic changes. The different nature of industries and agriculture was manifested in the fact that the economic crisis of 2009 and the annual fluctuations in weather conditions, in particular the poor harvest of 2010 and 2012, affected the treated and the control groups to a different extent. To overcome the problem, first, the model with fixed time effects is estimated. Model 1 is as follows:

$$y_{it} = \beta_0 + \beta_{1t} Agro_{it} + \beta_2 T_t + \beta_{3t} Agro_{it} T_t + Region_i \cdot Industry_i + \varepsilon_i \qquad (1)$$

here y_{it} are GVA growth rates, T_t are annual dummies, $Agro_{it}$ is a dummy distinduishing the treated and control groups, $Region \cdot Industry$ are fixed effects for a specific industry in a particular region. β_{3t} is the annual change in GVA growth rates in agriculture compared to the base 2005. To assess the differences between the growth rates in 2013 and the counter-sanction years, we estimate the differences in the annual effects of $\beta_{3t} - \beta_{3t\text{-}1}$ as the difference with the initial period is eliminated.

Bertrand et al. (2004) show that with DD for several periods, the null hypothesis that there is no effect is over-rejected due to positive autocorrelation. To solve this problem, they offer several methods: 1) the autocorrelation model is structured in the first step and then used in the evaluation; 2) bootstrapping procedure for estimating t-statistics; 3) clustering of errors. These approaches are implemented. Models are estimated with weights to account for the sizes of the treated group and the control group. We also use weights as the regional share of industrial production (GVA of the industry in the region in 2017).

Another approach to deal with deviation of the parallel trend assumption is to estimate the average GVA growth over the counter-sanction period and the pretreatment period as 2005-2008, 2011 and 2013, periods of violation of the assumption excluded (Model 2). A modification of the model is estimation with only the last level of 2013 as pretreatment. The exposure period is 2015-2017. The model is as follows:

$$y_{it} = \beta_0 + \beta_1 Agro_i + \beta_2 Reform_t + \beta_3 Agro_i Reform_t + Region_i \cdot Industry_i + \varepsilon_{it} \qquad (2)$$

here y_i is the logarithm of the GVA, $Reform$ is the dummy for the pre/sanction period, β_3 is the difference between the groups after the counter-sanctions and respects to the average GVA growth over the counter-sanction period. Since this specification does not model GVA growth rates, but its logarithms, this model automatically adds large weights to large agricultural regions.

We also use GSCM for robustness check. The synthetic control group is a method where "weighted average of available control units approximates the treated unit prior to the treatment" (Abadie et al. 2010). Primarily, this method allows solving the problem of estimation of the treatment effect when the treated unit is unique. Long pretreatment period is required to model the counterfactual. GSCM is the extension of SCM for a multiple treated units. We employ this method to account for a variety of industries and their dynamics in our control group.

Data

The data source is the Russian annual regional statistics of industrial gross value added (GVA) dynamics for 2005-2017 period. We consider agriculture as a treatment group. Electric power industry, construction and hotel services, as well as the transport industry are selected as the control group (the rationale of this selection is given below).

The countersanction («treatment») period includes 2014-2017 years. "Pretreatment" period - 2005-2013 - is not homogeneous in terms of the development of the analyzed industries. We exclude 2009 year - economic crisis in Russia, when there was a significant decline in the control group industries, and the absence of any negative dynamics in agriculture. We also exclude the unfavorable (rainless) years of 2010 and 2012, in which there was a serious decline

in agriculture, and respectively the subsequent years of 2011 and 2013, in which there was a quick recovery (rebound) in agro production if measured in GVA growth rates.

Control group: rationale

The control group of industries in accordance with difference-in-difference approach are selected so that they reflect general macroeconomic trends, but do not experience any specific shocks during the counter-sanction 2014-2017 period. Such specific shocks were the decline in oil prices and US/EU sanctions[1]. In the control group we do not include industries that are subject to these shocks.

The best candidates for the control group, from our point of view, are electric power industry, construction, hotel services and restaurants and transport industry. These sectors are mainly oriented to the domestic market and reflect general macroeconomic dynamics of Russian economy. Construction is particularly sensitive to overall investment activity. The hotel/restaurant business dynamics depends on real incomes and consumer demand, and is also associated with general business activity, since a significant part of hotel business revenues in Russia is related to business tourism.

Common and specific factors of treatment and control groups dynamics

Agriculture and control group industries experienced both common and specific factors in the counter-sanction 2014-2017 period. For correct interpretation of modelling results it is important to characterize these factors.

Common factors for all sectors were a consumer demand decrease due to stagnation in the Russian economy, a decrease in credit availability (negative factors) and a double ruble devaluation. At the same time, it seems that ruble devaluation has a stronger effect on agriculture[2]. Specific positive factors for agriculture are the agri-food embargo introduction since August 2014, and moderate increase in government subsidizing (+ 18% in 2017 compared to 2013 (at current prices)).

Thus, difference-in-difference estimates should be interpreted as a combined effect of the counter-sanctions and ruble devaluation effect. But, it should be kept in mind that devaluation was not an exceptionally positive factor for agricultural dynamics.

[1] Restrictions on obtaining external financing imposed on some Russian banks and companies in the oil and gas sector.

[2] This is due to the fact that the control group branches are oriented on the domestic market, producing mainly non-tradable goods and services. For agriculture, the effect of devaluation is mixed: a positive incentive to expand domestic production and exports (Liefert, Liefert, Seeley, & Lee, 2019) was complicated by rising production costs.

Results

The annual changes in the growth rates of β_{3t}-β_{3t-1} and their significance calculated using the Wald test are shown in the table (Col. 1-4). The FE-model without weights (Table, Col. 1) shows an acceleration in the growth rate of agriculture by 4.9 pp in 2014 compared with 2013. In subsequent 2015-2017 years no additional effect was observed (not significant): that is, the growth rate of agriculture remained at the same level as in 2014. Positive dynamics in the counter-sanctions period is manifested in agriculture precisely against the background of a general stagnation in Russian economy.

Taking into account that the counter-sanctions were introduced in August 2014, the positive effect for 2014 year should not be attributed entirely to the impact of counter-sanctions. While positive effects for 2015-2017 period could be attributed to the impact of both counter-sanctions and ruble devaluation.

When weighing on the regional structure of industries, changes in the GVA growth rates during the counter-sanctions period become insignificant, as well as dynamics in the selected industries in total (Table 3, Col. 4). This indicates that the regions with large agricultural production experienced no, or much smaller effect from counter-sanctions and devaluation.

It should be noted that the parallel trend assumption (β_3 is not significant in the pre-sanction period) is observed only for the base 2005, 2007, 2010, and 2012. Of these, 2010 and 2012 were poor harvest years. Otherwise, coefficients β_3 are significant and positive. That is, agriculture was successfully developing throughout the pretreatment period and the annual growth rates exceeded the same indicators in the sectors of the control group.

The average effect of the counter-sanction period 2015-2017 on agriculture in Model 2, as the GVA growth rate β_3 (Table 1 Col. 5), is insignificant when compared with the period 2005-2013 excluding 2009-2010 and 2012 years. Whereas the industries on average had a small significant annual growth of β_2 = 0.054pp. If we compare the GVA in 2013 with the period 2015-2017, then the industry show an average 0.62pp increase in GVA. While the growth rate in agriculture in comparison with the control group was 0.53pp lower (Table 1 Col. 6). This results, in general, are consistent with those obtained by estimation of Model 1 with weights (Table 1, Col. 4).

Application of GSCM to GVA growth rates, as an outcome (Table 1 Col. 7), provides more optimistic results. The estimated average treatment effect (ATT) of the counter-sanction period on the changes in GVA growth rates is significant in 2015-2017. ATTs suggest that the GVA growth rates in the counter-sanction period were increasing from 0.14pp in 2015 to 0.19pp in 2017. However, the results are likely attributed to the inclusion of periods where the assumption of a parallel trend was violated, that is, using the entire period 2005-2013 as the

pretreatment for the selection of weights of the synthetic group. It should also be noted that GSCM does not allow the inclusion of regional fixed effects in the model, which also reduces the credibility of the results.

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Since 2014, the Russian economy has been developing under US/EU-sanctions and counter-sanctions. The sanction policy has both a negative effect on the decline in business activity and a positive one, creating protectionist conditions for a number of industries, including agriculture Our results indicate, that regional dynamics of agriculture in the counter-sanction 2014-2017 period has accelerated by 4.9 percentage points (on year basis). At the same time, the main effect was experienced by the regions which contribution in Russian agricultural production is not large

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Table The estimates of the effect of sanction period

	DD-Model 1				DD-Model 2		DD-GSCM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	no weights	sample weights	industrial weights by production	bootstrap, no weights	2005-2008 2011 2013 as pretreatment period	2013 as pretreatment period	ATT estimates
Common trend							
2014	-0.386	-0.386	1.427	-0.386			
	(1.043)	(1.043)	(1.533)	(1.337)			
2015	-3.539	-3.539	-3.581	-3.539			
	(1.072)	(1.072)	(2.875)	(1.212)	0.0542***	0.620***	
2016	2.082***	2.082***	2.111	2.082	(0.0160)	(0.0210)	
	(0.856)	(0.856)	(2.187)	(1.257)			
2017	1.002	1.002	-1.892	1.002			
	(1.273)	(1.273)	(1.692)	(1.435)			
Effect of the counter-sanctions (to the previous year) $(\beta_{3t}-\beta_{3t-1})$							
2014	4.884*	4.884*	1.398	4.884			0.092***
	(2.908)	(2.908)	(3.532)	(2.509)			(0.029)
2015	-1.909	-1.909	-2.649	-1.909			0.142***
	(2.831)	(2.831)	(3.904)	(3.331)	0.0162	-0.526***	(0.040)
2016	-2.910	-2.910	-1.583	-2.910	(0.0260)	(0.0261)	0.160***
	(1.805)	(1.805)	(2.784)	(2.858)			(0.044)
2017	2.609	2.609	1.550	2.609			0.190***
	(3.078)	(3.078)	2.527)	(3.148)			(0.045)

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. The estimates in Col. 1-4 are made by Wald test. The estimates for the pretreatment period in Col. 1-4 are not presented.