



Chapter 3: The Role of Food Exports in Russia's Economy

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1 INTRODUCTION

The impressive increase in Russia's agri-food exports makes this chapter possible and gives it significance. Twenty years ago, Russia was not an important food exporter; today it is. Because Russia's food exports have become more significant, the chapter explores the role of food exports in Russia's national economy from different perspectives. In the 1980s, the USSR was a large grain importer and exported small amounts of agricultural and food products to its allies in Eastern Europe. In the post-Soviet 1990s, Russia's agricultural production plummeted during the transition to a market economy, and it reduced grain imports but became a large meat importer (see Chapters 1 and 2). Further, Russia's position in the 1990s was unfavourable because it produced low-quality wheat which did not have high global demand. Moreover, in general the country did not have capacity for large-scale food export. The claims of some experts that this situation could change relatively soon were not well-grounded.

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The inability to become a large food exporter was rooted not only in the dramatic fall of agricultural production in Russia after the crash of the USSR, but also in the structure of the Soviet economy in its last decades. After many political efforts to become a top agrarian power in the world (the campaign on developing virgin lands in Southwest Siberia and North Kazakhstan is a well-known example), the last years of the Soviet era witnessed the country having to trade oil and gas in exchange for buying food abroad.

During the past 20 years Russia's agricultural sector has rebounded and as noted by several authors in this book, the country has emerged as a major grain exporter. The existing literature related to Russia's food exports is not large but is growing and contributes to our understanding of the development of Russia's agricultural export capacity. Petrenko and his colleagues provide a brief historical review of food regulation in the Eurasian Economic Community.¹ Russia inherited important principles that earlier had been implemented by the World Trade Organisation (WTO), the Organisation for Economic Co-operation and Development (OECD), and the European Union (EU), and adjusted those processes to the institutional and technical heritage of the Soviet agricultural sector. Taking this pathway made it possible to establish stable and sufficiently working institutions. These, on one hand, made it worthy for producers to learn how to trade abroad; on another hand, secured food sufficiency and safety in domestic markets. Rau explores the quantitative characteristic of how the integration process changed agriculture and trade in the Eurasian Economic Union during the first decade of its operation.² Forecasts by Visser et al. and Liefert et al. that Russia could only be a moderate grain exporter has not played out in reality as Russia has achieved a significant share in global markets for grain and sunflower oil.³ More recently, other analysts have explored the impact of Russia's food security policy on food exports and prospects for a significant expansion of food exports to 2024 as posited by President Vladimir Putin.⁴ Currently, the Russian government is pursuing larger market shares for fish and seafood, vegetable oils, animal products, and processed food.⁵

Other macro-level debates raise other questions about Russia's food exports. For one, the resources and capacities of Russia, either alone or as part of the Eurasian Economic Union, have led many Russian-speaking researchers to optimistic views on the future of Russia's expansion of food exports and the food sector. However, Russia's food sector still suffers from institutional shortcomings, obsolete habits, excess risk aversion,

paternalism, poor management of human resources, and deficits in working capital. A different question asks whether agricultural exports can contribute to the welfare of people living in Russia. Ksenofontov warns that an increase in world grain prices creates incentives for increasing exports, possibly with damage to consumers if domestic prices increase as well.⁶ Others, however, conclude that risks to national food security arising from international food trade are minor.⁷ In either case, it is clear that certain political risks exist that could affect Russia's agri-food exports.⁸

Why does Russia export grain? Russia's grain exports are necessary when the yields are high. Liefert analysed border and domestic prices and concluded that the price transmission into domestic Russian markets is incomplete, and second, is due to the underdeveloped market infrastructure.⁹ Uzun and his colleagues show that the grain export volumes are weakly sensitive to price gaps between border and domestic prices, but very sensitive to current grain production with a delay of up to two months.¹⁰ Thus, exports are caused by the limited grain storage capacity within the country during large harvests, and this shortcoming limits the country's ability to benefit from favourable prices in the international grain market. Krylatykh and Belova, as well as Uzun and Lerman, argue that Russia can benefit from increased consumption of grain even while reducing its export, and instead entering the global market for animal products.¹¹

The purpose of this chapter is to examine from an economic perspective the significance of Russia's agri-food exports. It addresses two main questions: (1) what contribution do food exports make to the national economy and specifically the agricultural sector?; and (2) what contribution do food exports make to the national budget? The chapter is organised as follows. Section 2 uses national statistics and estimates from the available literature to explore the contribution of food exports to the national economy and the agricultural sector. Section 3 studies the expected consequences of various policy interventions primarily to figure out whether (and how) the role of agricultural export in Russia's economy can be increased by policy measures. Section 4 concludes with an outlook for Russia's food exports.

2 THE CONTRIBUTION OF RUSSIA'S AGRI-FOOD EXPORTS TO THE NATIONAL ECONOMY

Despite the impressive gains in the value of food exports during the last two decades, agri-food exports are far from a dominating share in Russia's overall exports. Popkova and Sukhodolov indicate the share of food products and agricultural raw materials in Russia's total exports measured in USD: 1.8 percent in 1995, 1.6 percent in 2000, 1.9 percent in 2005, 2.2 percent in 2010, and 3.8 percent in 2014.¹² In 2016, the share of agri-food exports amounted to 5 percent of total exports according to Rosstat.¹³ Agriculture exports alone accounted for only 1.81 percent of Russia's national exports in 2016. To compare, the export of oil and gas contributed nearly 19 percent of total national exports and about 5 percent of Russia's GDP. These data suggest that food exports play a secondary, if not tertiary, role in the Russian economy, although their role is steadily growing. That said, it is necessary to point out the record harvest in 2017 and the second highest harvest in post-Soviet Russia's history in 2020, including the higher levels of wheat output, help to account for a higher percentage of total exports than in 2016.

The agri-food sector largely relies on exports for its development, especially in recent years, thus suggesting the emergence of an export-led development strategy. Russia's agri-food exports grew annually by an average of more than 18 percent from 2001 to 2018. The fastest rate, 56.4 percent, was achieved in 2011 due to recovery after the drought of 2010 (see Table 1). The growth of food and agricultural export outstrips Russia's growth in total exports. After Russia's accession to the World Trade Organization in August 2012, the rate of export growth became lower, with an average rate of only 0.5 percent for the period from 2012 to 2016. This slowdown was caused by the high base from 2012. Nonetheless, the role of agricultural exports as a source of foreign currency inflows to Russia's economy is significant, although still far from the topmost.

Although Russia's agri-food sector is small in comparison to the whole national economy (as measured in the monetary value of output), it still influences the lives of more than 37 million rural dwellers as an employer, supplier, buyer, and taxpayer. The sector's capacity to contribute to family or municipal income is directly related to its export capacity. While the Russian economy has numerous sources of foreign currency, there exist millions of workers whose budgets and welfare are very sensitive to the

Table 1 Russian agri-food exports in comparison to other national indicators

Year	Total exports of agri-food products				Grain and legumes exports			
	Billion USD	Increase compared to the previous year	Percent of gross of Russia's export	Percent of gross agricultural production	Billion USD ^a	Increase compared to the previous year	Percent of gross agricultural production	
2001	1.460	...	1.46	4.64	0.3	...	0.95	
2002	2.177	1.49	2.04	7.05	1.0	3.3	3.24	
2003	2.690	1.24	2.01	7.67	1.1	1.1	3.13	
2004	2.479	0.92	1.37	5.70	0.7	0.6	1.61	
2005	3.881	1.57	1.61	7.96	1.4	2.0	2.87	
2006	4.849	1.25	1.61	8.38	1.6	1.1	2.76	
2007	8.257	1.70	2.35	11.34	4.1	2.6	5.63	
2008	8.389	1.02	1.79	8.86	3.3	0.8	3.49	
2009	9.281	1.11	3.08	12.34	3.5	1.1	4.65	
2010	7.250	0.78	1.83	8.94	2.4	0.7	2.96	
2011	11.337	1.56	2.19	10.75	4.6	1.9	4.36	
2012	16.738	1.48	3.19	16.46	6.6	6.252	1.4	6.49
2013	16.227	0.97	3.09	14.97	4.9	4.752	0.7	4.52
2014	18.981	1.17	3.82	18.18	7.3	7.060	1.5	6.99
2015	16.181	0.85	4.71	20.69	6.0	5.651	0.8	7.67
2016	17.045	1.05	5.97	22.28	6.0	5.610	1.0	7.84
2017	20.706	1.21	5.79	23.63	7.9	7.490	1.3	9.01
2018	24.885	1.20	5.54	29.28	10.8	10.464	1.4	12.71

^aValues printed in small font relate to grain export

Source Author's calculations based on Rosstat data

success and failure of agri-food exports. In 2001, the agri-food sector sent less than 5 percent of its production abroad, so revenues almost exclusively depended on the domestic market. By 2010, as Table 1 shows, the share of production exported abroad was about 10 percent, but by 2018 the share increased to about 30 percent. In other words, exports account for a substantial portion of growth within the agricultural sector. Thus, Russia's contemporary agri-food sector largely depends on exports, first, from the viewpoint of ability to reach foreign markets, and second, from the viewpoint of monetary inflows.

Among food exports, the export of grain (including a small share of legumes) is the most important (see Chapter 2). Since 2005, grain exports account for at least 30 percent of gross agri-food export. The average

annual growth rate for the exports of grain and legumes during 2001–2018 is almost 23.5 percent, a high number that is due mostly to a very low base in 2001. Because gross grain yields and weather conditions in a specific year have a significant impact on grain exports, it would be more correct to compare the averages of two nine-year periods, 2001–2009 and 2010–2018. In the 2001–2009 period, mean exports of grain and legume amounted to \$1.9 billion USD. In the 2010–2018 period, mean exports of grain and legume increased to \$6.3 billion USD. The nine-year growth has an average annual rate of 14.3 percent. The average annual growth rate for agricultural and food exports amounts to 14.7 percent, so the share of grain remains relatively stable in the long run. In comparison to gross agricultural production, the value of grain export reached 12.7 percent of total agricultural production by 2018. The value of grain exports in 2019 fell to \$7.928 billion USD, with grain and legumes exports valued at \$8.3 billion USD, which equals about 9 percent of gross agricultural production.

2.1 The Contribution of Agri-Food Exports to Agricultural Production¹⁴

Russian agriculture is meeting internal needs and import substitution, witnessed by the fact that domestic consumption per capita has approached the standards recommended by the Ministry of Health. At the same time, Russia's agrarian sector has significant potential and opportunities to increase its efficiency. Russia accounts for about 4.5 percent of the world's agricultural land and has only 2 percent of the global population. Under these conditions, exports play an increasingly important role in the growth of agricultural and food production.

Gross agricultural output from 2000 to 2018 increased by almost one and a half times. Crop and livestock production grew at approximately equal rates. The highest growth rates in production were observed in poultry meat farming (by 5.9 times), sugar beets and oilseeds (by 2.9 times), and in pig farming (by 2.2 times). During the same time period, the production of potatoes and forage crops decreased by 24 and 30 percent, respectively, as did beef and milk production by 16 and 5 percent respectively. The most significant contribution to the growth of gross agricultural production was made by grain farming and poultry meat farming: together their share accounted for more than 50 percent of gross growth

(26 percent for grain and almost 29 percent for poultry meat). Contributions to the growth of gross output were also high due to the growth in the production of oilseeds and pig breeding (more than 19 percent), as well as vegetables (8 percent) and sugar beet (4 percent).¹⁵

In parallel with the growth of agricultural production, the value of agri-food exports increased (see Table 1). During the period 2000–2018, the share of agri-food exports from crop production increased from 3 to 27 percent, while the share of export from livestock production remained low. The largest increase in exports was from the gross production of oilseeds and grain. In 2018, more than three-quarters of oilseed production was exported, including the export of sunflower oil. During 2012–2018, 31.5 percent of all grain production (including legumes) was exported. During the same period, the share of exported fruits (including berries and nuts) and poultry meat was 5.2 and 2.2 percent of production. For comparison, during 2000–2005 these shares were 10.4 percent for grain and legumes, 3.8 percent for fruits, berries, and nuts, and only 0.1 percent for poultry meat.¹⁶

According to calculations by this author, the growth in exports influences an increase in production. Exports in effect spurred sectoral growth during 2000–2018. Calculations show that for the period 2000–2018, the estimated contribution of exports to the incremental production of grain and legumes is 79 percent. A similar estimate for oilseeds shows that exports accounted for 61 percent; 56 percent for sunflower; and 78.5 percent for rapeseed. Conversely, the contribution of exports to livestock production appears very small, reaching only 0.9 percent for livestock (including poultry) and 2.4 percent for eggs during the same period. The contribution of exports to the production of cattle, milk, and wool approximates zero. In total, the growth of agri-food exports during 2000–2018 caused about 34 percent of the growth in gross agricultural output.

In conclusion, since 2000 exports have stimulated growth for a significant part of gross agricultural production. The contribution of exports to growth in the agri-food sector is positive and statistically significant for products that by 2018 accounted for 43 percent of gross agricultural production. Although the rate of growth in agri-food exports from the past two decades may not be duplicated in coming years, it can be projected that exports will remain a main source of growth in the agricultural sector. This projection is based on the satisfaction of consumption

demand by domestic production and a stabilisation in the volume of agri-food imports.

2.2 Budgetary Inflows from Agri-Food Exports Compared to Overall Budget Inflow

Due to the diversity of budgetary transfers and institutions reporting them, it normally is very difficult to assess the contribution of the agricultural sector as a taxpayer into the national budget from exports. Unfortunately, input–output tables are published seldom and differ from each other in how they aggregate economic activities. For 2016, however, a set of sufficiently detailed input–output tables for the Russian economy is available from Rosstat, which makes it possible to understand the role of agri-food exports in the national budget. The discussion below is based on this author’s calculations from available input–output data. To start, I refer the reader to Table 2, which shows net taxes paid by different sectors of the economy.¹⁷

A main conclusion from Table 2 is that the boom in Russia’s agri-food exports brings almost nothing to the consolidated budget. This conclusion is based on two considerations. First, the oil and gas industries provide more than one-third of overall net tax inflows and, if we limit the analysis to the tax inflows from exports only, more than 97 percent of the total. Thus, any other tax revenue from exporting businesses is minuscule for the national budget in comparison. Second, agri-food exports are taxed 5.2 times lower than household consumption, accumulation, and other internal uses. The rate of net taxation for exported agricultural output is 0.65 percent and for the remaining part it is 3.4 percent. Both rates are quite low, inasmuch as part of taxes are returned to agricultural producers via various subsidies. It becomes evident that the exported part of total agricultural output is taxed lower, and this helps Russia’s agricultural exporters to increase their shares in international markets. Lower taxes also positively influence the welfare of the rural population, but lower taxes barely make a contribution to the consolidated national budget. While it is true that the large harvests in 2017 and 2020 generate somewhat more tax revenue, it remains true that in terms of net input–output much of even higher tax revenue is returned to agriculture in the form of myriad subsidies.

Table 2 Net taxes from selected sectors of Russian economy

<i>Sector</i>	<i>Net taxes from exported production, million USD</i>	<i>Net taxes from exported production percent of national total</i>	<i>Net taxes from gross production, million USD</i>	<i>Net taxes from gross production, percent of national total</i>	<i>Net taxes from exported production, percent of those from gross production</i>
Agricultural products	14.7	0.04	980.2	0.89	1.50
Food and agricultural products	39.3	0.12	15,856.1	14.34	0.25
Food (excluding fish) and agricultural products	37.3	0.11	15,854.2	14.34	0.24
Total of national economy	33,106.3	100	110,535.4	100	29.95
Oil, oil-based products and natural gas	32,187.7	97.23	41,427.0	37.48	77.70

Sources Rosstat; author's calculations

The main takeaway of this subsection is that Russia's agri-food export is not a significant source for Russia's national budget. The positive contribution from agri-food exports to the national economy falls into the hands of private actors. Subsequently, revenue is redistributed between various economic agents through a network of contract relations, including employment contracts.

3 HOW SENSITIVE ARE AGRICULTURE EXPORTS TO TRADE POLICIES?

State financial support to agriculture in various forms has increased substantially since 2006, helping to boost food production. That part of the story has been well told.¹⁸ This section explores the impact of national policy on Russia's agri-food exports. The section examines

through modelling the extent to which agri-food exports are sensitive to trade policy.

3.1 *Methodology*

At a policy level, scholars and analysts have known for many years that trade policy affects the level of exports through such instruments as export subsidies, export quotas, or outright export bans. Russia does not use direct export subsidies but did ban wheat exports in 2010–2011 and introduced the option to enact export quotas for the second half of agricultural years starting in January 2020. While it is generally true that national trade policy impacts agri-food exports, this section is unique in that it attempts to measure the sensitivity of agri-food exports to different policies. To measure sensitivity, the section employs a mathematical model called the ‘production frontier plus partial equilibrium’.¹⁹ The mathematical principle of combining the production frontier with partial equilibrium equations is developed in Central Economics and Mathematics Institute (Moscow). This principle was used in an analysis of the impact of climate change on Russia’s agricultural markets, taking into account spatial differences.²⁰ The purpose of the model is to quantify the effects of policy change based on four scenarios.²¹

The ‘base scenario’ simulates the policies that were in force during the model’s base period 2013–2017. The differences between the base scenario and reality are twofold. The first difference is that the base scenario assumes that each region consumes each of five products that is sufficient to comply with food consumption norms recommended by Russia’s Ministry of Health. The second difference is that the scenario presumes equilibriums in all the markets which, in general, is not the case in reality. Four alternative scenarios are compared to this base scenario. All the four inherit the conditions of the base scenario with some specific change.

The first alternative scenario imposes some effective regulation that increases the export of five products in total by at least 10 percent compared to the base scenario. In this scenario, ‘the government’ permits the producers to meet food consumption norms at least 95 percent of the recommended levels instead of 100 percent in the base scenario. This scenario describes partial redistribution of sales from domestic to foreign markets. The second scenario relates to when the country rejects the regulations of the World Trade Organisation. The scenario imposes 10 percent

export subsidies on the five products. Other conditions do not differ from the base scenario. The third scenario relates to forcing national agribusinesses to use a larger share of their grain production as fodder internally instead of exporting it.²² The scenario imposes a 10 percent export tax on wheat and grain while leaving other conditions of the base scenario unchanged. The fourth scenario is 'populistic'. It imposes a 10 percent export tax on the export of the five products, a step that would partly lock in the supply for the domestic market, resulting in lower domestic prices for producers if during good harvest years.

3.2 Results

The major economic indicators for the entire agricultural sector under the four scenarios are summarised in Table 3. In the case of the first scenario, the growth of the gross margin is fully due to the opportunity to reduce food supply to regions with low demand, while in the second scenario it is due to the considerable export subsidy inflows. The second and third scenarios promote exports, increase production, reduce domestic sales and import, slightly raise domestic prices, and increase the sectoral gross margin.

Table 3 Models of agricultural production under different trade policies (billion USD)

<i>Indicator</i>	<i>Scenario</i>				
	<i>0. Base</i>	<i>1. Export + 10%, food security rate -5%</i>	<i>2. Export subsidy + 10%</i>	<i>3. Grain export tax +10%</i>	<i>4. Export tax +10%</i>
Production	80.09	81.12	81.12	79.93	79.92
Domestic sales	89.27	88.13	88.26	89.25	89.24
Import	21.60	19.90	19.90	21.58	21.56
Export	9.89	10.87	10.87	9.81	9.79
Farm gate price index to the base scenario	×	1.014	1.014	0.997	0.997
Gross margin	8.51	10.14	10.27	7.70	7.45

Source Author's calculations

In the third and fourth scenarios, exports account for less agricultural production in comparison to the base scenario and also in domestic sales, although this effect is small. The reason is a lower margin on sales, which makes it unprofitable to supply food above the set food consumption rates in some regions. The decline in the gross margin is caused by lower domestic prices, lower exports, and larger imports.

In general, we conclude that the policy has a weak impact on the outcomes of policy. The overall outcome of the export promoting policy is clearly to the favour of agricultural producers, yet at the expense of domestic consumers, who experience a bit lower consumption and a bit higher prices, and taxpayers (in the case of the export subsidising scenario).

Thus, it can be concluded that purely economic considerations do not support any systematic change in the agricultural and trade policy from the base period. In the view of this, large policy changes are not very likely, unless they would be driven by non-economic considerations, and even if that occurs, they will not make important changes in the domestic production and markets.

4 OUTLOOK

It is essential to distinguish the role of agri-food exports in Russia's national economy and in its national food economy. In the national economy, the role is still minor, while in latter the role is very important. This chapter has shown that the percentage of agri-food production is now exported, but the agri-food sector does not contribute much to the national economy or to the national budget, although exports do spur development in the agricultural sector and do provide some welfare to the rural population. For these reasons, the short-run outlook for an expansion in Russia's agri-food exports will likely be driven from commercial interests. Over the longer term, one can ask whether agricultural export can one day become a factor of importance for the welfare of the whole nation.

As for now, Russia has a wide choice on what to export in the future, depending on its successes or failures in frontier research, global demand for oil and gas, the consequences of climate change,²³ and its political willingness to join international food production chains. Even with comparative advantages due to climate change, Russia's agricultural sector is unlikely to become one of the topmost sectors of the national economy

unless severe crises occur in other sectors that currently fund the national economy and budget. In addition, scenario modelling makes it evident that in the short run there is a very small likelihood for raising the role of agricultural exports in the national economy through trade policy instruments. Sanctions and countersanctions between the European Union and Russia constrain exports.²⁴ Sanctions in general slow down further Russia's achievements in international agricultural trade.

That said, Russia's agri-food exports face both obstacles and opportunities in the years ahead.²⁵ My feeling is that agri-food exports are more likely than not to keep growing in the coming years, although the rate of growth may decrease. Two factors favour an increase in production that may fuel higher exports: progress in technology as well as overcoming existing inefficiencies; and, to a smaller extent, an abundance of unused land suitable for cultivation.²⁶ In the long run, Russia's large water resources became an important additional factor contributing to the competitiveness of crop production in the country compared to increasing aridity around the world.²⁷ Thus, the role of agricultural export in overall Russia's economy is likely to gradually increase, but within the constraints and limitations that have been examined in this chapter.

NOTES

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 12. Elena G. Popkova and Yakov A. Sukhodolov, *Foreign Trade as a Factor of Economic Growth: Russian-Chinese Foreign Trade Cooperation* (Cham: Switzerland: Springer, 2017), 50.
 13. This figure encompasses the production of agriculture, services provided to agriculture (excluding veterinary), hunting and breeding wild animals, fishery, all kinds of food products, beverages and tobacco.
 14. The subsection is based on the earlier quantitative study carried out at the Russian Presidential Academy of National Economy and Public Administration (RANEPa) with the participation of the author of this chapter. Nikolai M. Svetlov, Denis S. Ternovskii, Vasilii Ia. Uzun, Natalia I. Shagaida, Ekaterina A. Shishkina, *Vliianie eksporta na sel’khozproizvoditelei i potrebiteli v Rossii* (Moscow: Izdatel’skiy dom Delo, 2020), 17–25. The

methodology is developed by Professor Vasili Ia. Uzun in cooperation with Professor Denis S. Ternovskii.

15. The largest negative contribution in gross production was due to the decline in potato growing (by 6.7 percent) followed by the decline in the production of forage crops (by 3.8 percent), cattle for slaughter (3.9 percent) and milk (2.7 percent).
16. A methodological issue arises while quantifying the contribution of export in the growth of agricultural production. Ultimately, the role of exports is defined as its contribution to the indicators of growth in gross output. However, the use of the traditional approach, which provides for the calculation of the ratio of incremental export to incremental production, in the case of the analysis of agricultural exports is difficult for the following reasons. First, the dynamics of exports are not solely provided by production change, but also by changes in stocks, consumption and imports. Second, export volumes, as a rule, tend to be stable over time because of the need to secure the occupied share of the international markets, even in a situation of a short-term or cyclical reduction in production. Taking into account the above, the contribution of exports to the growth of gross output for an individual agricultural product is calculated in the RANEPА study as the ratio of the average absolute increment of its export to the average absolute increment of its production. Furthermore, both increments are computed from the parameter estimates of functions that approximate the original time series, provided that these estimates are unidirectional for both export and production and statistically significant. In turn, the average estimate of the contribution of exports to the output of any product aggregate is calculated as the average weighted by the share of the incremental production of each product in the incremental output of gross agricultural production for 2000–2018. See Svetlov, Ternovskii, *Uzun, Shagaida, and Shishkina, Vliianie eksporta na sel'khozproizvoditelei i potrebitelei v Rossii*.
17. The calculations are based on Rosstat's input–output tables spreadsheet accessed March 1, 2020 from <https://rosstat.gov.ru/storage/mediabank/baz-tzv-2016.xlsx>. One of sheets in this file contains data on net tax (i.e. tax less subsidies) transfers to the consolidated (i.e. federal, regional and local in total) national budget, distributed among products and sectors. The row 'Agricultural products' in Table 2 sums up rows in the source sheet coded 001 to 008 and 010 to 017. The row 'Food and agricultural products', adds to the list above rows coded 022, 036 to 046 and 049 to 055. The next row 'Food (excluding fish) and agricultural products' excludes the code 022 from the bundle of codes for the previous row. The row 'Total of national economy' comes from code 207. Finally, the row 'oil, its products and gas' sums up rows 025, 026 and

079. Column ‘Net taxes from exported production’ comes from column coded 109 in the source and column ‘Net taxes from gross production’ from column coded 111. Then all the transfers are converted into million USD.
18. Wegren, Nikulin, and Trotsuk, *Food Policy and Food Security*, 54–76.
 19. Nikolai M. Svetlov, ‘Neparametricheskaia granitsa proizvodstvennykh vozmozhnostei v vychislmoi modeli chastichnogo ravnovesiia’, *Ekonomika i matematicheskie metody* 56, no. 4 (2019): 104–16.
 20. Nikolai M. Svetlov and Ekaterina A. Shishkina, ‘Innovatsionnaia model’ chastichnogo ravnovesiia v prilozhenii k analizu effektivnosti izmeneniia klimata’, *Mezhdunarodnyi sel’skokhoziaystvennyi zhurnal* 5 (2019): 58–63.
 21. The model operates with six products: wheat, other grain, sunflower, milk, meat (in liveweight measure) and the remaining agricultural production. The products are measured in 1000 tonnes, except for the latter, for which the monetary measure is used. The model allows inter-regional transportation (along with import and export) and calculates revenues using prices of the region where the product is consumed, again excluding the remaining production: its transportation (both within the country and across its borders) is not modelled and the prices to calculate revenue from its sales are those of the producing region. For simplicity, it is assumed that the products are always transported in kind and processed at the place of consumption.

The production frontier is defined as the following set of resources: labour resources; arable land; all agricultural land; value of fixed assets used in agricultural production; the resource of mechanical power; herd population (derived to the number of cows); working capital. This frontier differs on 12 natural agricultural zones defined with respect to climate and soil conditions and on the year-specific conditions modelled from five distinct years of the period 2013–2017. The modelled unit (region) is a Russia’s federal subject. In total, the model includes 82 regions, of which 80 are agricultural producers and two remaining regions are cities (Moscow and Saint Petersburg). Crimea and Sevastopol are not included in the current version of the model.
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