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Russia in world trade: Between globalism and regionalism

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Abstract

The article examines Russia's participation in world trade and trade policy, using trade data for 1996–2017 and simulations of a numerical world trade model where Russia is divided into domestic regions. Since the mid-1990s, Russia's foreign trade has grown much faster than the world average. This was accompanied by rapid deterioration in the trade balance for manufacturing, and fast redirection of imports, with more from China and relatively less from others, especially Eastern Europe. Only $^{1}/_{8}$ of Russia's foreign trade in 2017 was with Eastern Europe. This is why Russia can gain more from trade integration with the world beyond Eastern Europe, according to the model simulation analysis. For Russian domestic regions, multilateral liberalization among all countries has a similar effect across all of them, with a welfare gain due to lower import prices. For the commodity-exporting regions of Russia, preferential free trade agreements (FTAs) have a similar impact. For the more industrialized Russian regions, on the other hand, FTAs lead to manufacturing growth, rising wages and higher prices, and a larger welfare gain. According to the model simulations, trade integration promotes industrial diversification, with manufacturing growth also in some commodity regions. The results indicate that external liberalization is particularly important for the central parts of Russia; with Volga and West Siberia generally obtaining the strongest manufacturing boost from trade integration.

Keywords: international trade, trade policy, globalization, regional integration, model simulation, regional inequality, domestic regions.
JEL classification: C15, C6, D58, E31, F1, F6.

1. Introduction

Since 1990, Russia's economy and trade have undergone dramatic changes.

- The end of communism, following the fall of the iron curtain in 1989 and the dissolution of the Soviet Union two years later, led to a strong reorientation

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towards Western Europe, and the gradual decline of intra-Soviet and (former) intra-COMECON trade.

- But Russia's foreign trade did not decline in the longer run: on the contrary, its exports were fuelled by rising commodity prices. In the following, we show that until 2011–2012, Russia's trade was among the fastest growing in the world — not only for exports but also including imports.
- Russia's trade was accompanied by fast geographical reorientation of trade; notably the rise of Asia, replacing post-Soviet trade and to some extent trade with Europe with imports from Asia and particularly China.
- Parallel to this geographical change, there was a rapid weakening of the trade balance in manufacturing — faster than for other major countries.
- The last phase of Russia's encounter with globalization is from 2014. This combines two major influences: First, the end of the commodity price boom hit Russia's trade and globalization strongly, with curves falling in many areas. Second, there was the Ukraine crisis and the souring of Russia's relations with the West, including sanctions and countersanctions.

On top of these developments, there were also the international economic cycles that hit Russia hard, with sizeable dips in GDP in 1998, 2009 and 2015.

In the first part of this article, we describe the fast changes in Russia's foreign trade during 1996–2017, decomposing trends in order to see what is due to the cyclicality in commodity prices, and what is due to other factors.

In the second part of the article, we use numerical model simulations to shed light on Russia's trade policy options, presenting new results using the world trade model presented in Melchior (2018). This is a stylized global model with three sectors (commodities, services, tradables), where industrial structure, trade and income levels are endogenously determined. In the model, large countries such as Russia are split into domestic regions, and we present results not only for Russia as a whole, but also for its major domestic regions. With fuels representing more than half of Russia's exports in 2018, it is also important that commodities are part of the analysis. For commodity traders, terms-of-trade effects of trade policy are of particular importance and the model captures these effects in a stylized way.

In the empirical part as well as in the reporting of numerical model results, we generally split the world into seven major regions:

- The three industrial world regions are Asia/Pacific, North America and Western Europe.
- The four commodity regions are Africa, Eastern Europe, the Middle East and Latin America.[1]

This article uses the terms regionalism or regionalization for trade and trade integration within world regions, and globalism or globalization for economic integration between them.[2]

In the analysis of Russia's trade and trade policy, a key issue is about regionalism versus globalism: How much can Russia gain from intra-regional integration within its Eastern European neighborhood, compared to global integration? For

[1] Eastern Europe is here the former Soviet Area except the Baltic states, or CIS (Commonwealth of Independent States) + Georgia and Ukraine. Since Russia is the main focus of the analysis here, results are often reported for Eastern Europe except Russia.

[2] We use the term "globalism" independently from President Trump, who has recently given the term a more negative interpretation!

Russia, the major trade policy events in recent years have been the accession to the World Trade Organization (WTO) in 2012, and the formation of the Eurasian Economic Union (EAEU) in 2015 (preceded by the Eurasian Customs Union in 2010, and the Eurasian Economic Space in 2012). How much is there to gain; which track is more important, regionalism or globalism? We do not say that the two are mutually exclusive; but aim to shed light on the economic impact and proportions. For Western Europe, regionalization was a post-war driver of growth; can Russia obtain the same?

As a commodity trader, Russia is by nature more globally oriented. As shown by Melchior (2018, Ch. 2), commodity trade is more globalized than manufacturing trade, in the sense that the share of intra-regional trade in total trade is higher for manufacturing. The key industrial regions of the world have large two-way trade in manufacturing within their regions and between them. These two types of trade flows — within and between the three industrial regions — represented about ¾ of world gross trade in 2015 (Melchior, 2018, p. 26). For the four commodity regions, intra-regional trade is more limited, and a large part of trade is exchange of commodities for manufacturing vis-à-vis the industrial regions. These trades between industrial and commodity regions represented another 22% of world trade in 2015. The residual, trade within and between the four commodity regions, represented a share of only 4% of world trade in 2015 (Melchior, 2018, p. 26)! For the commodity regions, representing 131 countries, intra-regional trade is therefore relatively small. The question is: Can they still gain from intra-regional integration between them? The answer suggested by the model-based analysis in Melchior (2018, Ch. 8) is partly affirmative; e.g., Africa is one of the world regions that has (relatively) more to gain from intra-regional integration. In this article, we consider the balance between regional and global integration for Russia. We focus on trade and trade integration only, and it should be recalled that, e.g., the EAEU includes elements that are not captured by this trade-focused analysis, such as migration.

The analysis of regional versus global integration must be distinguished from aspects related to domestic regions, which are also addressed in the model simulation analysis. In this part, Russia is split into domestic regions for three reasons. First, Russia is the largest country in the world, so its domestic regions have widely differing locations and geographical trade patterns. Second, some Russian regions are abundant in natural resources and others are not. For both reasons, domestic regions may be affected by trade policy in different ways, and they may potentially have different trade policy interests. Third, domestic trade costs within Russia play a role behind the scene, and they are important due to the huge distances and low economic density in parts of Russia. Tariffs and trade policy barriers do not apply within Russia, but trade is limited by distance and infrastructure barriers, and some domestic regions are more peripheral than others. This is captured in the numerical simulation model, and plays a role even if we do not explicitly examine changes in domestic trade costs. How external trade integration affects domestic regions is a research field of growing attention (see the survey in Brülhart, 2011, and Melchior, 2011 for analysis of European regions); and especially relevant for Russia due to its size. Will external liberalization promote multiple economic centres or agglomerations or higher growth in certain areas?

Beyond the EAEU and Eastern Europe, Russia has currently very few other preferential free trade agreements (FTAs), and Russia has not fully joined the recent global race for FTAs (see Melchior, 2018, Ch. 3). The Ukraine crisis and sanctions have delayed this further: Russia's FTA negotiations with EFTA (European Free Trade Association) was a signal of Russian ambitions beyond Eastern Europe, but negotiations were put on halt in 2014. Russia's focus on Eastern Europe is motivated by history and geopolitics, but this may now be changing, with new FTA initiatives beyond Eastern Europe recently.[3] With Iran on the top list, the country selection is still influenced by geopolitics, and major industrial countries are missing among the candidates. In the field of FTAs, should Russia in the longer run strive for global integration, including Asia and Europe? Using numerical simulation and stylized scenarios, we shed light on the major options. We also compare the impact of preferential integration between Russia and other countries with the effects of multilateral integration, where trade costs are reduced worldwide and between all countries, without the discriminatory effect of FTAs.

While some research exists on the economic impact of Russian trade integration (see, e.g., Malokostov and Turdyeva, 2014; Böhringer et al., 2015; Tarr, 2016), the recent literature is limited and this article fills a gap by providing a broad and comprehensive analysis of Russia's integration options. Our approach also differs from standard CGE (Computable General Equilibrium) models where the aim is often to provide numerical predictions on the impact of specific trade policy reforms; e.g., Russian WTO membership where several contributions exist (see, e.g., Rutherford and Tarr, 2006). The approach here differs from standard CGE since we aim to be "quasi-realistic" rather than accurate; we do not calibrate the model to fit data exactly; and we have three sectors rather than 65 (as in the latest version of the GTAP — Global Trade Analysis Project — model database). In this way we hope to introduce a middle ground with more specificity than general theory, and with the aim of obtaining qualitative knowledge more than numbers. Rather than abstract universal predictions from models with a few countries, we cover the whole world and account for global interactions, geography as well as different levels of development.

The article proceeds as follows: In Section 2, we analyze Russia's foreign trade during 1996–2017, using a data set newly constructed for the purpose. In Section 3, we analyze Russian trade policy options by means of numerical simulation, using the world trade model of Melchior (2018) but presenting new results from scenarios for Russian trade integration. Section 4 concludes.

2. Russia in world trade

For the analysis of Russia's trade in goods, a global trade data set for 1996–2017 is constructed. For a consistent analysis of trends over time, an issue is that the number of countries reporting trade data varies over time. We therefore use "mirror data" to fill in the gaps: Every trade flow between two countries may be reported at both ends, and if one is missing, we can use the other observation to

[3] Beyond Eastern Europe, Russia has FTAs with Vietnam and Serbia, and has recently (through the EAEU, and according to information from the Gaidar Institute for Economic Policy) initiated several new FTAs, including with Egypt, India, Iran and Singapore.

get the information. In this way, we fill in most of the gaps and obtain a data set that is almost complete and consistent over time for 1995–2017.[4,5]

2.1. The cycles of Russia's globalization

While Russia is a giant in terms of land and natural resources, it is a medium-sized economy for trade and international investment (Fig. 1); e.g., the 18th largest trader in the world. The snapshot in Fig. 1 does not reveal the whole story: During the last two decades, the relative importance of Russia in the world economy has fluctuated strongly over time, with fast growth until 2008; turbulence during 2009–2013; and decline from 2014. Figs. 2 and 3 show, respectively, Russia's share of world FDI (Foreign Direct Investment) flows during 1992/1993–2017 (Fig. 2); and Russia's share of world trade in goods during 1996–2017 (Fig. 3).

While FDI flows are more erratic than trade flows, the major pattern over time is the same; with fast growth, turbulence and decline. At the peak, Russia's share of the world economy was about twice as high as in 2016–2017, for trade as well as FDI.

A main driver underlying the observed pattern was the change in commodity prices. With natural resource rents providing 10.7% of Russia's GDP in 2017, Russia was the second largest commodity producer in the world,[6] and fuels rep-

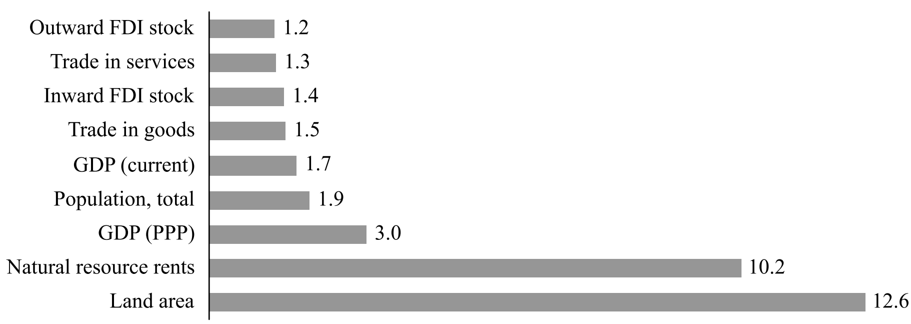

Fig. 1. Russia: Share of the world total, 2016 (%).

Sources: World Development Indicators, UNCTAD for FDI, and trade calculated from WITS/Comtrade data.

[4] We build on the global trade in goods data set for 1995–2015 developed in Melchior (2018), who also presents more detailed information on the use of mirror data. We extend data to 2017 using trade data from Comtrade, retrieved using WITS (World Integrated Trade Solution). Russian data for 1995 goods trade seem less reliable and since we do not focus on the first "post-communist" transition, we generally use data from 1996 onwards for Russia's goods trade.

[5] For brevity, we omit a detailed analysis of Russia's services trade, but Appendix Table A1 provides an overview of Russia's trade in goods and services in 2013–2017. The table shows that during this period, Russia had a trade surplus for goods, and a trade deficit for services. Since trade in goods is larger than trade in services, Russia had a significant trade surplus, that peaked in 2015. In 2017, Russia had a higher share in world trade for goods than for services; higher for exports than for imports; and the share fell from 2013 to 2017 (due to falling commodity prices). The appendix table shows that the share of services in Russia's trade is below the world average, particularly for exports. This is also evident from Fig. 1. Since a large share of world services trade is through investment abroad or local presence (the so-called Mode 3 in the World Trade Organization vocabulary), the relatively low share of Russia in world FDI may also affect negatively Russia's international economic integration for services.

[6] Total natural resource rents (% of GDP) is reported in World Bank/World Development Indicators. Using this and GDP data, the nominal value of natural resource rents is then calculated (USD 169 billion for Russia in 2017). China had the largest natural resource rents in 2017, even if their share of GDP (at 1.5%) was much lower than for Russia. Saudi Arabia, Australia and the USA were the next three on this ranking after Russia.

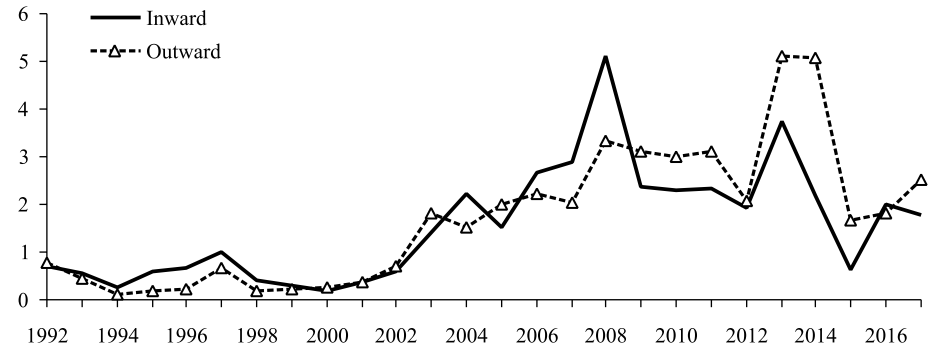

Fig. 2. Russia: Share of world FDI flows (%).

Source: Author's calculations from UNCTAD data.

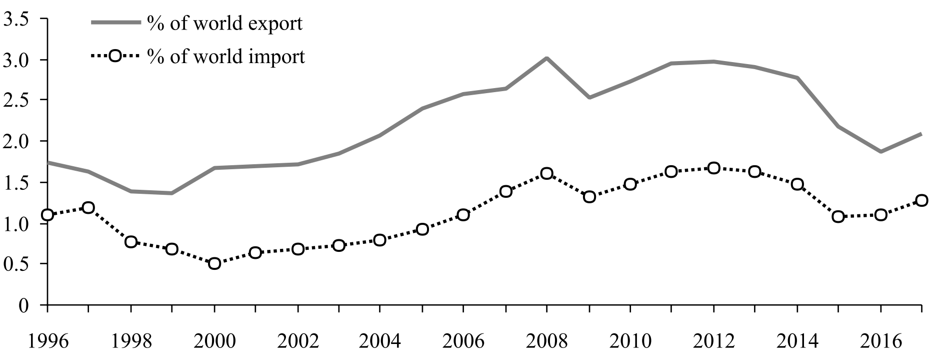

Fig. 3. Russia: Share of world goods trade 1996–2017 (%).

Source: Author's calculations based on data from WITS/Comtrade.

resented more than half of Russia's exports of goods. Because of this, commodity price changes have a strong impact on the Russian economy. Commodity price increases automatically increase the share of commodities in world trade as well as in Russia's exports. As shown in Melchior (2018, Ch. 2) for 1995–2015, rising commodity prices boosted the value of world commodity trade until 2012, with a fall thereafter. Extending this analysis until 2017, Fig. 4 shows, for the world as a whole, the development of commodity prices during the period, against the share of bilateral two-way manufacturing trade in total world trade.[7]

The close resemblance between the shapes observed in Figs. 2 and 3 and the commodity prices in Fig. 4 illustrates that changing commodity prices were a major determinant of Russia's development. Furthermore, sector shares in trade are strongly influenced by commodity prices: The curve for two-way manufacturing trade in Fig. 4, a proxy for intra-industry trade, is almost a mirror image of the commodity price curve. In the following analysis of Russia, we therefore need to disentangle such nominal effects from true changes in industrial specialization.

Since nominal export growth for Russia is strongly influenced by commodity

[7] Two-way manufacturing trade is the "trade overlap"; e.g., if exports are 100 and imports are 50, the trade overlap or two-way trade is 100. This can be considered as a good proxy for intra-industry trade, even if such trade is often measured at a more disaggregated level (see Melchior, 2018, Ch. 2).

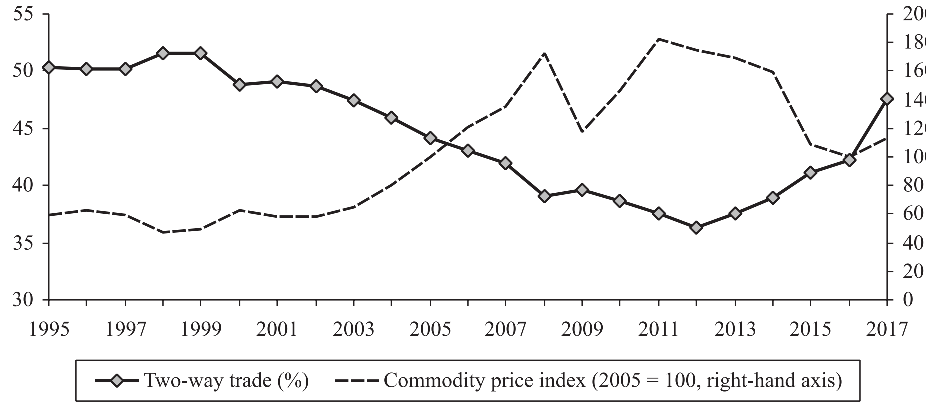

Fig. 4. Two-way manufacturing trade as a share of world trade (%), and commodity prices, 1996–2017.

Note: The commodity price index is for all commodities and energy, based on prices in U.S. dollars.
Source: Author's calculations based on data from WITS/Comtrade, and commodity prices from IMF (https://www.imf.org/external/np/res/commod/index.aspx).

prices, it is important to observe that Russia's imports followed suit (see Fig. 3). Russia has a trade surplus so the share of world exports is higher, but the two curves follow each other in parallel. For imports, the share of manufacturing was higher than for exports, so price fluctuations were likely smaller and more of the variation was due to volume changes. It is likely (although not proven here) that growing export revenues also led to higher imports.

While the average share of Russia in world trade in goods is in the range of 1–2%, Russia's share of world trade varies considerably across goods and sectors. In some sectors, Russia is a major supplier with a share considerably above the average.[8]

2.2. The changing geography of Russia's trade: The rise of Asia

For Russia, the fast trade growth coincided with a shift in the geographical composition of trade, with fast-growing imports from Asia and particularly from China. This is shown in Fig. 5.

- Western Europe remains the largest trade partner region for Russia, even if its share of trade fell from above 50 to about 40%.
- The share of Eastern Europe in Russia's trade declined from 18 to 12% for exports, and from 24 to 10% for imports. This is dramatic in the light of the short time period and the integration efforts in the region. The collapse of Russia–Ukraine trade contributed to this development; however, most of the decline happened before the escalation of the Russia–Ukraine conflict in 2014. The relative decline in post-Soviet trade is likely also a transition phenomenon, with a lagged change from historically established trade patterns.
- While Russia's imports from Asia except China increased nine-fold from 1996

[8] Defining sectors at the two-digit level of the Harmonised System trade classification, with a total of 96 sectors (using HS2012), the sectors with the highest Russian share of world exports in 2016 were (with HS number): 75 Nickel — 15.5%; 31 Fertilizers — 14.3%; 27 Fuels — 11.1%; 81 Other base metals — 6.4%; 44 Wood and articles — 6.1%; 76 Aluminium — 5.5%.

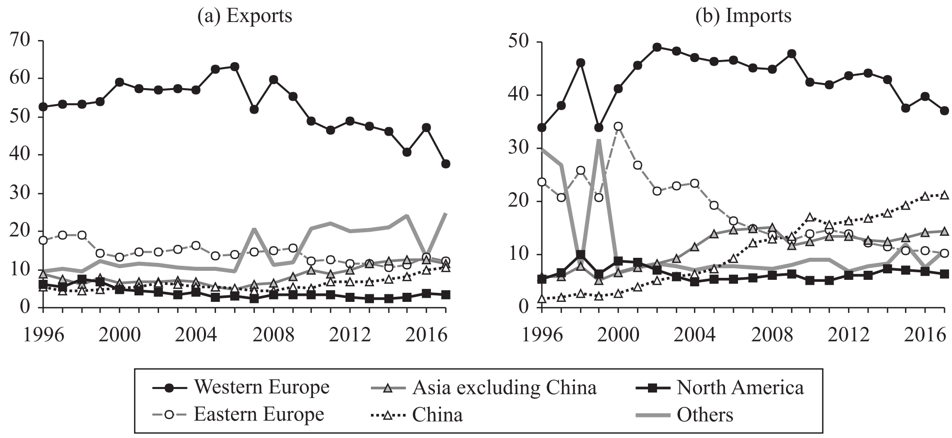

Fig. 5. Russia: Geographical composition of (a) exports and (b) imports, 1996–2017 (%).

Source: Author's calculations based on data from WITS/Comtrade.

to 2017, imports from China multiplied by 37,[9] with China's share rising from 1.6 to 21.2% of Russian imports. In 2017, Asia including China had a share of 35% of Russia's imports, slightly below Western Europe. The share of Asia in Russia's exports also increased—however not like imports—from 14 to 22% for China and the rest of Asia taken together.

- North America accounted for a relatively stable share of Russia's imports (around 5–7%), but its importance in Russia's exports declined (from 6 to 3%).

Splitting out Russia from Eastern Europe, and China from Asia/Pacific, Table 1 shows nominal growth from 1996 to 2017 for the matrix of trade flows between the seven world regions. Appendix Table A2 shows the corresponding shares of world trade in 1996 and 2017.

In nominal terms, world trade has grown considerably over time, but the trade of Russia has grown faster, as already evident from Fig. 3. Table 1 shows the change between the end points; Fig. 6 shows the development for world trade (export + imports of goods) and Russia's trade over the whole period 1996–2017.

The nominal value of world trade more than tripled during the period, but the value of Russia's trade grew even faster, increasing almost six-fold from 1996 to the peak in 2013. At the end of the period, the increase for Russia was about four-fold (equal to the weighted average of the figures for total exports and imports in Table 1).

Table 1 illustrates the spectacular trade growth of China: China's trade with all trade partners was multiplied by 12 (exports) and 14 (imports). China's exports to Russia were multiplied by 37, and to the rest of Eastern Europe by 103! Trade in the other directions also grew faster than world trade, but much slower than China's exports. In spite of this, Russia–China trade has recently been more or less balanced, due to large commodity exports to China from Russia.

9 This is based on Table 1, where each entry is based on an average of export and import data. Using import data, the ratio was even higher, almost at 50. Since imports from China were small in 1996, modest measurement differences have a strong effect on the ratio.

Table 1
Nominal trade growth between Russia, China and major world regions, 1996–2017 (ratios $trade_{2017} / trade_{1996}$).

Exporting region	Importing region									
	Africa	Asia xChina	China	Eastern Europe xRus	Latin America	Middle East	North America	**Russia**	Western Europe	World
Africa	5.7	4.8	56.6	13.7	2.9	5.2	1.9	**4.5**	2.5	3.6
Asia xChina	4.2	2.9	14.6	6.5	3.3	4.9	2.2	**6.9**	2.6	3.4
China	37.4	9.1		102.6	32.9	32.2	14.3	**36.7**	14.8	12.5
Eastern Europe xRus	20.7	7.2	14.1	2.7	2.4	7.5	3.9	**1.8**	9.1	4.8
Latin America	4.9	4.5	34.3	3.8	2.8	6.6	2.6	**5.5**	2.5	3.6
Middle East	7.0	4.5	44.4	6.7	3.8	7.2	3.6	**4.4**	4.3	5.2
North America	2.4	1.6	10.0	3.4	2.7	2.9	2.5	**3.2**	2.2	2.4
Russia	**11.7**	**5.1**	**8.0**	**2.8**	**1.7**	**7.5**	**3.4**		**3.2**	**3.8**
Western Europe	2.8	2.3	12.9	4.3	2.3	3.5	3.1	**3.6**	2.5	2.6
World	4.5	3.1	14.4	4.0	3.1	5.1	2.9	**4.2**	2.6	3.1

Note: China and Russia are split out from Asia and Eastern Europe, respectively (indicated by xChina and xRus). Here the left column indicates the exporting region/country, and the top header the importing region/country. The bottom row (far right column) shows nominal growth in the total imports (exports) of each region/country.
Source: Author's calculations based on data from WITS/Comtrade. Ratios based on export and import data differ somewhat, and here an average of the two has been used.

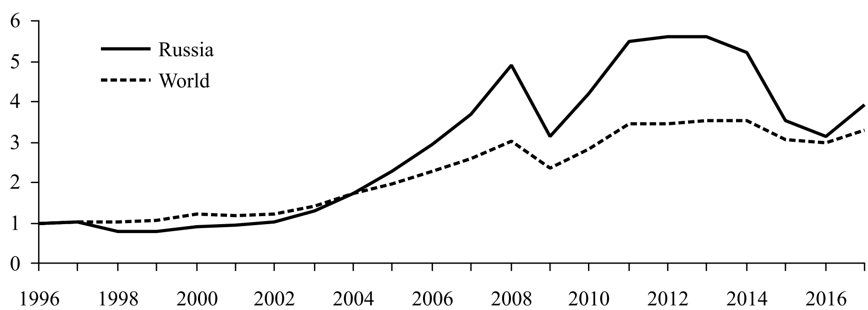

Fig. 6. The nominal growth of world trade and Russia's trade, 1996–2017 (1996 = 1).
Source: Author's calculations based on data from WITS/Comtrade.

2.3. Russia's deindustrialisation: A Dutch disease?

Was the fast growth and reorientation of Russia's trade merely a switch to new suppliers and trades, or has it changed Russia's pattern of specialization in trade? In order to check this, we divide trade into manufacturing and other trade. Other trade includes agriculture/food, raw materials, non-ferrous metals and oil/gas.[10] Fig. 7 shows the share of manufacturing in Russia's exports and imports, and the share of two-way manufacturing trade in total trade, using the term IIT

[10] We use the standard manufacturing definition of the SITC Rev. 3 trade classification, covering SITC chapters 5 through 8 except 667 Pearls, precious and semi-precious stones etc., and 68 Non-ferrous metals. This is group A12 in UNCTAD's trade classification, see http://unctadstat.unctad.org/EN/Classifications/DimSitcRev3Products_DsibSpecialGroupings_Hierarchy.pdf

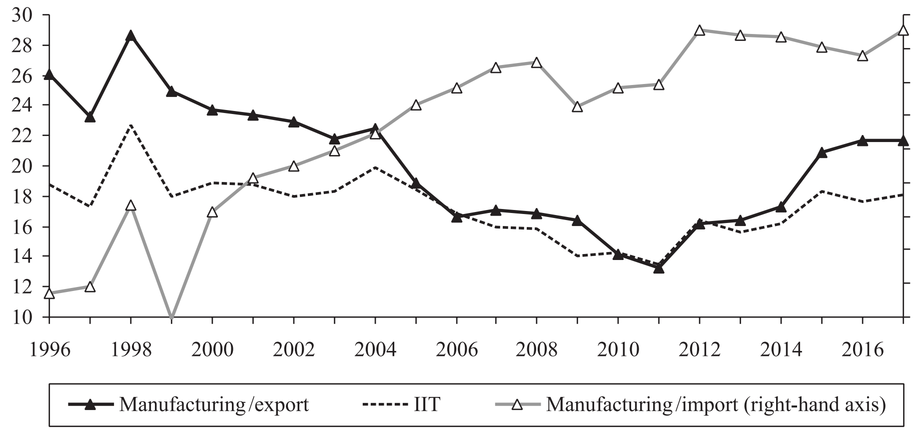

Fig. 7. Russia: Share of manufacturing in trade, and share of two-way manufacturing trade in total trade, 1996–2017 (%).

Source: Author's calculations based on data from WITS/Comtrade.

(intra-industry trade) since it measures the "trade overlap" (see footnote 7).

Given Russia's large commodity exports, we expect that the share of manufacturing in exports, and the share of two-way manufacturing trade in total trade, have been falling as long as commodity prices were on the rise. This is indeed confirmed in Fig. 7; with V-shaped curves for the two and a turning point around 2011, and a pattern resembling the one observed for global trade in Fig. 4.

A much more dramatic change took place for Russia's imports, where the share of manufacturing increased significantly, from less than 50 to more than 80%. Hence not only the geographical but also the sectoral composition of Russia's trade has changed strongly over just two decades only.

These trends suggest a deteriorating trade balance for manufacturing. This can be shown using a simple net export ratio for manufacturing, ranging from minus 1 (only imports) to plus 1 (only exports). While the sector shares in Fig. 7 are affected by commodity prices, especially for exports and two-way trade, the net export ratio for manufacturing largely avoids this commodity price effect. Fig. 8 shows this index.[11]

It is evident that Russian trade growth corresponded to a weakening trade balance for manufacturing, with a dramatic change during one decade only. Manufacturing decline could partly be a lagged post-communist transition effect, with old value chains in Eastern Europe being gradually dismantled. The development could also indicate that Russia had a "Dutch disease" syndrome during 2000–2011, although it is beyond our scope here to go in depth on this issue. As described by Corden and Neary (1982), the "spending effect" from higher commodity prices may drive out manufacturing in commodity-producing countries. The reversal of this trend during 2012–2017 could be explained by a similar model, but trade sanctions and import substitution policies might also have played a role. The development observed here is an important backdrop for the "import substitution policies" of Russia from 2014 (Government of the Russian Federation,

[11] This index has the form $(x - m) / (x + m)$, where x — exports and m — imports. Observe that due to the different valuation of imports (cif) and exports (fob), the index will be negative when trade is actually balanced. For comparison over time we can live with this bias.

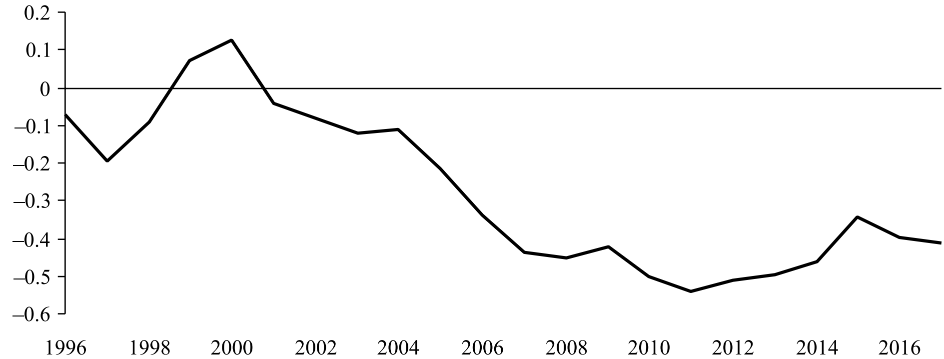

Fig. 8. Russia's trade specialization in manufacturing, 1996–2017 (net trade ratios).

Note: Net trade ratios, see explanation in text.
Source: Author's calculations based on data from WITS/Comtrade.

2018). While many countries have experienced falling shares for manufacturing due to technological change and weakening trade balances due to the rise of Asia, the change for Russia during 2000–2011 is faster than for other large nations (also ahead of the USA, that had an almost similar development).

This deindustrialization in Russia's trade played out differently across trade partners, with considerable differences across regions, especially for exports. Appendix Table A3 shows the shares of manufacturing in exports and imports, for the same partner countries and regions.

- Russia's trade with Western Europe has throughout the period been an exchange of commodities for manufacturing, with no major change.
- For Asia, the pattern has changed dramatically, with a falling share of manufacturing in exports and a rising share in imports. For China, there was a complete reversal of roles, with Russia being the manufacturing exporter in 1996, but the commodity exporter in 2017.
- CIS and Latin America are the only regions where the share of manufacturing in Russia's exports has been rising over time.

3. Russia, regionalism versus globalism: A numerical simulation analysis

As demonstrated in section 2, Russia is a globalist in terms of its trade pattern, and its membership in the WTO from 2012 is a major pillar of its trade policy. Historically, however, the Soviet Union established full integration in Russia's neighborhood, and this has later been followed up through various trade agreements, with CIS (Commonwealth of Independent States) and the EAEU as the most important ones. How should Russia balance between regionalism and globalism in the future? In the following, we use a world trade model to run stylized scenarios that shed light on the potential economic impact of various options.

3.1. An overview of the model

For the simulations, we use the world trade model developed by Melchior

(2018).[12] Here we provide an overview of the model characteristics and motivation, and the interested reader is referred to the link in footnote 12 for further technical detail. In this article, we present new scenarios and original results, but the model framework is identical to Melchior (2018).

The model is a general equilibrium model of the world economy; with a mathematical solution determining wages, prices and production in all the world's countries, as well as trade between them. It is a static model without growth, and the numerical simulations are used to find this solution; not to examine trajectories over time. Trade policy is examined by changing trade costs in the model, and comparing the results to the base scenario. Key properties of the model structure are:

- Each country or region is endowed with capital, labor and natural resources, in given quantities.
- Capital K and labor L are fully employed and combined to produce services S (we drop country subscripts for simplicity), that are partly consumed and partly used in the production of tradables X.
- Tradables X are produced combining natural resources or commodities G and services S.
- Commodities G are traded internationally at zero cost, and used as numeraire for measuring prices and costs; with the world price of G equal to one.
- Tradables X is a standard "Dixit–Stiglitz" sector with product differentiation, scale economies and monopolistic competition, traded internationally with real trade costs between countries and regions.[13] We often call this manufacturing, although in real life tradables could be manufacturing or services.
- Since K and L are not used directly in the production of X, and S is not traded, there is no trade exchange of capital-intensive against labor-intensive goods. But countries with a high K/L ratio are more productive in the production of X, and if they have a trade surplus in X, they must be importing G. The model thereby replicates a key feature of the observed world trade pattern, with large intra-industry trade between rich industrial countries, and exchange of manufacturing for commodities between industrial and commodity-exporting countries (as shown in Melchior, 2018, Ch. 2).

The model solved numerically using MATLAB software. Solving for the wage levels in each country and region, the rest falls into place. The exogenous variables are K, L, G and the matrix of trade costs T, plus various elasticities and cost shares in demand and production functions. The number of manufacturing firms in each country/region is determined endogenously. Countries with large natural resource endowments G may be deindustrialized with zero production of manufacturing X. In the model base scenario, twelve out of 110 countries and regions are deindustrialized with no X production; with seven Russian domestic regions among these. The endogenous and mathematically consistent handling of corner solutions is an original feature of the model. For more technical detail, see Melchior (2018).

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[12] The technical documentation and model details available online at https://link.springer.com/content/pdf/bbm%3A978-3-319-92834-0%2F1.pdf

[13] Trade costs are mark-ups on marginal costs, and not taxes. This is slightly different technically but still equivalent to so-called iceberg trade costs where some goods melt on their way. In the current version of the model, the revenue impact of tariff changes is not accounted for; but tariffs account for a modest share of overall trade costs, so the inaccuracy caused by this is limited. An aim is to include revenue effects in later versions of the model.

While there is a vivid discussion about the existence of a "resource curse" or not (see, e.g., Alexeev and Conrad, 2009; Van der Ploeg, 2011), the model here predicts that natural resources are a blessing in terms of the income they generate; however they may be a curse in terms of deindustrialization, due to the "spending effect" as described by Corden and Neary (1982): Resource income bids up wages and leads to lower production of tradables. Harding and Venables (2013) provide recent evidence to the effect that resource abundance reduces manufacturing exports. As shown in Melchior (2018), commodity-abundant and commodity-scarce countries have most to gain from international trade, since they have too much or too little natural resources, and trade is the solution. Corden and Neary (1982) also include a "resource movement effect" whereby natural resources production affects factor markets and factor prices; this effect is not present in our model since G is an endowment only, ready for use or sale and requiring no further processing. This is clearly a simplification, and in real life, some resource-based sectors such as metal production represent an intermediate category that the model does not capture so well in its current version.

The model is implemented with 110 countries and regions, using data for 2014. Factor endowments are obtained as follows:

- Labor force and population (used for calculating per capita measures) are from World Bank data. We think of this as "raw" labor, and skills should therefore be reflected in the capital measure.
- Natural resource endowments are derived based on World Bank data on natural resource rents as a share of GDP (World Bank, 2006, 2011 and later online data). The inclusion of commodities in the model is important since about half the world's countries are commodity exporters, and it is important to shed light on whether trade policies affect these countries differently.
- For capital, we draw on the growth literature result that capital-labor ratios are highly correlated with GDP per capita (Caselli, 2005); and there is complementarity between physical and human capital at the country level (for discussions, see, e.g., Parro, 2013; Hsieh and Klenow, 2010). Using recent evidence from the growth accounting literature (Zuleta and Sturgill, 2015), we use the relationship between capital-labor ratios and GDP per capita to derive capital-labor ratios (including human capital) for all countries and domestic regions.

Trade costs have four components:

- tariffs (including preferential tariffs, from the UNCTAD/TRAINS database);
- infrastructure costs (internet users, logistics performance index, costs of business start-up, all from World Bank data);
- export and import costs (costs, documents, time to export and import, from World Bank data);
- distance-related costs including transport costs, derived as a scaling of geographical distance, and assuming that trade costs increase less than proportionally with distance.

The four components enter additively in the overall trade cost mark-up. Appendix Table A4 shows simple averages of total trade costs between Russia and the other world regions, and inside Russia. The scaling of the three latter trade cost components is uncertain, and we use estimates from existing literature, such as Anderson and Wincoop (2004), to make an informed choice. Even if all trade cost components are based on real data, there is uncertainty about the scaling of its components except for tariffs, and this can be better underpinned in the future, based on empirical research. According to the data set used in the simulation model, average trade costs for Russia's trade with the whole world amount to 55%. Out of these, 5% are tariffs; 7% infrastructure costs; 11% export/import costs; and 31% distance-related or transport costs. Our average trade costs at 55% may be compared to that of Anderson and Wincoop (2004), who found 70%. With more recent data, it is plausible that we have a lower average.

Empirical research using the "gravity model" has confirmed beyond doubt that trade falls with distance (Head and Mayer, 2014). Trade is therefore strongly affected by geography, and we have all reasons to believe that this applies within as well as between countries. In order to capture geography in a better way, a special feature of the model is that large countries are decomposed into regions: Russia, Kazakhstan, China, India, Brazil, USA, and Canada. The motivation is obvious: treating Russia or other large countries as single points, at par with Luxemburg, obviously misses important aspects of geography. There is a growing body of research on regional dimensions of large countries; see, e.g., Autor et al. (2013, 2016) on the USA, or Banerjee et al. (2012) on China. Given the large territory of Russia, we split the country into twelve regions. Appendix Table A5 presents the regional subdivision of Russia, partly using Federal Districts but splitting some of them for geographical reasons. Earlier work, e.g., by Melchior (2010, 2011), see also the survey of Brülhart (2011), demonstrates how domestic regions are affected differently by international trade and integration. As we shall see, this also applies to Russia. Within Russia and other countries that are split into regions, there are still distance- and infrastructure-related trade costs; however, tariffs and export/import costs do not apply inside countries. Hence the model also captures the internal geography of Russia, with considerable trade costs due to distance. As seen from Appendix Table A4, trade costs within Russia are on average 30%; much lower than average trade costs for Russia's foreign trade.

The model is highly stylized, with three sectors only, and it has not been designed to provide "the exact numbers" about the detailed impact of trade policy, but rather qualitative insight about trade-related mechanisms. The model is simplified, with no government, no financial sector, no currencies etc., so there is no reason to believe that it should match the world perfectly. We therefore do not calibrate the model in order to match the real world exactly, e.g., by adding "wedges" (trade costs, elasticities, etc.) to replicate real world data. The model is "theory with numbers," and the goal is to capture world trade and geography approximately right. The model replicates income levels rather well, with a correlation coefficient of 96% between observed and predicted income levels in the base scenario. Correlation between predicted and observed trade flows is somewhat lower, at 65% (Melchior, 2018, p. 204). Hence the model is on the right track but further improvement is possible, e.g., by obtaining better estimates for trade costs.

As a reality check for Russia, we may compare observed price levels for Russian regions provided by Gluschenko and Karandashova (2016) with the model predictions in the base scenario.[14] Figs. 9 and 10 show, respectively,

[14] These results are at the Federal District and county (oblast) levels, so population-weighted averages have been calculated in order to match the regional subdivisions used in the simulations.

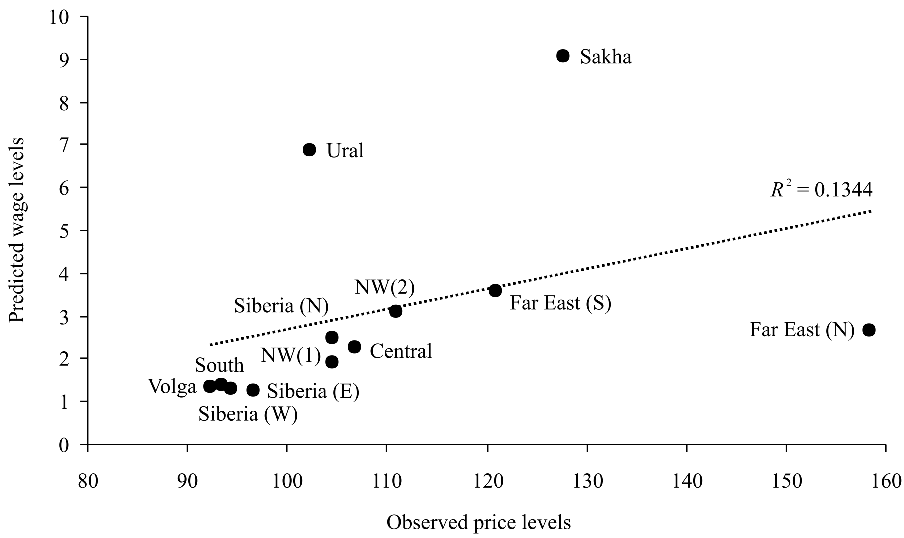

Fig. 9. Observed price levels vs. predicted wages for Russian regions.

Source: Observed prices from Gluschenko and Karandashova (2016). Predicted wages from author's model simulations.

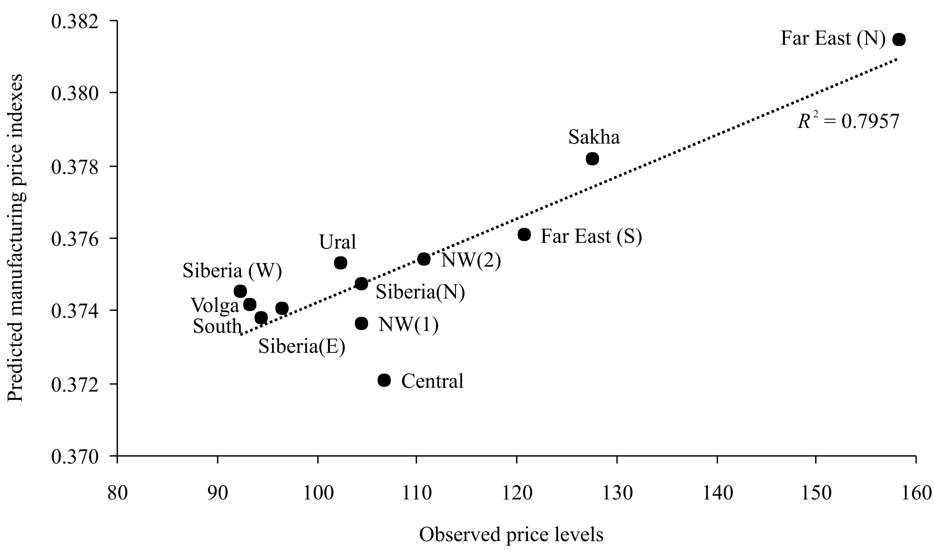

Fig. 10. Observed price levels vs. predicted manufacturing prices for Russian regions.

Source: Observed prices from Gluschenko and Karandashova (2016). Predicted manufacturing prices from author's model simulations.

correlations between observed price levels and (i) predicted wages (Fig. 9); and (ii) predicted manufacturing prices (Fig. 10).

While the good fit between observed and predicted income levels is partly determined by the way the capital-labor ratios are constructed in the data, wages and prices are complex model outcomes so it is interesting to see whether they correspond to reality. In this sense Fig. 10 gives reasons for optimism; the fitted curve has $R^2 = 0.80$, so for traded goods, the model seems to be on the right track. For wages, which is a key determinant of price levels in the model, Fig. 9 gives a mixed picture, with the commodity regions Ural, Sakha and Far East (N) being outliers that bring R^2 down to 0.13. A limitation of the model is that resource income is spent by the factor owners of each domestic region, creating a strong "spending effect." This is clearly a simplification, given that key firms have headquarters in Moscow and resource income is spent outside the source regions. In future versions of the model, this feature might be modified.

For the interpretation of results, it is useful to observe that for a given trade policy shock in the model, such as trade liberalization, the impact may be reflected in trade specialization effects (some countries exporting more manufactures), and/or wage effects (higher wages in some countries).[15] From international trade textbooks we are used to expect changes in the trade specialization patterns, but as we shall see, wage effects may be equally or sometimes even more important. In the model used here, there are both trade and wage effects, and the result also shed interesting light on price effects of trade policy.

3.2. Scenarios: Preferential and Most-Favoured Nation (MFN) trade liberalization

We run the five following scenarios:

- Eastern Europe: Trade integration between Russia and Eastern Europe.
- China: Trade integration between Russia and China.
- EU: Trade integration between Russia and the EU.
- FTA race: Bilateral trade integration between Russia and all other countries.
- Multilateral: Trade integration between all countries in the world.

In this menu, "Eastern Europe" is the most regionalist option; integration with China and the EU go one step towards globalism; and the "FTA race" scenario is full globalism; however, in the form of preferential FTAs, where Russia's trade partners do not liberalize between them. We therefore also include the fifth "Multilateral" scenario where liberalization is on MFN (Most Favoured Nation) basis and between all countries of the world. While the Multilateral scenario can be promoted via WTO liberalization, Russia could approach the FTA race scenario by means of an ever-expanding set of FTAs.

The four first scenarios are preferential or discriminatory; i.e. trade costs are only reduced between Russia and the partners involved. Given that the tradable/manufacturing sector in the model has scale economies and imperfect competition, and the number of manufacturing firms is endogenous and determined in the model, preferential trade liberalization leads to trade diversion and "production shifting" from third countries to the integrating countries (Baldwin and Venables, 1995). In the Multilateral scenario, trade costs are also reduced between Russia's trade partners, so the reform is not preferential. This scenario therefore provides a check on the production shifting effect; i.e. how much of the gains from integration are driven by trade discrimination and diversion.

[15] A way to illustrate wage effects is this: Imagine that L is the only factor of production, and the Dixit–Stiglitz X sector is the only sector in the economy, so trade in X has to be balanced. In this case, trade policy shocks will only affect wages and price indexes, but there can be no trade specialization effects, even if the trade volumes can change.

In the scenarios, we make the stylized assumption that all types of trade costs are reduced by 25% between countries involved. We do not ask whether this is feasible or not, or whether some of it has already been undertaken. In order to reduce all these costs in real life, not only tariff cuts are needed, but also infrastructure development, trade facilitation and better transport networks. Cutting 25% of all costs is clearly a significant reform. An interesting issue is whether reductions in distance-related costs have different effects compared to the trade costs that are not spatially dependent (see, e.g, Melchior, 2011). For the sake of brevity, we do not examine this further here; only assume that all types of costs are reduced in the same proportion. For Russia, the distinction may be important due to the vast land area, and this may be addressed in further research.

3.3. Results for Russia as a whole

Given the stylized nature of the model, we are not so interested in the absolute magnitudes but rather the changes induced by the different scenarios.[16] We therefore generally report changes from the base case. Appendix Table A6 reports key results for Russia, China and major world regions for the five scenarios. For Russia, the simulation output is at the level of domestic regions, but we aggregate and present the results first for Russia as a whole, in order to provide an overview across scenarios. Table 2 and Fig. 11 show the average outcome for Russia.[17] Appendix Table A6 shows similar results for all world regions. Later, the same results will be reported for Russian domestic regions.

In Fig. 11, the four lowest scenarios all represent preferential integration, but with different partners. It is clear that gains from integration with EU and China are of similar magnitude, and several times larger than for integration with Eastern Europe. Even more can be gained from preferential integration with the whole world, as shown by the FTA race scenario.

Hence the results indicate that the potential benefits from regional integration in the post-Soviet space are small compared to the potential gains from integration with more distant world regions. In the real world, this clearly depends on

Table 2
The impact of trade integration for Russia. Changes from base case in five different scenarios (%).

Variable	Scenario (see main text for explanation)				
	Eastern Europe	China	EU	FTA race	Multilateral
Nominal wage	0.22	1.34	0.91	7.31	0.46
Welfare	0.10	0.95	0.77	4.31	2.98
Manufacturing	0.21	1.33	0.89	6.83	0.47
Price level	0.13	0.41	0.16	2.99	–2.44
Nominal GDP	0.19	1.15	0.78	6.27	0.39

Source: Author’s results from numerical model simulation.

[16] For detailed results for the base scenario, and for key variables in the five key scenarios, see Supplementary material.

[17] Results for Russian regions are aggregated as follows: Nominal wage is weighted by labor force L; welfare and price level by population; manufacturing (the number of firms) and GDP are additive and summed before the change is calculated.

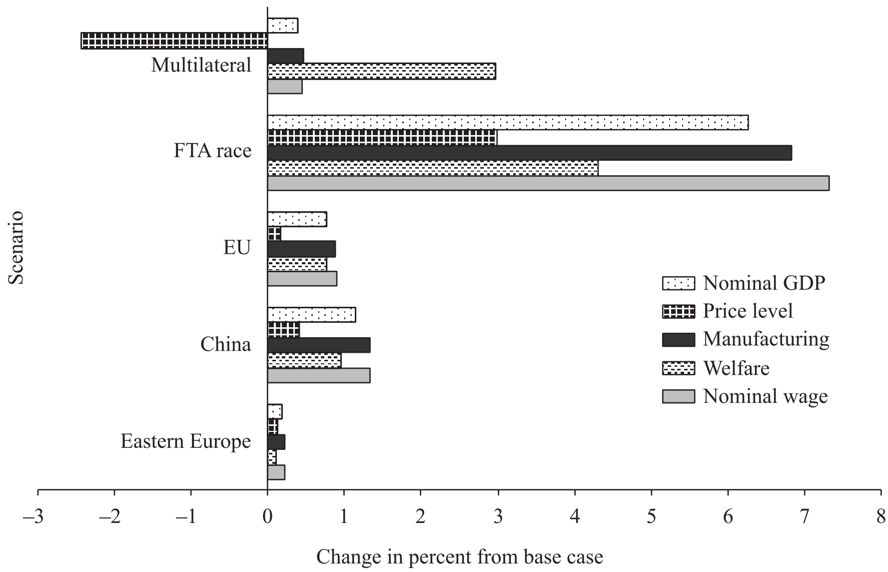

Fig. 11. The impact of trade integration for Russia: Change from base case in five scenarios, for key variables.

Source: Author's results from numerical model simulations.

what is feasible: If feasible integration can be much deeper in the neighbourhood, it will change the balance. For tariffs, distant integration is clearly feasible, and with some caution about feasibility, the results suggest that Russia should pursue more FTAs on the global scene.

Given that Russia is a commodity exporter, a potential fear is that trade integration will lead to further industrial decline. The results suggest that the opposite is in fact the case: For Russia, preferential integration leads to considerable growth in the number of firms in the manufacturing sector. Hence the results indicate that commodity traders have no reason to fear free trade. For the whole world, Melchior (2018) also found that trade liberalization tends to promote diversification in commodity-abundant countries. We will revert to this issue when discussing the results for Russian regions, of which some are commodity-rich and others not.

In partial equilibrium, we generally expect that trade liberalization leads to lower prices. In our results for Russia, this is reversed in all the preferential trade liberalization scenarios: here trade liberalization drives up wages, prices and nominal GDP, and the income growth is large enough to generate an overall welfare gain. This is a general equilibrium effect in the model, and illustrates that partial effects may be reversed by the more complex economy-wide interactions. In order to interpret this result, it may be observed from Appendix Table A6 that the wage and price hike in the preferential scenarios applies only to the integrating partners, and is reversed for other world regions. A closer examination reveals that in the preferential scenarios, the total number of manufacturing firms in the world is constant or slightly falling, so trade integration shifts firms and thereby labor demand across countries. Hence production shifting drives the differential price and wage developments in the integrating and non-integrating countries.

Turning to the non-preferential Multilateral scenario, liberalization now also leads to a price level reduction in Russia. Comparing the dark columns for the number of manufacturing firms (see Fig. 11), there is a slight increase for Russia also in this case, but much smaller than in the preferential FTA race scenario. This illustrates the role of "production shifting" due to FTAs. With production shifting gone, manufacturing growth is smaller, and the impact on wages and prices mostly vanished.[18] In spite of this, the welfare gain in the Multilateral scenario is almost as large as in the preferential FTA race scenario, due to the lower prices. Looking at Appendix Table A6, we also observe that the Multilateral scenario is more equitable: all world regions gain in welfare. There is an increase in the global number of manufacturing firms, and there is some manufacturing growth in most world regions. This growth is strongest in some developing regions, notably Africa and Latin America. Eastern Europe is here in third place suggesting that they might also have an interest in globalism.

3.4. The impact of liberalization on Russian domestic regions

Russia is an interesting country in this context for many reasons; one is its geography; another is that some domestic regions are pure commodity exporters while others are diversified. As shown by Fig. 12, large parts of Russia are resource-based, with zero predicted output of manufactures.

In the base scenario of the model, the predicted manufacturing production is zero for seven of the twelve Russian regions. The largest domestic regions for manufacturing/tradables are the Central Federal District (with Moscow), North West (1) (with St. Petersburg), followed by the Southern Federal District, West Siberia and Volga. Some of the commodity regions have very high GDP per capita (Ural, Sakha); and the South has a much lower income level than other manufacturing regions.[19]

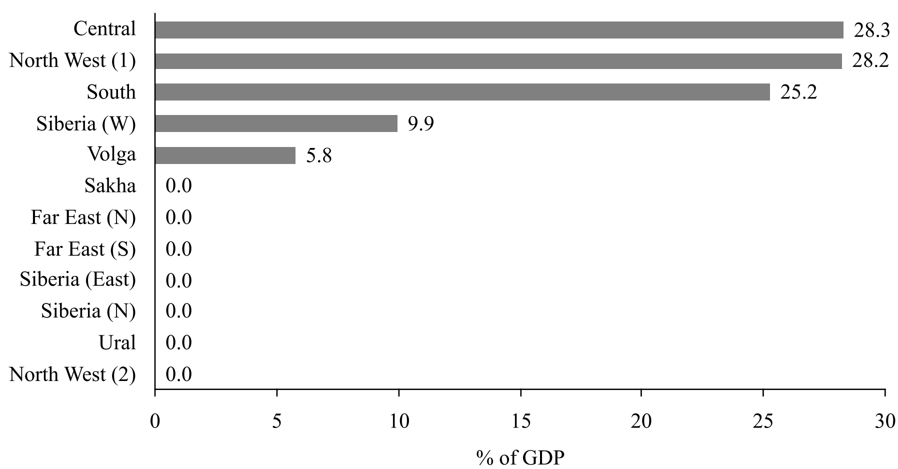

Fig. 12. The share of tradables in GDP for Russian regions, according to base scenario.

Source: Author's results from numerical model simulations.

[18] Due to variation in trade costs, some production shifting may occur in the Multilateral scenario even if trade liberalization is non-preferential.

[19] The predicted pattern corresponds partly but not fully with observed manufacturing/GDP ratios for the domestic regions. A main reason is that some resource-based production such as metals is classified as manufacturing in Russian statistics, and regions such as North Siberia (Krasnoyarsk) therefore have more manufacturing production than predicted by the model. A better fit might perhaps be expected with a narrower definition of manufacturing, but at the time of writing, we do not have data that allow an examination of this.

If a domestic region becomes deindustrialized, it will export all its commodity endowment (since nothing is used for domestic tradables production), and import all its consumption of tradables. The region's capital and labor endowment will be used entirely in the services sector, and by assumption the commodity income will be redistributed for consumption in the given domestic region. Foreign trade effects are then just a matter of prices for commodities versus tradables, since the markets for capital and labor are unaffected by trade. For the commodity regions, the terms of trade are therefore a key issue. With high commodity prices, the country or domestic region becomes rich and can import more for its consumption.

The cut-off point for becoming deindustrialized is determined endogenously in the model, so the number of deindustrialized countries and domestic regions can vary across scenarios. In the base scenario, twelve countries or domestic regions are predicted to have zero tradables production. In addition to our seven Russian regions, the group includes West Kazakhstan, Azerbaijan, Arabia (a group of seven Middle East countries), Iran and the Chinese Province of Mongolia. In our simulations, the number of deindustrialized countries is still twelve in the Eastern Europe scenario, but reduced to eleven in the China, EU, FTA race and Multilateral scenarios. The domestic region becoming diversified due to trade integration is East Siberia, which establishes some tradables production (although small). This is another illustration of the diversifying impact of trade liberalization for commodity-exporting countries suggested by the model.

Turning to the detailed simulation results, however, it is not mainly the diversification effect that raises Russia's overall manufacturing production, but production growth in the key manufacturing regions. For brevity, we present only two scenarios; the preferential FTA race scenario and the Multilateral scenario. Compared to the FTA race scenario, the other preferential scenarios (Eastern Europe, China, EU) are similar but quantitatively smaller (except that East Siberia remains deindustrialized in the Eastern Europe scenario). In Appendix Table A7, we show domestic regional results for all the five scenarios. In order to facilitate reading and visualisation, we have sorted domestic regions with the commodity regions at the bottom of the table as well as the diagrams.

Results for the preferential FTA race scenario is shown in Fig. 13. Here we show wages, welfare, manufacturing and price level changes.[20] The results demonstrate again that preferential trade liberalization promotes manufacturing, and for one region — East Siberia — this influence is sufficient to cross the borderline and become diversified.

For the other six commodity regions at the bottom of Fig. 13, manufacturing production remains at zero, and the nominal wage is also unchanged since it is not affected by trade. However, the price level reduction due to cheaper imports leads to a welfare gain — the two are of similar magnitude and with opposite signs.

For the manufacturing regions, there is not a price level reduction but — as seen for Russia as a whole — rather the opposite: wages increase significantly and therefore also the price levels. In spite of this, the income gain is large enough to generate a welfare gain that is larger than for the commodity regions.

[20] For the sake of illustration, manufacturing growth has been arbitrarily set at one for East Siberia in the diagram, in order to show that such production has started. Since such production is zero in the base scenario, the percentage increase cannot be calculated.

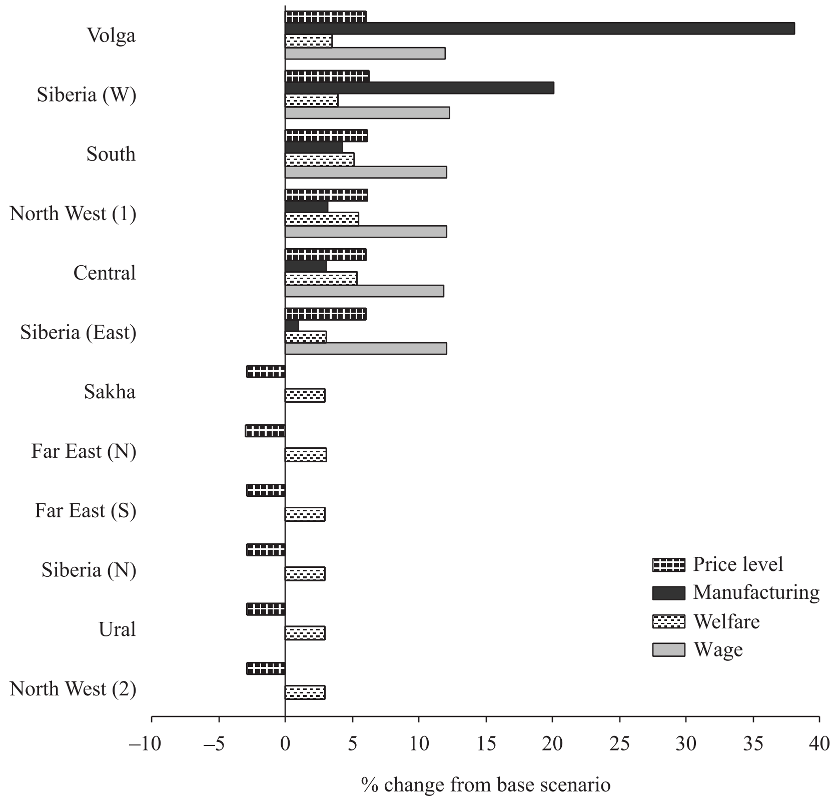

Fig. 13. FTA race scenario: Predicted impact for Russia regions.

Source: Author's results from numerical model simulations.

Considering Russia as a whole, the bulk of manufacturing growth takes place in the domestic regions that were already diversified in the base scenario. Here there is an interesting economic geography pattern, with higher increases in manufacturing for Volga and West Siberia. The exact reasons are not so easy to pin down, since this is the result of complex interactions in the model. One possible driver is higher demand from neighbour countries and domestic regions, especially the Russian commodity regions. Another explanation can be geography: Volga and West Siberia are centrally located regions and it may be the case that external liberalization promotes development in this area. In spite of the higher manufacturing growth in these two domestic regions, the welfare gain is even higher for the key manufacturing regions: Central and North West (1). The reason is the higher weight of the tradables sector in their economies.

In Appendix Table A7, results for the three other preferential scenarios (Eastern Europe, China, EU) are shown. The results are similar to the FTA race scenario, just quantitatively smaller, and with a similar ranking as seen for Russia as a whole. This is surprising since one might expect, e.g., that integration with China should be better for the east of Russia; and integration with the EU should be better for the west. But the ranking in terms of manufacturing growth across domestic regions is similar across the preferential scenarios, with Volga and West Siberia as the winners for manufacturing across all scenarios. One interpretation is that since the geographical pattern is stable across scenarios, it may be demand from neighbour regions that drives this positive outcome in the central parts of Russia. However, more research is needed to obtain a firm conclusion on this.

While it is beyond the scope of this article to undertake a further empirical analysis of the Russian regions, the FTA race scenario illustrates some key phenomena that should be taken into account in empirical research on the impact of FTAs:

- Industrial and commodity regions differ fundamentally with respect to the production and price effects of integration.
- Economic geography creates spatial differences with respect to the impact of integration, so the effects differ across regions due to their location.

These two implications apply similarly to the analysis of preferential trade integration among countries.

Turning to the non-preferential Multilateral scenario, we have seen from the country-level results (see Fig. 11) that it is qualitatively different from the preferential ones. Fig. 14 shows the underlying results at the regional level within Russia, in stark contrast to the preferential scenario in Fig. 13.

The difference is particularly marked for the industrial regions, since multilateral liberalization wipes out the production-shifting to Russia seen in the preferential scenarios, and the corresponding wage- and price-driving impact of manufacturing growth. Now the price and welfare effects are similar for all Russian regions, with a welfare gain that is mainly due to cheaper (or more diversified) imports, and the resulting lower price level. Hence Multilateral integration is more equi-

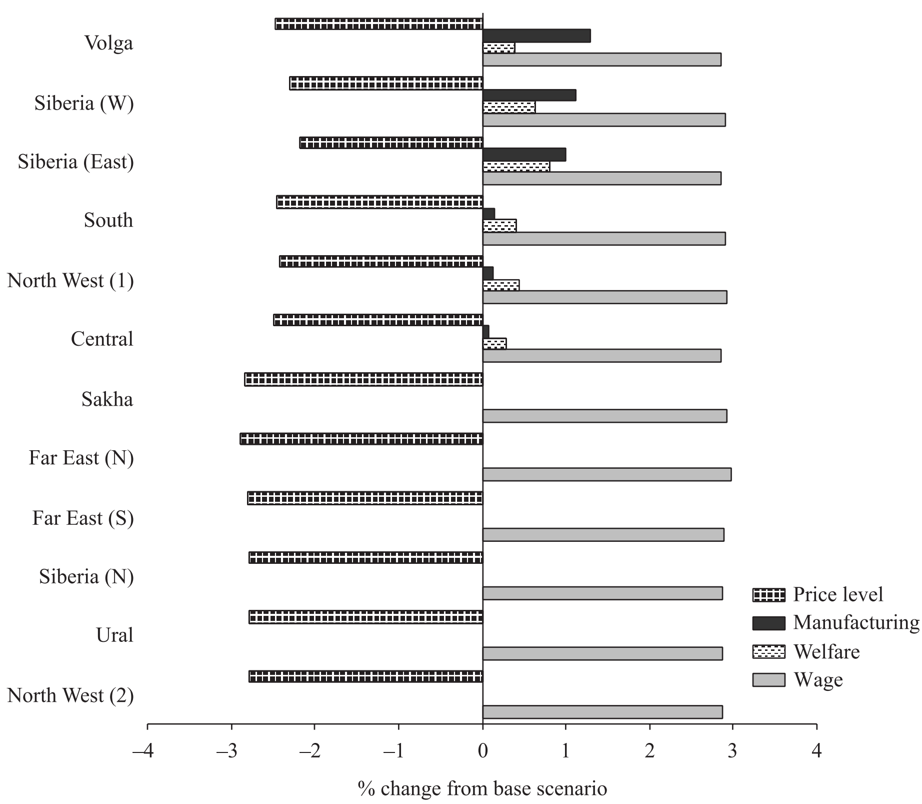

Fig. 14. Multilateral scenario: Predicted impact for Russian regions.

Source: Author's results from numerical model simulations.

table across regions, but preferential FTA race integration is Pareto-improving since the commodity regions get their price level reductions also in this case.

As noted earlier, the Multilateral scenario leads to global growth in the number of manufacturing firms (due to the larger overall reduction in trade costs). Fig. 14 shows that Russia also gets a share of this, with manufacturing growth in the diversified domestic regions, and diversification of East Siberia also in this case. Again, there is more industrial growth in the Volga and West Siberia regions.

Hence in the Multilateral scenario, the industrial and commodity domestic regions are not as different as they were in the preferential setting, but the threshold between deindustrialization and diversification is still at work, and the manufacturing effects still apply to the diversified regions. The results of this section provide a conceptual framework and hypotheses for further empirical work, and the results concerning price and wage effects suggest that these variables are of great interest in empirical work on trade integration, be it at the country level or for domestic regions. As shown earlier, there are considerable price level differences across Russian regions, and the predicted price levels for tradables correspond well to the real observations. Hence it is hoped that the model simulations presented here provide a useful framework for further empirical analysis.

4. Concluding remarks

The analysis of this paper provides some interesting findings of a more general nature. First, the persistent wage- and price-rising impact of preferential integration for participating countries is an original result. It is well known from the literature, e.g., already in Krugman (1980), that a market access advantage may show up in higher wages, but this has to a limited extent been focused in later research. The model analysis here provides a comprehensive analysis of wage and price effects that delivers interesting hypotheses for empirical research. The analysis shows that preferential liberalization differs strongly from multilateral liberalization in this respect, and this is to our knowledge a new finding. Second, we examine the role of trade policy for commodity exporters. The results show that they have no reason to fear trade liberalization, and such liberalization may even promote industrial diversification rather than de-industrialization. Our theoretically consistent analysis of complete specialization sheds new light on this phenomenon. Given that half the world's countries are commodity exporters, this analysis is of general interest. More research should be undertaken to examine the generality of this result and its drivers.

Given that more than half of Russia's regions are commodity exporters, the analysis of Russia demonstrates how preferential and multilateral liberalization differ, and how the outcome for diversified and commodity domestic regions differ, particularly in the preferential scenarios. With reference to the initial empirical analysis of regionalization versus globalization, the analysis suggests that Russia has much more to gain from global than from intra-regional integration, even if there are gains also from the latter.

The model also shows how geography creates effects that depend on the location of countries/regions and their neighbors. For Russia, the centrally located regions Volga and West Siberia are predicted to get the strongest manufacturing boost from trade integration, be it "production shifting" in the preferential scenarios, or production increases in the multilateral scenario. Surprisingly, the same ranking is largely replicated across all scenarios, be it with Eastern Europe, China, EU or the world. This effect may either be caused by higher demand from the neighboring commodity regions, or because international integration has a centralizing geographical impact on Russia. The stability of this result across scenarios points to the first of these drivers, even if a firm conclusion could not be drawn.[21]

While the paper started with an empirical analysis of Russia' trade, much more empirical work could be undertaken in the light of the numerical simulation results. For that reason, these results should be considered as hypotheses and possible mechanisms only, and more empirical work should be done in order to shed light on their relevance. As noted, the model is stylized and missing important aspects of the real-world economy, so the results should be interpreted with this caution in mind. In future work, the model may also be improved by obtaining better empirical estimates of trade costs and other inputs, or by extensions that take into account important missing features.

Acknowledgements

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[21] Our results differ from those of Rutherford and Tarr (2006), who found that WTO liberalization would benefit Northwest Russia, St. Petersburg and Russia's Far East more than others; their results were however driven by reduced investment barriers, which are not covered by the analysis here. This provides a reminder that our analysis of trade is partial in the sense that investment and migration are not accounted for.

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Supplementary material

Detailed results from base scenario and for five scenarios

Author: Arne Melchior

Data type: Table

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Appendix A

Table A1

Overview of Russia's foreign trade, 2013–2017.

Indicator	2013	2014	2015	2016	2017
Russian exports (million USD)					
Goods	527,266	497,834	343,908	285,491	359,152
Services	70,123	65,745	51,697	50,554	57,828
Total	597,389	563,578	395,605	336,045	416,980
Services % of total	11.74	11.67	13.07	15.04	13.87
Russian imports (million USD)					
Goods	314,945	286,649	182,121	182,257	227,588
Services	128,382	121,022	88,617	74,381	88,647
Total	443,327	407,671	270,739	256,639	316,235
Services % of total	28.96	29.69	32.73	28.98	28.03
Russian trade (exports + imports) (million USD)					
Goods	842,211	784,482	526,029	467,748	586,740
Services	198,504	186,767	140,315	124,936	146,475
Total	1040,716	971,249	666,344	592,684	733,215
Services % of total	19.07	19.23	21.06	21.08	19.98
Net trade ratio $(x - m)/(x + m)$					
Goods	0.25	0.27	0.31	0.22	0.22
Services	–0.29	–0.30	–0.26	–0.19	–0.21
Total	0.15	0.16	0.19	0.13	0.14
Russia % of world exports					
Goods	2.91	2.77	2.18	1.86	2.10
Services	1.45	1.27	1.05	1.02	1.09
Total	2.60	2.43	1.91	1.66	1.86
Russia % of world imports					
Goods	1.63	1.48	1.08	1.10	1.28
Services	2.73	2.37	1.84	1.54	1.75
Total	1.84	1.67	1.25	1.20	1.38
Russia % of world trade					
Goods	2.25	2.10	1.61	1.47	1.68
Services	2.09	1.82	1.44	1.28	1.41
Total	2.21	2.04	1.57	1.42	1.62

Note: Symbols in formula: x — exports, m — imports.

Sources: Trade in goods — author's data set constructed from WITS/Comtrade data, see paragraph 2. Trade in services: ITC Trade Map at www.trademap.org

Table A2
Shares of world trade 1996 and 2017, for Russia, China and major world regions (%).

Exporting region	Importing region									
	Africa	Asia xChina	China	Eastern Europe xRus	Latin America	Middle East	North America	**Russia**	Western Europe	World
Shares of world trade, 1996										
Africa	0.20	0.28	0.02	0.00	0.05	0.08	0.36	**0.01**	1.14	2.14
Asia xChina	0.31	10.78	1.33	0.03	0.48	0.75	5.42	**0.09**	3.85	23.04
China	0.04	2.26		0.00	0.06	0.09	0.84	**0.03**	0.59	3.91
Eastern Europe xRussia	0.00	0.03	0.02	0.11	0.01	0.04	0.02	**0.26**	0.14	0.64
Latin America	0.05	0.39	0.06	0.01	0.83	0.08	1.01	**0.02**	0.76	3.22
Middle East	0.10	1.30	0.05	0.03	0.05	0.36	0.45	**0.03**	1.01	3.36
North America	0.18	4.31	0.32	0.03	1.14	0.55	8.21	**0.07**	3.25	18.07
Russia	**0.01**	**0.18**	**0.10**	**0.32**	**0.06**	**0.08**	**0.10**		**0.89**	**1.72**
Western Europe	1.03	4.07	0.40	0.22	0.85	1.91	3.62	**0.50**	31.30	43.89
World	1.92	23.60	2.30	0.75	3.52	3.95	20.01	**1.02**	42.93	100.00
Shares of world trade, 2017										
Africa	0.34	0.39	0.37	0.01	0.05	0.12	0.20	**0.01**	0.85	2.33
Asia xChina	0.39	9.42	5.57	0.05	0.46	1.11	3.59	**0.18**	3.05	23.83
China	0.47	5.87		0.15	0.59	0.89	3.38	**0.27**	2.53	14.14
Eastern Europe xRussia	0.02	0.07	0.10	0.09	0.01	0.09	0.02	**0.14**	0.39	0.93
Latin America	0.08	0.52	0.62	0.01	0.71	0.17	0.80	**0.04**	0.58	3.51
Middle East	0.21	1.67	0.60	0.06	0.05	0.77	0.48	**0.04**	1.29	5.16
North America	0.13	2.03	0.97	0.03	0.93	0.48	6.27	**0.06**	2.18	13.08
Russia	**0.03**	**0.27**	**0.23**	**0.27**	**0.03**	**0.17**	**0.09**		**0.86**	**1.96**
Western Europe	0.88	2.79	1.55	0.28	0.57	2.03	3.36	**0.54**	23.06	35.07
World	2.54	23.04	10.01	0.95	3.39	5.83	18.18	**1.28**	34.78	100.00

Notes: Average of shares based on export and import data. Data set extended with mirror data. xRus, xChn — excluding Russia and China, respectively.
Source: Own calculations based on data from WITS/Comtrade.

Table A3
The share of manufacturing in Russia's foreign trade (percentages of total exports to or imports from the partner, respectively).

Indicator	Africa	Asia xChina	China	Eastern Europe xRus	Latin America	Middle East	North America	Western Europe	World
Exports									
1996	62	35	76	31	17	40	40	16	26
1997	55	28	74	25	27	42	51	14	23
1998	45	34	75	23	27	51	57	20	29
1999	48	36	70	21	21	45	32	19	25
2000	58	37	48	25	16	38	52	16	24
2001	48	37	41	29	20	41	32	16	23
2002	52	38	44	26	17	38	28	13	23
2003	42	36	44	28	18	34	24	12	22
2004	35	43	34	27	27	34	40	12	22
2005	44	43	32	32	25	31	41	10	19
2006	43	30	25	32	31	26	40	9	17
2007	39	24	26	35	53	33	39	11	17
2008	30	31	20	30	53	22	30	9	17

(continued on next page)

Table A3 (continued)

Indicator	Africa	Asia xChina	China	Eastern Europe xRus	Latin America	Middle East	North America	Western Europe	World
2009	29	29	23	27	53	23	19	9	16
2010	31	25	18	20	63	27	22	10	14
2011	22	22	11	19	49	29	23	10	13
2012	21	22	12	44	56	24	30	10	16
2013	25	17	11	50	48	29	34	10	16
2014	27	15	11	51	76	31	50	11	17
2015	45	20	14	53	75	36	49	15	21
2016	19	20	13	49	58	29	32	13	22
2017	41	21	12	55	56	35	43	16	22
Imports									
1996	4	68	53	37	7	62	59	75	44
1997	10	62	65	28	6	73	55	75	45
1998	8	61	61	26	5	74	64	76	57
1999	5	53	66	25	3	58	58	75	40
2000	7	60	75	28	2	65	71	79	56
2001	8	71	83	30	2	70	68	81	61
2002	7	72	82	27	3	74	73	80	63
2003	8	78	85	29	3	72	75	81	65
2004	10	85	88	31	6	72	75	83	67
2005	13	89	89	37	7	73	78	84	72
2006	15	89	92	41	8	72	68	85	74
2007	15	91	94	44	10	71	77	86	77
2008	16	90	94	42	9	73	76	87	78
2009	18	85	94	37	5	60	71	78	71
2010	20	87	95	36	5	62	80	84	74
2011	26	89	95	35	7	65	80	85	75
2012	26	90	96	73	10	70	78	85	83
2013	27	89	96	67	18	68	85	85	82
2014	24	88	95	61	8	66	89	87	82
2015	22	84	94	54	6	57	92	89	80
2016	21	86	95	59	6	57	68	85	79
2017	23	87	95	57	12	60	93	90	83

Source: Author's calculations based on data from WITS/Comtrade.

Table A4
Total trade costs in the base scenario (%).

Exporting country/region	Importing country/region							
	Russia	Eastern Europe xRus	Western Europe	North America	South America	Middle East	Asia / Pacific	Africa
Russia	30	56	42	49	74	61	56	78
Eastern Europe xRussia	50	49	42	55	77	59	60	78
Western Europe	54	59	25	45	66	54	58	68
North America	62	58	46	26	63	70	63	79
South America	65	66	50	46	42	72	68	77
Middle East	52	68	37	51	70	48	55	71
Asia/Pacific	54	68	47	51	72	62	44	77
Africa	59	67	43	53	66	63	62	61

Source: Author's calculations based on numerical simulations.

Table A5
Russian regions in the simulation model.

Region	Description
Russia central including Moscow	Central Federal District
Russia Far East — northern	Kamchatka, Magadan, Chukotka
Russia Far East — southern part	Primorsky Krai, Khabarovsk, Amur, Sakhalin, Jewish Autonomous Region
North West Russia — part 1 with St. Petersburg	Vologda, Kaliningrad, Leningrad, Novgorod, Pskov, St. Petersburg
North West Russia — part 2 with Murmansk	Karelia, Komi Rep., Nenets, Arkhangelsk, Murmansk
Russia Far East — Sakha	Sakha (Yakutia)
Siberia — eastern part towards China	Buryatia, Tyva Rep., Transbaikal, Irkutsk
Siberia — northern part (Krasnoyarsk)	Krasnoyarsk
Siberia — western part with Novosibirsk	Altai Rep., Khakassia, Altai region, Kemerovo, Novosibirsk, Omsk, Tomsk
Russia South and North Caucasia	Southern Federal District, North Caucasian Federal District
Ural	Ural Federal District
Volga region	Volga Federal District

Notes on Russian regional data: Data on Russian regions are generally from Russian Federation, Federal State Statistics Service (http://www.gks.ru/free_doc/new_site/region_stat/sep_region.html). This included regional GDP, population and labor force data. For natural resource endowments, the point of departure was country data on natural resource rents as a percentage of GDP, provided by the World Bank. The total value of these rents is allocated across regions as follows: For Canada, India, Kazakhstan and Russia, it is allocated proportional to value added in mining and quarrying. Geographical data (latitudes and longitudes) were taken from the Global Cities Database. For Russian regions, average coordinates were also calculated across all cities within each region, and the average between this and the capital/administrative center coordinates was used in the model calculations. This method takes into account that for some Russian regions, the location of administrative capitals and the economic mass differ considerably, and this is important for Russia due to the large space.

Table A6
Trade policy scenarios for Russia: Key results for world regions (changes in % from base scenario). Results aggregated across countries and domestic regions included in each world region or country.

World regions	Scenario				
	Eastern Europe	China	EU	FTA race	Multi-lateral
Nominal wage					
Russia	0.22	1.34	0.91	7.31	0.46
Eastern Europe	0.65	–0.17	–0.14	–0.26	1.49
Western Europe	–0.02	–0.18	0.48	–0.30	0.59
North America	–0.02	–0.17	–0.12	–0.25	0.03
Latin America	–0.02	–0.17	–0.13	–0.24	1.58
Middle East	–0.01	–0.09	–0.06	–0.14	0.35
China	–0.02	0.38	–0.13	–0.33	–1.82
Asia xChina	–0.02	–0.17	–0.13	–0.30	–0.06
Africa	–0.02	–0.19	–0.14	–0.27	1.67
Real income per capita (welfare)					
Russia	0.10	0.95	0.77	4.31	2.98
Eastern Europe	0.23	–0.03	–0.03	0.03	3.62
Western Europe	0.00	–0.03	0.15	–0.01	2.37
North America	0.00	–0.03	–0.02	0.01	2.03
Latin America	0.00	–0.02	–0.02	0.05	3.38
Middle East	0.00	–0.02	–0.02	0.05	3.19
China	0.00	0.12	–0.02	0.00	1.57
Asia xChina	0.00	–0.03	–0.02	0.02	2.66
Africa	0.00	–0.02	–0.02	0.06	3.80

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Table A6 (continued)

World regions	Scenario				
	Eastern Europe	China	EU	FTA race	Multi-lateral
Number of manufacturing (tradables) firms					
Russia	0.21	1.33	0.89	6.83	0.47
Eastern Europe	0.38	–0.10	–0.08	–0.16	0.89
Western Europe	–0.01	–0.05	0.12	–0.08	0.16
North America	–0.01	–0.05	–0.04	–0.07	0.03
Latin America	–0.01	–0.11	–0.08	–0.15	1.01
Middle East	–0.01	–0.07	–0.05	–0.12	0.28
China	–0.01	0.13	–0.05	–0.12	–0.63
Asia xChina	–0.01	–0.06	–0.05	–0.11	–0.02
Africa	–0.02	–0.13	–0.10	–0.19	1.16
Price level					
Russia	0.13	0.41	0.16	2.99	–2.44
Eastern Europe	0.44	–0.15	–0.11	–0.31	–2.01
Western Europe	–0.02	–0.15	0.33	–0.29	–1.75
North America	–0.02	–0.14	–0.09	–0.26	–1.95
Latin America	–0.02	–0.14	–0.10	–0.26	–1.85
Middle East	–0.01	–0.10	–0.07	–0.24	–2.70
China	–0.02	0.25	–0.11	–0.32	–3.29
Asia xChina	–0.02	–0.13	–0.10	–0.32	–3.01
Africa	–0.02	–0.15	–0.10	–0.30	–2.21
Nominal GDP					
Russia	0.19	1.15	0.78	6.27	0.39
Eastern Europe	0.58	–0.16	–0.12	–0.24	1.34
Western Europe	–0.02	–0.18	0.47	–0.30	0.58
EU	–0.02	–0.18	0.50	–0.30	0.58
North America	–0.02	–0.16	–0.12	–0.25	0.03
Latin America	–0.02	–0.16	–0.12	–0.22	1.46
Middle East	–0.01	–0.07	–0.05	–0.12	0.30
China	–0.02	0.36	–0.13	–0.32	–1.76
Asia xChina	–0.02	–0.16	–0.12	–0.29	–0.06
Africa	–0.02	–0.17	–0.13	–0.24	1.52

Note: Observe that commodities are the model numeraire, so we measure the change in prices relative to commodities. In all scenarios, total trade costs, including tariffs, export/import costs, infrastructure costs and transport costs, are reduced by 25% between selected countries. The following scenarios are presented:

- Eastern Europe: Between Russia and Eastern Europe
- China: Between Russia and China.
- EU: Between Russia and the EU.
- FTA race: Between Russia and all other countries.
- Multilateral: Between all countries in the world.

Source: Results from numerical simulations. Author's calculations based on the model presented in Melchior (2018). Model details are available at https://link.springer.com/content/pdf/bbm%3A978-3-319-92834-0%2F1.pdf

Table A7
Trade policy scenarios for Russia: Key results for Russian regions (changes in % from base scenario).

Russian regions	Scenario				
	Eastern Europe	China	EU	FTA race	Multi-lateral
Nominal wage					
Central	0.37	2.15	1.48	11.86	0.29
North West (1)	0.37	2.21	1.54	12.08	0.45
South	0.38	2.21	1.52	12.13	0.40
Siberia (W)	0.38	2.40	1.49	12.30	0.64
Volga	0.38	2.21	1.48	11.99	0.38

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Table A7 (continued)

Russian regions	Scenario				
	Eastern Europe	China	EU	FTA race	Multi-lateral
Siberia (East)	0	2.16	1.11	12.05	0.80
North West (2)	0	0	0	0	0
Ural	0	0	0	0	0
Siberia (N)	0	0	0	0	0
Far East (S)	0	0	0	0	0
Far East (N)	0	0	0	0	0
Sakha	0	0	0	0	0
Real income per capita (welfare)					
Central	0.13	1.13	0.91	5.37	2.85
North West (1)	0.14	1.16	0.94	5.46	2.92
South	0.13	1.11	0.89	5.22	2.91
Siberia (W)	0.08	0.91	0.68	3.92	2.91
Volga	0.07	0.80	0.66	3.51	2.86
Siberia (East)	0.05	0.74	0.55	3.02	2.86
North West (2)	0.06	0.70	0.60	2.92	2.87
Ural	0.06	0.72	0.59	2.93	2.87
Siberia (N)	0.05	0.73	0.57	2.92	2.87
Far East (S)	0.05	0.76	0.55	2.94	2.89
Far East (N)	0.05	0.77	0.58	3.04	2.98
Sakha	0.05	0.75	0.57	2.98	2.93
Number of firms in the traded sector					
Central	0.10	0.58	0.40	3.08	0.08
North West (1)	0.10	0.60	0.42	3.16	0.12
South	0.14	0.81	0.56	4.24	0.15
Siberia (W)	0.67	4.20	2.61	20.11	1.12
Volga	1.30	7.53	5.07	38.13	1.30
Siberia (East)	0	*)	*)	*)	*)
North West (2)	0	0	0	0	0
Ural	0	0	0	0	0
Siberia (N)	0	0	0	0	0
Far East (S)	0	0	0	0	0
Far East (N)	0	0	0	0	0
Sakha	0	0	0	0	0
Price level					
Central	0.23	0.98	0.55	6.02	–2.50
North West (1)	0.23	1.01	0.58	6.13	–2.41
South	0.24	1.01	0.57	6.16	–2.45
Siberia (W)	0.24	1.11	0.57	6.25	–2.30
Volga	0.23	1.00	0.54	6.04	–2.48
Siberia (East)	–0.05	0.91	0.30	6.07	–2.18
North West (2)	–0.06	–0.70	–0.60	–2.84	–2.79
Ural	–0.06	–0.71	–0.58	–2.84	–2.79
Siberia (N)	–0.05	–0.73	–0.56	–2.84	–2.79
Far East (S)	–0.05	–0.75	–0.54	–2.85	–2.80
Far East (N)	–0.05	–0.76	–0.58	–2.95	–2.89
Sakha	–0.05	–0.75	–0.57	–2.90	–2.84

*) The number of firms in the base scenario is zero for East Siberia, so growth rates cannot be calculated. In the China, EU, FTA race and Multilateral scenarios there is a small positive number of firms in the region.

Notes: Observe that commodities are the model numeraire, so for prices we measure the change relative to commodities. For explanation of regional sub-division, see Table A5. For explanation of scenarios, see main text and Table A6. In order to facilitate reading, the regions have been ranked according to the share of tradables production in the base scenario (see Fig. 12 in the main text). The six regions at the bottom remain deindustrialized in all scenarios, while East Siberia becomes diversified in four scenarios.

Source: Results from numerical simulations. Author's calculations based on the model presented in Melchior (2018). Model details are available at https://link.springer.com/content/pdf/bbm%3A978-3-319-92834-0%2F1.pdf