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DISCUSSION PAPER

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ASSESSING THE EXTENT OF EU–RUSSIA TRADE INTEGRATION IN THE PRESENCE OF GLOBAL VALUE CHAINS

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CONTENTS

ABBREVIATIONS

BRII – Brazil, Russia, India and Indonesia
CESEE – Central, Eastern and Southeastern Europe
EU15 – EU countries before 1 May 2004
EU27 – EU countries from 1 January 2007 to 30 June 2013
GVC – global value chains
I2P – importing-to-produce
I2E – importing-to-export
NBER – National Bureau of Economic Research
OeNB – Oesterreichische Nationalbank
UK – United Kingdom
wiiw – Vienna Institute for International Economic Studies
WIOD – World Input-Output Database

ABSTRACT

The present paper analyses trade linkages between EU Member States and Russia taking into account the indirect trade links through global value chains based on data for 2011 from the World Input-Output Database combined with gross flows between Russia and individual EU countries. We base our conclusions on three indicators: gross exports in final use, value added in final use and value added in output. The latter two novel indicators are able to capture direct and indirect links jointly by allocating the full amount of Russia's value added in the EU's final domestic use and output (and vice versa: the EU's value added in Russia's final domestic use and output). In terms of direct export shares, Russia represents the EU's fourth largest trade partner, while the EU is Russia's largest trade partner. The Russian economy is also considerably more dependent on European value added in terms of both final use and producing output than vice versa. However, the degree of integration varies greatly across the EU Member States. For example, the Baltic States are notably more dependent on Russia's value added than vice versa. Moreover, certain economic sectors in the EU are strongly dependent on Russian inputs, such as the energy sector, electricity, gas and water supply and air transport.

Keywords: trade integration, global value chains, Russia, European Union

JEL codes: F12, F15, F51

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1. INTRODUCTION

Recent geopolitical tensions and discussions about trade sanctions have raised widespread interest regarding the economic linkages between the EU27[1] and Russian economies. In this paper, we assess the status-quo of the current trade integration between Russia and individual EU27 Member States. While realising that it is very complicated (if not impossible) to encompass the total degree of interconnectedness between these economies, we aim to gauge the degree of interdependence nevertheless in a comprehensive way. This paper focuses on trade linkages but, in contrast to existing studies, we broaden the view to take into account global linkages (i.e. direct and indirect trade linkages) in order to get a fuller picture. We would like to emphasise that our analysis here is not an attempt to estimate the impact of current and potential further sanctions, but a broad examination of the current state of trade linkages between these economies.

Several publications on global value chains (GVCs) have demonstrated that a narrow focus on direct trade flows, without taking into account global interdependencies, gives an incomplete picture of mutual trade interdependencies. The international fragmentation of production is an important element of today's global economic activity. Stehrer et al. (2012) find that international linkages have increased over the last 10 years globally. They observe more generally an overall increase in interconnectedness, i.e. stronger domestic and international linkages between industries. According to their results, the Central, Eastern and Southeastern Europe (CESEE) EU Member States appear to be the most interlinked region, in the sense that the CESEE countries show strong bilateral linkages with the EU15 Member States. Riad et al. (2012) observe an increase in trade interconnectedness as well which also increases the transmission of shocks between countries through the trade channel. Besides noting the rapid rise of China as a systemically important trading partner, they point towards the European countries as being "central" in the trade network primarily due to their high degree of interconnectedness rather than their economic size. Baldwin and Lopez-Gonzalez (2013) also point towards radical changes in trade linked to international production networks which they identify to have taken place between 1985 and 1995. Again, they emphasise the rise of China in what they call the "global supply-chain trade". Conceptually, they distinguish between "importing-to-produce (I2P)", which describes the use of foreign intermediates (goods and services) in a country's total production, and "importing-to-export (I2E)", which refers to the use of imported inputs in exported goods and services (thus being a subset of I2P). Their analysis reveals some stylised facts with possible relevance for the relationship between Russia and the EU27. For example, they find that I2E-trade is more regionally concentrated than aggregate trade. They further emphasise that the so-called "global value chains" remain, in fact, structured into three main regions ("Factory Asia, Factory Europe, and Factory North America") with the three corresponding hubs being US, Germany and China. Another stylised fact postulates that countries which are smaller and located more closely to one of the three major supply networks are more dependent in terms of their reliance on intermediate inputs from other countries within the respective regional value chain. However, they also note that trade patterns for raw materials

[1] Since we base our analysis on data for 2011, we focus here on the EU27, i.e. the EU prior to Croatia's accession.

are less regionalised. In our context, this would imply an asymmetric relationship between Russia and the EU countries, with the former being more strongly dependent on intermediate inputs from the EU Member States given the geographic proximity, while the EU Member States are likely to depend on Russia for raw materials (especially, energy products). Overall, backward linkages are more important than forward linkages, highlighting the importance of sourcing from abroad. This finding is particularly relevant in our context as Russia is a major source country for energy products. Stehrer et al. (2012) support this view by stating that backward linkages to the BRII countries are particularly relevant for the CESEE EU Member States in the chemical sector.

Our contribution here is to scrutinise the extent of interconnectedness between the EU27 and Russia in terms of final use and total output. Thus, within the meaning of the notation introduced by Baldwin and Lopez-Gonzalez (2013), we analyse I2P patterns here. Our analysis of trade integration is based on data for 2011 from the WIOD. This database offers a world's input-output table by combining national input-output tables with global trade data. Hence, using this database enables to take account of direct as well as indirect trade flows between the EU27 Member States and Russia. This means that we can identify the full amount of foreign value added in total output and final use in any bilateral comparison. Calculations show that Russia's value added is more important for the EU's final use than direct imports suggest, while the EU's value added is even more important in Russia's final use. Also, the EU27 output shows a higher amount of Russia's value added compared to the EU27 final demand, while Russian producers are, on average, even more dependent on the EU's value added than vice versa. There are wide-ranging differences within the EU27: some EU Member States (Latvia, Lithuania, Estonia, Finland, Bulgaria and Hungary) and certain industries could be severely affected by trade disruptions with Russia, especially when the full amount of value added is taken into account.

The present paper is structured as follows. Section 2 provides an overview of bilateral trade relations between Russia and EU Member States based on traditional statistics. Section 3 reviews the methodology used in this paper to identify the extent of trade linkages between the EU and Russia using the GVC approach. A detailed description of our findings is provided in Section 4, whereas Section 5 concludes the paper.

2. DIRECT BILATERAL INTEGRATION THROUGH TRADE

When we restrict our focus to direct trade flows in goods between the EU and Russia, we find that Russia is the EU's fourth most important trading partner (excluding intra-EU trade), while the EU represents the most important export destination for Russian goods (see Chart 1). Intra-EU trade included, Russia accounted for 2.5% of the total exports of the EU27 countries in 2011 which amounted to 0.8% of the EU27 GDP.[2] However, there are large differences across individual Member States. For the Baltic countries, Russia plays a much greater role as an export destination (Lithuania: 11% of GDP; Latvia and Estonia: 8%). The following EU Member States of the Eastern and Northern Europe recorded exports

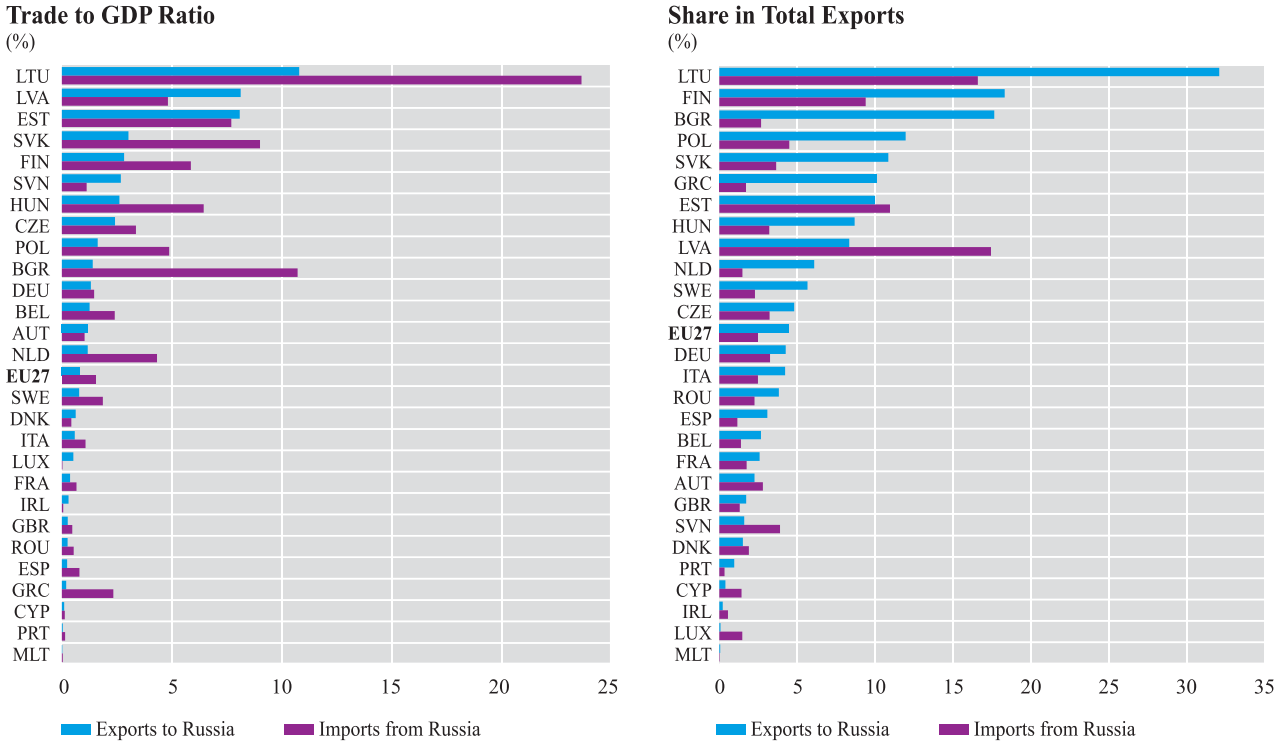
[2] These figures do not change much over time: in 2013, 2.6% of total EU27 exports went to Russia; this corresponds to 0.9% of GDP.

to Russia of about 2% to 3% of their respective GDP: Slovakia, Finland, Slovenia, Hungary, the Czech Republic and Poland.

Russia has traditionally been a more important trade partner for the EU countries in terms of imports which averaged 1.5% of GDP in 2011. Again, some Member States posted much higher figures: e.g. Lithuania (23.6% of GDP), followed by Bulgaria (10.7%), Slovakia (9.0%), Estonia (7.7%), Hungary (6.4%) and Finland (5.9%). However, for the following EU Member States, Russia's importance as a destination for their exports exceeds its importance as a source of imports: Austria, Denmark, Estonia, Ireland, Latvia, Luxembourg and Slovenia.

Chart 1

Bilateral Trade in Goods between the EU27 and Russia (2011)



Source: Latvijas Banka and OeNB calculations based on Eurostat.

On the import side, the importance of Russia for the EU Member States is very much concentrated in the raw material sectors. Russia is the main supplier of energy products for many EU Member States. Again, this dependence varies greatly across the Member States. Slovakia depends most on Russia in this regard, as 70% of its oil and gas imports hailed from Russia in 2011. The respective share ranged between 50% and 30% in Finland, Latvia and Estonia. It has to be noted though that these figures only represent the direct oil and gas supplies from Russia to Latvia and Estonia. Russian oil and gas enters those two countries also indirectly via Lithuania and Belarus.[3] Austria's and Germany's shares were slightly lower at 28.8% and 27.3% respectively. Some countries (e.g. Ireland, Cyprus, Malta, but also Portugal)

[3] We focus on such indirect trade linkages and their respective importance for economic activity in Section 3 below.

do not report any direct oil or gas imports from Russia at all. Hence, Russia is an important direct trading partner for energy products in the case of some Member States (namely, the Baltic States).

3. CAPTURING INDIRECT LINKAGES

The international fragmentation of production has changed the nature of the international economy and, as a result, trade flows (gross exports and imports) are no longer an appropriate indicator of a link between two countries. Products exported from country s to country r are only partly produced in country s, while, on the other hand, country s may reach consumers in country r via intermediate inputs in any third country. Thus, a simple analysis of Russian exports to the EU27 will ignore e.g. Russian energy used in third countries to produce goods and services for the EU27 market. This calls for refined indicators that are able to capture direct and indirect links jointly. In order to avoid double counting of gross trade flows which arise from imported intermediate goods embodied in exports, such indicators should, in addition, account for the share of value added in production.

In this paper, we use three indices: a traditional one that relies on gross exports and two novel GVC-compatible indices that focus on value added instead of trade flows. Then we look at the importance of inputs from Russia for both final use (private and government consumption, gross fixed capital formation and changes in inventories) in the EU27 economies and total output. Thus we capture both the demand side and the supply side of the economy. Our first two indicators calculate the relevance of Russian inputs for final domestic demand (i.e. consumption and investment) in the EU27. We distinguish between direct trade flows from Russia (restricting attention to gross exports of goods and services) and Russia's value added that enters the EU directly and indirectly through goods and services that are imported from third countries. Our third indicator assesses the importance of the value added from Russia for the EU27 producers. Of course, we also calculate all three indicators with respect to the importance of the EU27 inputs for the Russian economy.

3.1 Gross Exports in Final Use

As a first indicator, we calculate the share of gross exports from country *s* which is to be found in domestic final use of country *r*. This reflects the portion of the final domestic demand in country *r* that is served by imports from country *s* and is evaluated as follows:

$$E_{sr}^{ratio} = \frac{\sum_{n} E_{sn,r}}{\sum_{i}\sum_{n} Y_{in,r}}, \qquad (1)$$

where E_{sr}^{ratio} is the share of the final use products exported from country *s* to country *r*, while $E_{sn,r}$ denotes the exports of final use products supplied by sector *n* of country *s* to country *r*. Equation (1) can be modified to calculate the share of the final use products coming from a particular sector of country *s*. *E* denotes exports of the source country *s*, *Y* refers to the final domestic demand of the destination country *r*, with *i* being a running index of all source countries.

This indicator does not tell anything about the value added produced in country *s*. Rather it reflects the perception of country *r*'s consumers based on "Made in .." stickers. In our analysis, this indicator reflects the share of "Made in Russia" products in the EU27 consumption and investments as well as the share of "Made in the EU" products in the final domestic demand of Russia. As mentioned before, usually this does not mean the ultimate role of a country mentioned on a sticker in the production process. Moreover, it does not account for the importance of a country via indirect links (e.g. it does not fully capture oil and gas from Russia, as a large part of mineral products is not consumed directly). However, the share of direct exports can serve as a useful benchmark for comparison.

3.2 Value Added in Final Use

It is useful to compare this rather traditional measure based on direct exports to the importance of the value added which is moving directly and indirectly from one country to another. This measure was initially introduced by Johnson and Noguera (2012) and is also termed "value-added exports" or "value-added trade". It focuses on final use again and can be described as ".. value added produced in source country *s* and absorbed in destination country *r*" (see Koopman et al. (2014), p. 462). For example, this would decompose the final domestic demand of Russia (consisting of private consumption, government consumption and investments) into value added produced by various source countries (including Russia).

The decomposition of the final domestic demand by source of value added is given by[4]:

$$VA^{USE} = V \cdot B \cdot Y = V \cdot (\mathrm{I} - A)^{-1} \cdot Y, \tag{2}$$

$$V \equiv \begin{bmatrix} diag(V_1) & 0 & \cdots & 0 \\ 0 & diag(V_2) & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & diag(V_K) \end{bmatrix}, \quad V_r \equiv u\left(\mathrm{I} - \sum_s A_{sr}\right),$$

where:

– VA^{USE} is a $KN \times K$ matrix that provides the disaggregated value added by producer country and sector in the final domestic demand for each country. K is the number of countries and N is the number of sectors. Each row of VA^{USE} represents the particular country and sector from which the value added originates. Each column of VA^{USE} reflects a specific destination country. $VA^{USE}{}_{sn,r}$, an individual element of the VA^{USE} matrix, shows the value added produced by country s in sector n and consumed in country r.

– Y is the $KN \times K$ matrix of the final domestic demand (private consumption, government consumption and investment). It contains blocks Y_{sr} representing the $N \times 1$ final domestic demand vector that describes the demand in country r for final goods shipped from country s. $Y_{sn,r}$, the individual element of Y, denotes the final domestic demand of country r for the products of sector n supplied by country s.

[4] This decomposition is based on a standard input-output analysis using the industry-specific technology assumption.

– V is a $KN \times KN$ diagonal matrix, V_r is a $1 \times N$ direct value-added coefficient vector, and each element gives the share of the direct domestic value added in total output for each sector of country r.

– A is a $KN \times KN$ matrix of input-output coefficients that is constructed from the $N \times N$ blocks A_{rs}. Those blocks contain information on intermediate use by country s of the goods produced in country r.

– B is the Leontief inverse matrix $B = (\mathrm{I} - A)^{-1}$.

– u is a $1 \times N$ unity vector.

– I denotes the $KN \times KN$ identity matrix.

The matrix VA^{USE} contains information on the decomposition of the final domestic demand for the entire set of countries present in the world input-output table. When we are interested in a particular subset of countries (source country s and destination country r), we use the following formula:

$$VA_{sr}^{USE\_ratio} = \frac{\sum_{n} VA_{sn,r}^{USE}}{\sum_{i}\sum_{n} Y_{in,r}}, \tag{3}$$

where $VA_{sr}^{USE\_ratio}$ denotes the share of the value added directly and indirectly coming from country s and absorbed in country r. The denominator of equation (3) is just the total final domestic demand of country r, while the numerator contains the total value added from s consumed in the final destination country r. Equation (3) can be easily modified to show the share of the value added coming from a particular sector of country s.

In contrast to the gross exports indicator, this measure is not tied to the final assembly country only. It goes much deeper and reflects the direct and indirect contribution of every country to the production of a consumption or investment good. More specifically, this indicator captures the indirect contribution of the Russian energy sector to the EU27 final domestic demand, at the same time also accounting for non-Russian inputs in "Made in Russia" final use products.

3.3 Value Added in Output

Both previous indicators characterise inter-country links from the expenditure side of the economy. However, we also need an indicator that describes the role of one country's inputs in another country's output, i.e. taking into account vertical specialisation (when countries tend to specialise in particular stages of the production process). The usual way of assessing vertical specialisation is to calculate "value added in gross exports" (see Koopman et al. (2010); closely related to "value added in trade" as named by Stehrer (2012)): this allows decomposing gross exports by producer countries.

The above-mentioned measure is useful when analysing the effect of globalisation on international trade, while our goal is somewhat different and we need to focus on the total supply (output). However, the methodology used by Koopman et al. (2010) in decomposing gross exports can be applied to the total output by simply replacing the gross exports matrix by the total output matrix:

$$VA^{OUTPUT} = V \cdot B \cdot X = V \cdot (\mathrm{I} - A)^{-1} \cdot X, \tag{4}$$

$$X \equiv \begin{bmatrix} diag(X_1) & 0 & \cdots & 0 \\ 0 & diag(X_2) & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & diag(X_K) \end{bmatrix},$$

where:

– VA^{OUTPUT} is a $KN \times KN$ matrix that decomposes the output of all sectors in all countries into the value added by source country and sector. Each row of VA^{OUTPUT} represents the producer country and sector from which the value added is originated. Each column of VA^{OUTPUT} shows the country and industry that uses this value added in its total output. $VA^{OUTPUT}{}_{sn,rm}$, an individual element of VA^{OUTPUT}, denotes the value added of country *s*'s sector *n* that is contained in the output of country *r*'s industry *m*.

– X is the $KN \times KN$ diagonal matrix of output. It contains $N \times N$ diagonal blocks X_s of output in country *s*. X_{sn}, the diagonal element of X, denotes the output of country *s* in sector *n*.

The information about the particular pair of countries (source country *s* and destination country *r*) can be discovered using the following equation:

$$VA_{sr}^{OUTPUT\_ratio} = \frac{\sum_m \sum_n VA_{sn,rm}^{OUTPUT}}{\sum_m X_{rm}}, \tag{5}$$

where $VA_{sr}{}^{OUTPUT\_ratio}$ is the share of the value added from country *s* directly and indirectly included in the output of country *r*. *X* is the total output and *m* refers to all industries of the destination country *r* that are producing the output, while *n* refers to all industries of the source country *s* that are delivering inputs. The numerator of equation (5) shows the total value added of country *s* used in the output of country *r*, while the total output of country *r* appears in the denominator. Equation (5) can also be modified to assess more detailed information on particular sectors.

While essentially similar to the value added in final use, the value added in output describes linkages from a different perspective: it focuses on direct and indirect inputs from Russia in the EU27 output (and vice versa). For instance, it shows the contribution of the Russian energy sector in the EU27 production, capturing also the indirect inputs via third countries.

3.4 Database

We use the recently established WIOD that combines information from national supply and use tables, National Accounts data on industry output and final use, and bilateral trade in goods and services for 40 countries, 59 commodities and over the period from 1995 to 2011 (see Timmer et al. (2012) for more details on the database and Stehrer (2012) for empirical calculations based on the WIOD). The database covers all EU Member States except Croatia; therefore, we have to restrict our analysis of direct and indirect trade linkages to the EU27. Moreover, although the

latest year available is 2011, we argue that it still reflects bilateral links between Russia and EU countries well, since the input-output structures do not change rapidly.

4. IMPORTANCE OF DIRECT AND INDIRECT TRADE LINKAGES

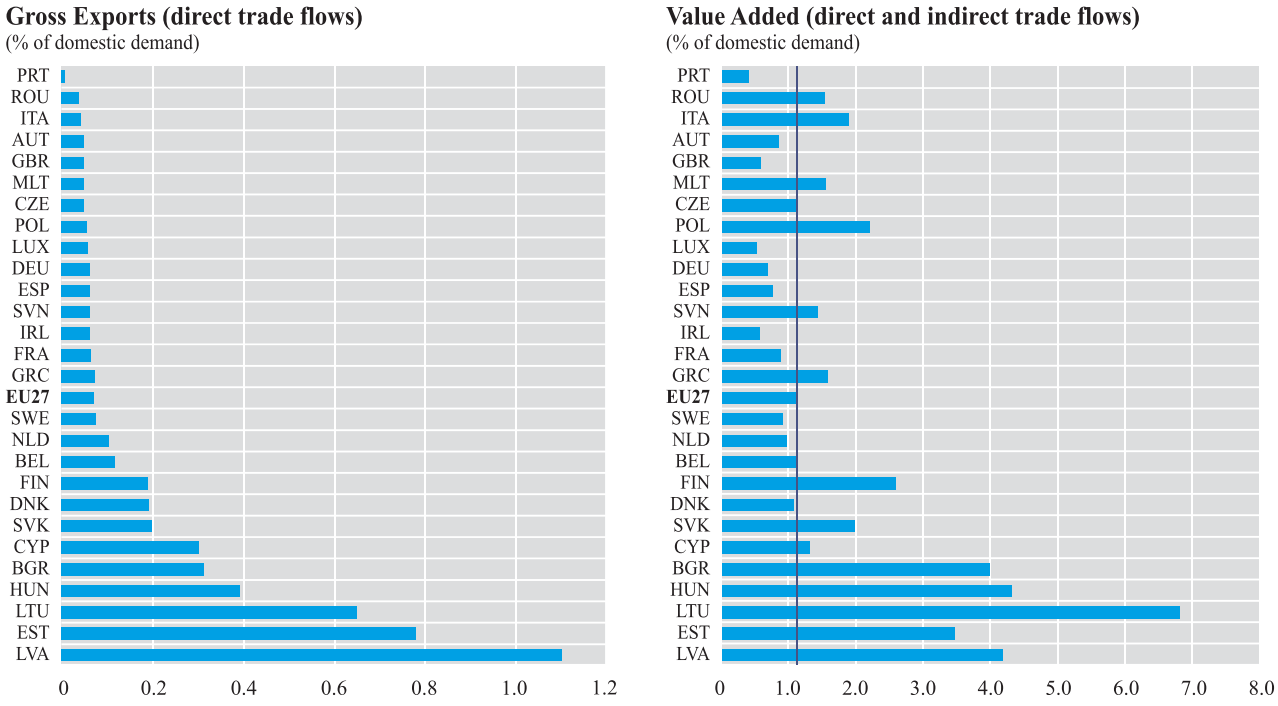
In section 2, we touched upon the importance of Russia as a direct trading partner for the EU members, which is not fully representative in the presence of internationally fragmented production processes. In addition, we restricted our attention to trade in goods only. In this Section, we broaden the view and employ the conceptual framework described in Section 3 to assess the importance of Russia for economic activity in the EU Member States. In other words, we analyse how dependent EU economies are on inputs from Russia, regardless whether these inputs are sourced directly or embedded in intermediate inputs sourced from elsewhere in the world. As we base our calculations on globally connected input-output tables, we also capture the role of service inputs here.

4.1 Importance of Bilateral Gross Exports and Value Added in Final Use Differs Between EU and Russia

At first sight, inputs from Russia play only a minor role for European economies. On the demand side, direct imports from Russia amount to 0.07% of the EU27 final use (left-hand panel of Chart 2). If the full amount of Russia's value added in the European final domestic demand is taken account of, the share of Russia's value added, which is absorbed directly and indirectly in the EU27 through GVC-integration, increases to 1.1% (right-hand panel of Chart 2).

Chart 2

Share of Russia's gross exports of final products and value added in the EU27 domestic final use (2011)



Source: Latvijas Banka and OeNB calculations.

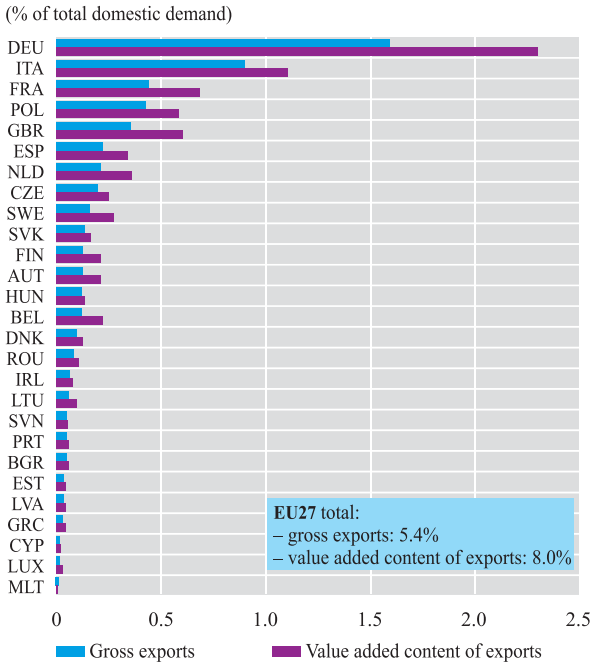
Individual EU Member States exhibit strong differences in their degree of integration with the Russian economy. The share of direct imports from Russia in final domestic use ranges from 1.1% for Latvia to 0.01% for Portugal. Including also indirect inputs from Russia, Lithuania shows the highest dependence on Russia's value added (6.8% of the final domestic demand). Portugal is again the least integrated with 0.4%. The integration in value added terms is particularly pronounced for Hungary, Latvia, Bulgaria and Finland. Differences between direct trade exposure and value added trade exposure are particularly pronounced for Poland, Italy and Greece. In Poland, the share of direct imports from Russia in the final domestic use is 0.06%, while Russia's value added in the final domestic use amounts to 2.2%. For Italy, the corresponding figures are 0.04% and 1.9% respectively. This large discrepancy may be related to Fiat producing in Russia. Finally, for Greece, the importance of Russian products in the final domestic use rises from 0.07% (direct imports only) to 1.6% (value added).

More than half of the demand for direct imports from Russia emerges from the coke, refined petroleum and nuclear fuel. Even though the importance of Russia for the EU's final domestic use remains limited and highly concentrated, Russia's value added is notably more important for the EU's final use than suggested by direct imports only.

Putting the focus on Russia, Chart 3 reveals that the EU's value added is considerably more important in Russia's final domestic use than vice versa. Around 5.4% of the final domestic demand in Russia is directly dependent on final products imported directly from the EU27. The level of dependence increases to 8% when we take into account also indirect effects i.e. when we focus on the EU27 value added instead of the goods exported directly from the EU27 to Russia. For instance, the final goods that reach Russia may come from elsewhere in the world, other than the EU27, via the participation of the EU27 exporters in global value chains. Hence, imports from non-EU countries also contain the EU27 value added.

Chart 3

Share of the EU gross exports of final products and value added in Russia's domestic final use (2011)



Source: Latvijas Banka and OeNB calculations.

A closer look lets us discover that Germany is the most important EU27 counterpart for Russia's final users, with a direct exposure of 1.6%. This figure increases to 2.3% when indirect effects are taken into account. The exposure of Russia's final domestic use to Italy, France, Poland and the UK is less important, but nevertheless significant, while other EU Member States play a less prominent role both directly and indirectly.

Looking by sector, in terms of direct exposure, the following industries in the EU27 have the highest relevance for the final domestic use in Russia: "Transport equipment" where the European exports account for 1.4% of Russia's final use, "Chemicals and chemical products" (0.6%), "Machinery" (0.9%) and "Textiles and textile products" (0.8%). Apart from these, it is difficult to single out other industries since the exposure is evident in many of them to some extent, although it does not exceed 0.5%. When considering the full value added content from the EU27 (i.e. including the European value added that is traded through third countries), two other industries emerge to be more important than the rest, namely "Basic metals and fabricated metal products" (0.5%) and "Renting of machinery and equipment and other business activities"(0.9%).[5]

To sum up, Russia's consumers and investors are more dependent on the EU's inputs than vice versa; therefore, we could suppose that, in case of a trade disruption, they might need to refocus on other trading partners for substitution.

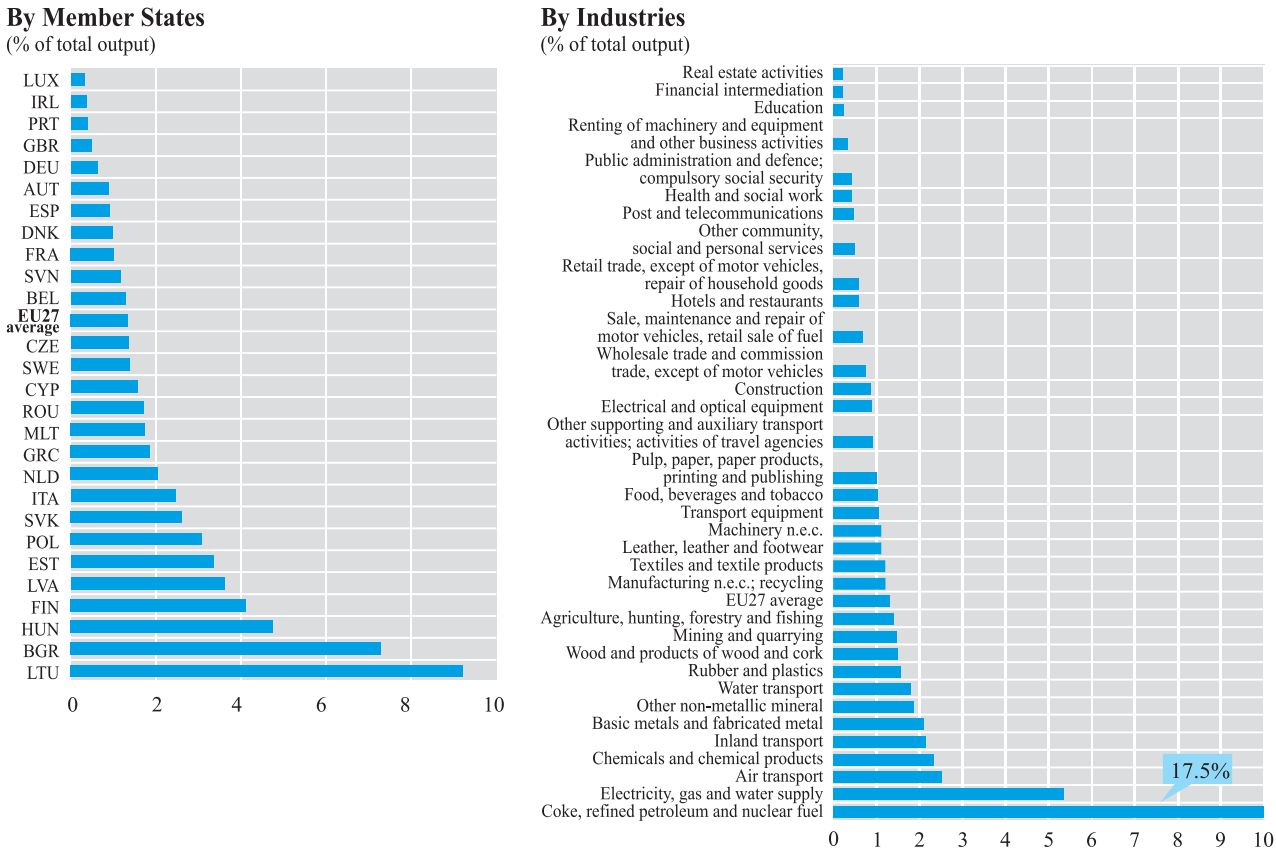
4.2 Russia's Value Added Is More Important for the EU's Output than for the EU's Final Use

The output approach allows us to assess the extent to which European industries are dependent on inputs from Russia and how this dependence differs across individual countries (see Chart 4). For the EU27 as a whole, Russia's value added is more important for the production of output (including the production of intermediate goods, final domestic use and exports) than for final use. On average, 1.3% of the EU27 output is dependent on Russia's value added. Again, linkages with the Russian economy vary greatly across individual EU Member States, ranging from 9.2% (Lithuania) to 0.3% (Luxembourg). Apart from Lithuania, the strongest dependence is observed for producers in Bulgaria, Hungary, Finland, Latvia and Estonia.

We can differentiate which industries show the highest share of Russia's value added in the EU27 output. Besides the coke, refined petroleum and nuclear fuel (Russia's value added amounts to 17.5% of the total EU27 output), electricity, gas and water supply (5.3%) and transportation services (around 2%) are also most dependent on Russia's value added.

[5] Results are available from the authors upon request.

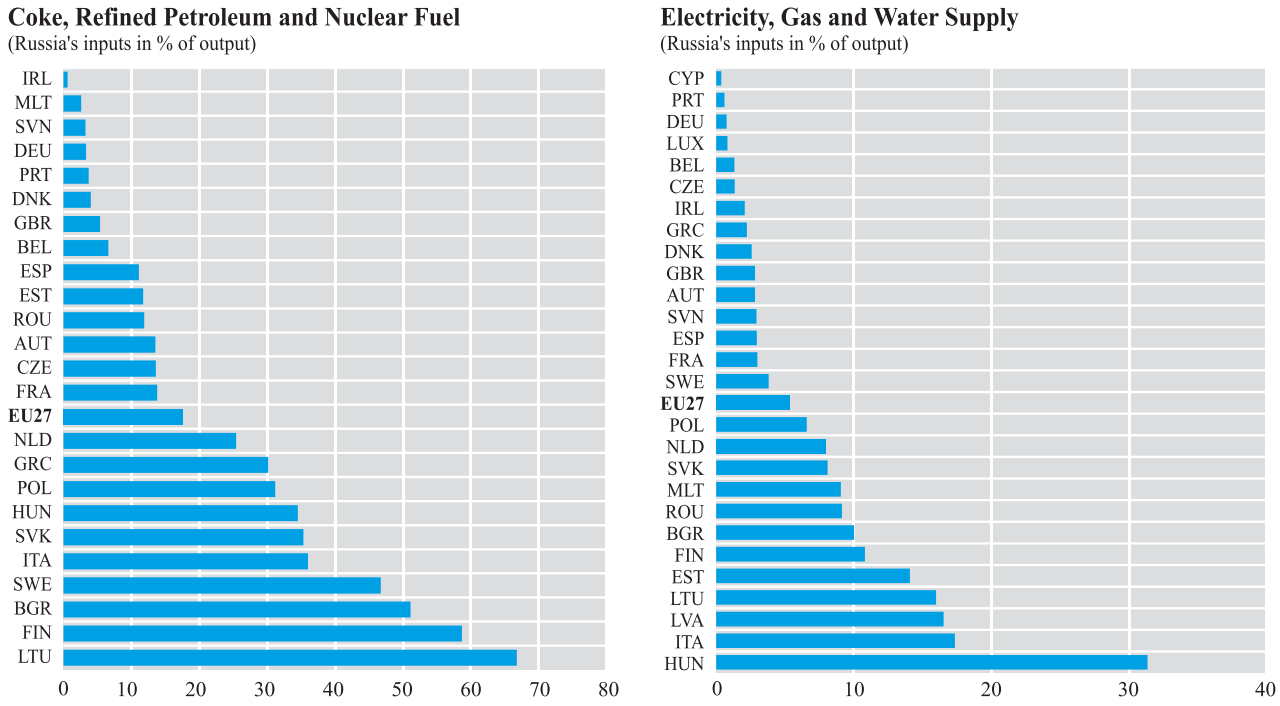
Chart 4
Share of Russia's value added in the EU27 total output (2011)



Source: Latvijas Banka and OeNB calculations.

Chart 5 focuses on the regional differences within the EU27 in the two industries where the EU Member States show the highest share of Russia's value added in output (i.e. coke, refined petroleum and nuclear fuel and electricity, gas and water supply). According to our earlier observation in Chart 4, the Central, Eastern and Southeastern Europe EU Member States, Finland and Italy report the largest share of Russia's value added in total output also in those two industries. Clearly, the actual impact of reducing trade flows between Russia and the EU depends not only on the importance of industrial linkages, but also on substitution possibilities. In this respect, some of the countries which are most strongly integrated with the Russian economy (particularly, the Baltic States) have very limited possibilities of switching from Russian suppliers to other suppliers in the short- to medium-run, especially in the most affected industries.

Chart 5
Share of Russia's value added in the EU27 (selected industries)

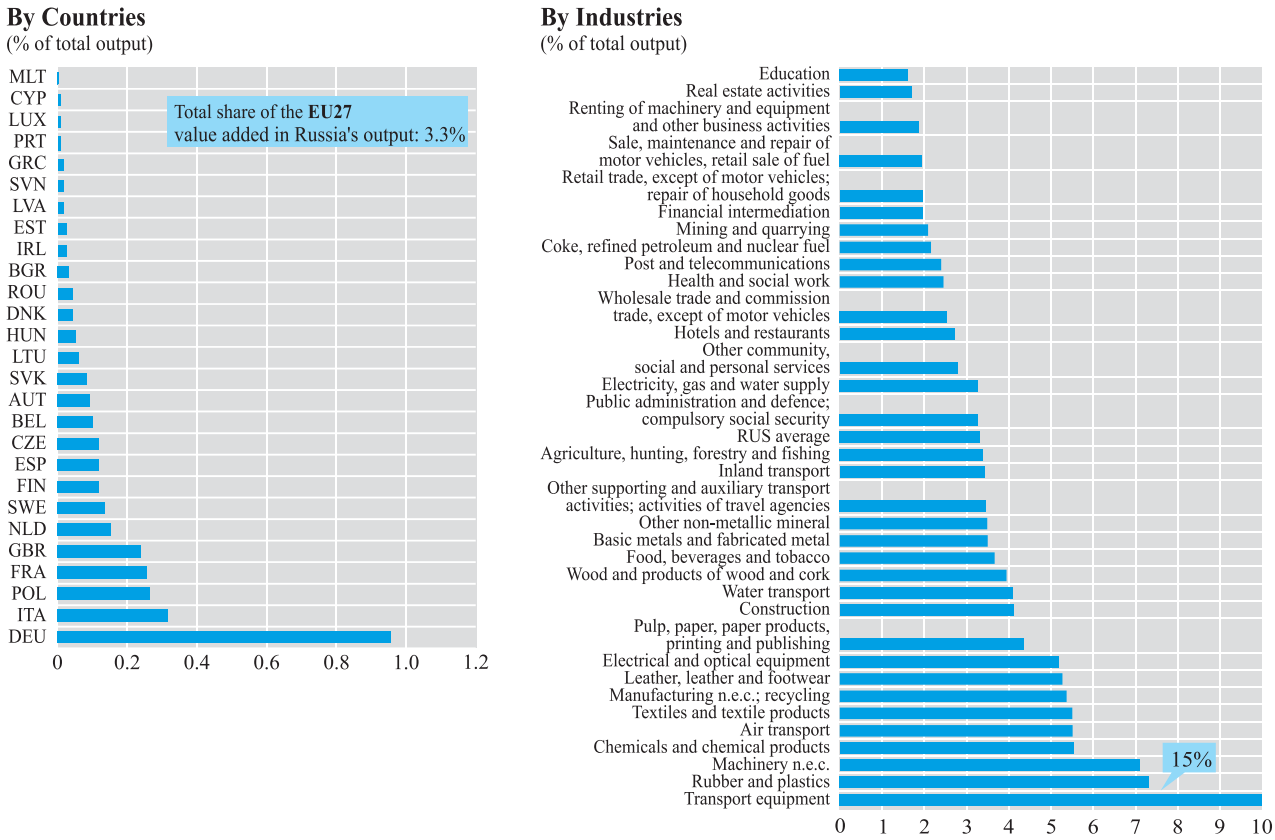


Source: Latvijas Banka and OeNB calculations based on WIOD.

Hence, compared to the final domestic use, the EU27 output embodies more value added from Russia. Yet again, Russian producers are, on average, by far more dependent on the EU's value added in absolute terms. Chart 6 shows the dependence of Russia's output on the EU27 value added. On average, looking at all Member States, about 3.3% of Russia's industrial output is (directly or indirectly) dependent on inputs from the EU27 (left-hand panel). In terms of individual countries, the most important counterpart for Russia's industrial production enterprises is Germany (about 1%), followed by Italy, Poland, France and the UK.

The importance of the EU27 value added for Russia's output is also somewhat more evenly distributed across industries (right-hand panel) compared to the skewed distribution in the case of the EU output which we saw in Chart 5. "Transport and equipment" is the sector with the greatest share of the EU value added: almost 15%, with more than one third originating from Germany. Other heavily-dependent sectors are "Rubber and plastics" (7.3%), "Machinery" (7.1%), with more than one third in both cases again originating from Germany, "Air transport" (5.5%) and "Manufacturing" (5.4%). Russia's output in the remaining sectors contains at least 2% of the value added from the EU27.

Chart 6
Share of the EU27 value added in Russia's total output (2011)



Source: Latvijas Banka and OeNB calculations.

In contrast to the dependence of the EU27 economies on Russia, the Russian economy emerges as being more dependent on the EU27 value added on the demand side than on the production side. The substantial reliance of Russia's industrial sector on the EU value added means that, in case of a trade disruption, Russian producers and consumers would need to find new counterparts.

4.3 Summary of Mutual Dependence between the EU and Russian Economies

To summarise the results, we find that Russia is clearly more dependent on the EU27 than vice versa. This finding remains unaltered when we turn from direct trade linkages (gross exports) to direct and indirect linkages (value added) as well as examine the dependence from the consumers' (final domestic use) and producers' (output) point of view. The headline figures are reported in Table below.

Table
Summary of the EU-Russia trade integration (based on WIOD for 2011)

	Gross exports in final use (%)	Value added in final use (%)	Value added in output (%)
Importance of Russia for the EU27	0.1	1.1	1.3
Importance of the EU27 for Russia	5.4	8.0	3.3

Source: Latvijas Banka and OeNB calculations based on WIOD.

The importance of Russia for the EU27 consumers and investors increases more than 10 times when taking into account the indirect linkages. This simply reflects that the Russian economy is an upstream producer, mainly focused on intermediate goods and raw materials (i.e. oil, gas and metals). The relatively low importance of Russia for the EU27 final domestic demand and output, however, signals a generally low degree of Russia's integration into the GVCs.

The importance of the EU27 for the Russian economy, on the other hand, is significantly higher due to several reasons. First, the size of the EU27 economy exceeds that of Russia. Second, many European producers are positioned downstream in the global value chains, which explains a larger share of gross exports from the EU27 in Russia's final domestic use. Finally, higher participation in the GVCs increases the importance of the EU27 value added for the Russian consumers and producers.

CONCLUSIONS

This paper summarises the importance of trade integration between the EU27 Member States and Russia. In doing so, we take account of the international fragmentation of production and assess the importance of Russia's (EU's) value added for final use and total output in the EU economies (in Russia) in addition to a description of direct trade links. Our analysis of trade linkages in the presence of global value chains (GVCs) is based on data for 2011 from the WIOD (see www.wiod.org for details on the database). This database combines national input-output tables with global trade data. Hence, we consider both direct as well as indirect trade flows between the EU27 Member States and Russia. This means that we can identify the full amount of foreign value added in total output and final domestic use in any bilateral comparison.

As an export destination, albeit being the fourth most important export destination when intra-EU trade is excluded, Russia is not really important for the EU countries on average (0.9% of GDP). It is only slightly more important as a source of imports (1.6% of GDP; especially, energy imports from Russia). Already when looking at the direct trade flows, we note that the importance of Russia as a trading partner differs greatly across individual EU Member States. We further observe strong differences between individual industries. Thus, the importance of Russia for the EU is highly concentrated both geographically and sectorally.

However, integration into the GVCs implies that bilateral trade flows do not reflect the actual amount of linkages between modern economies well. When taking into account the full extent of intermediate linkages, we find that both Russia and the EU would suffer to some extent from potential trade disruptions. On average, the degree of mutual integration through trade linkages remains low for the EU Member States, even when indirect linkages are taken into account. However, the degree of integration varies again greatly across the EU Member States, with some of them (namely, the Baltic States) being notably more dependent on Russia's value added than vice versa. The Russian economy emerges as being more dependent on the EU's direct imports and value added than vice versa. Moreover, according to the results for the direct trade linkages, certain economic sectors in the EU are strongly dependent on Russia's inputs, such as the energy sector, electricity, gas and water supply and air transport.

Our results show the degree of trade integration by contrasting two different views. The results obtained from looking at direct trade flows (Section 2) are important as direct trade flows would be immediately affected by administrative measures such as trade sanctions. Yet at the same time, direct trade flows understate and overstate the real importance of the Russian economy for the EU. On the one hand, Russian goods may be passed through European production processes and hence the net value of trade with Russia for European consumers may be lower than these direct trade figures suggest. On the other hand, direct and all indirect trade flows are captured in the value added aspect (Section 4), thus reflecting the full importance of value added originating from Russia for European producers and consumers. As a second word of caution, in the present paper we depict the status-quo of the interdependencies between the EU27 and Russia's economies.

Summing up our results from the three proposed indicators of integration (two of them being compatible with the GVCs), we find that Russia is more dependent on the EU's value added than vice versa. Final domestic use in Russia would be affected notably from trade disruptions, as the share of the EU in Russia's final domestic use is between 5.4% (only direct inputs) and 8% (share of all direct and indirect value added of the EU entering Russia, including via third countries). The corresponding figures for the EU27 are as low as 0.07% and 1.1%. These findings reflect two features of the Russian economy: (1) its position in the GVCs as an upstream producer whose economy relies strongly on imports of final goods and (2) its generally low degree of integration into the GVCs.

In terms of total output (comprising intermediate goods, final domestic use and exports), 3.3% of Russia's total output is based on the EU27 value added, while the share of Russia's value added in EU27 total output amounts to 1.3%. Hence, the extent of bilateral integration through global value chains is small, but clearly non-negligible, especially for the Russian economy.

While Russia's value added is more important for the EU's total output than for the EU's final domestic use, the opposite holds for Russia: the share of the EU's value added is higher in Russia's final domestic use than in Russia's total output.

Notwithstanding the lower dependence of the EU27 economic aggregate on Russian imports and value added than vice versa, one has to take into account the wide-ranging differences across the EU27 Member States as well as across industries. Some countries (Latvia, Lithuania, Estonia, Finland, Bulgaria, Hungary) and particular industries (namely, coke, refined petroleum and nuclear fuel) could be severely affected, especially when the full amount of Russia's value added is taken into account. The share of Russia's value added in total output ranges from 9.2% (Lithuania) to 0.3% (Luxembourg). Apart from Lithuania, the strongest dependence is observed for producers in Bulgaria, Hungary, Finland, Latvia and Estonia. Besides the coke, refined petroleum and nuclear fuel where Russia's value added amounts to 17.5% of total output, electricity, gas and water supply (5.3%) and transportation services (around 2%) are also fairly dependent on Russian inputs, taking into account the indirect linkages.

In this context, one has to keep in mind the low degree of substitutability of energy products from Russia for several EU countries in the short- to medium-term. In fact, the high degree of variation observed across individual Member States in this respect calls for the completion of the single market in the energy and electricity, gas and water supply with a corresponding physical infrastructure across Europe and reducing the dependency on single source countries in general.

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