Barometr Regionalny
Rok 2023 Tom 19 nr 2

Disparities in Net Income Growth of Russian Companies Facing Crisis and Heightened Exchange Rate Volatility

Michał Brzozowski, Grzegorz Tchorek, Larysa Myrgorodska
University of Warsaw, Poland

Submitted: October 25, 2023
Accepted: December 28, 2023

Abstract

This paper aims to compare net income growth per employee in exporting and non-exporting Russian companies, addressing a gap in understanding this issue during crisis periods. Binary treatment models were applied to 1,600 Russian firms, utilizing data from EFIGE (European Firms in a Global Economy) and Amadeus databases. We used an estimation approach that permits a heterogeneous average treatment effect under the assumption of the endogeneity of the treatment variable. Since exporting and profitability can be caused by firms' unobserved characteristics, we employed instrumental-variables estimators and a generalized two-step regression fitted by probit and two-stage least squares methods to obtain consistent estimation of average treatment effects. Our research found that exporters, in general, do not achieve higher productivity. The practical outcomes of the research could be beneficial, especially considering the impact of crisis outbreaks and changes in the trade directions of Russian exporting firms due to Western sanctions.

Keywords: productivity, exporting and non-exporting firms; innovation; crises; export premium; Western sanctions.

DOI: 10.56583/br.2308

Introduction

The main objective of the theoretical considerations and empirical research presented in the article is to compare the performance of exporting and non-exporting Russian companies in terms of net income growth per employee and to confirm the existence of an export premium for these firms. These tasks determine the structure of the article, which consists of six sections.

The introduction presents the research problem and justifies the choice of exporters' productivity as the topic of focus, particularly during crises. The second section presents a review of the literature and current research on the performance of export companies during crisis episodes. The third section addresses the research gap related to export and internationalization behavior, forming the basis for the data and hypotheses. The fourth section, which is the most important part of the empirical analysis, presents the methodology of the study, model selection, and description of the research sample. The tables and appendix in this section provide information on data quality, comparability, and sample selection. The fifth and final section presents some risk predictions and business opportunities which carry a dual significance for Russian exporting firms in the context of Western sanctions. The conclusions drawn from the research indicate that Russian exporters achieved higher productivity levels than non-exporters when they improved their innovations. This

E-mail addresses and ORCID digital identifiers of the authors
Michał Brzozowski • e-mail: brzozowski@wne.uw.edu.pl • ORCID: 0000-0003-3963-9162
Grzegorz Tchorek • e-mail: tchorek@wz.uw.edu.pl • ORCID: 0000-0003-0307-7639
Larysa Myrgorodska • e-mail: lmyrgorodska@wz.uw.edu.pl • ORCID: 0000-0002-9293-9095

finding opens up further discussion on the innovative aspects of firms involved in international trade during crises.

From a historical perspective, in economics, trade relations have mainly been studied using a macro approach, based on the theoretical background and data availability. Until the 1990s it was assumed, according to trade theory, that all export companies had the same characteristics (were homogenous), which allowed for discovering at most some macro or sectoral drivers of exports (Melitz and Redding 2014). Trade theory assumed that it was countries, rather than companies, that were involved in trade. It is only in recent decades, accompanied by the development of new trade theory, that a fresh view in terms of internationalization of companies has emerged, highlighting individual (heterogeneous) factors in trade expansion.

While research at the level of individual companies in the open macroeconomics has not been conducted, the International Business literature (Johanson and Vahlne 1990) is a little more advanced in defining companies' features that help them to conduct exports and use other, more sophisticated forms of internationalization. It was already in the 1970s that the role of transaction costs, companies' size and age, as well as internal resources in overcoming barriers to internationalization, was emphasized. The so-called "new new" trade theory led economists dealing with international trade to similar conclusions only in the early 2000s. While general assumptions of the new new trade theory are not substantially different from those put forth in the managerial approach, both independently developed strands of the literature underline the role of non-price competitiveness, the quality of company resources and productivity, which have become an important measure of export firms' performance and also a prerequisite to internationalizations.

Nowadays, productivity plays a central role in describing the mechanism which has led companies to internationalization, and its critical role is expressed in the new new trade theory (Krugman 1980). In the new new trade theory, it is assumed that export is accompanied by important sunk costs which can be covered only by the most productive (profitable) companies. Thanks to access to unique resources, export companies are more productive and "self-selected" to operate on international markets. After accumulation of competences, skills, knowledge and financial resources, companies are able to bear sunk costs of internationalization, which have to be covered by higher productivity. Otherwise, if the period of lower productivity is prolonged, an export company might be forced to exit the market. Enterprises are also very diversified in terms of their productivity level, growth and size, which results in the bulk of exports being concentrated within a small number of highly productive firms. It is also assumed that the rising sophistication level of internationalization modes is accompanied by increasing productivity and performance (Wagner 2007).

Although the above phenomenon, which is often considered as an export productivity premium, is confirmed by many studies, we will also find research (although relatively rare) which does not endorse this view. The results obtained by The International Study Group on Exports and Productivity (2008) showed that the average exporter premium in 14 examined countries (11 EU countries, Chile, Colombia, and China) was 7%, mainly for self-selection reasons. Moreover, the authors confirmed that productivity export premiums rise with the share of exports in total sales and might be larger in the case of countries with lower export participation, more restrictive trade policies, lower GDP per capita and less effective government. Berthou et al. (2015) indicated (based on a panel of 15 European economies during the 2000s) that exporters are more productive than non-exporters and that the productivity premium rises with the export experience of companies. The status of a *permanent exporter* increases the export premium in comparison to *exporter starters*. We have also found confirmation of the existing export premium in the case of Russian companies (Golikova, Gonchar, and Kuznetsov 2012). Researchers have confirmed the self-selection hypothesis (Gajewski and Tchorek 2017) for continuing and new exporters.

We would like to establish if the export premium exists in a key emerging economy such as Russia on the basis of a unique companies database. The Russian case is especially interesting because standard macroeconomic internationalization measures, such as exports of goods and services as a percent of GDP and its annual growth, have been on a downward trend at least since 2000. According to the World Bank, the rate of exports of goods and services as a percentage of

GDP fell from 44% in 2000 to 28% in 2015 and remained at this average level from 2016 to 2021. This decline was influenced by an unfavorable export environment and a decrease in energy prices.

It should be emphasized that due to Western sanctions, the frozen sectors of Russian export and import began to change, gaining potential (Shishkin and Latyshov 2015). The authors maintain that Russia has a chance to expand its export of manufacturing industry products and develop its import substitution before the sanctions are lifted.

The persistent surplus in the Russian trade balance and current account was partially explained by a study of bilateral trade in goods for Russia, which considered changes in relative income and the exchange rate (Tovar-García and Carrasco 2019). The research indicated that the rate of exports of crude oil and natural gas (price-inelastic goods) had a positive correlation with the trade balance, while the import of high-tech goods (income-elastic and price-inelastic goods with high added value) showed a negative correlation with the bilateral trade balance. However, the findings also suggested that the structure of exports and imports primarily influenced the trade balance through its indirect impact on income and price elasticity.

We contribute to the literature related to companies' heterogeneity in terms of productivity by exploring the issue of the export premium, comparing exporters and non-exporters on the basis of the data on firms from one of the biggest emerging countries. Moreover, we explore the problem of the export premium during the regional crisis in Russia, which made it possible to gain new insights into exporters' performance in turbulent times marked by an exchange rate depreciation.

This paper concludes with an analysis of the impact of Western sanctions on the productivity and export capacity of Russian firms, as well as predictions of some risk and uncertainty factors and identification of business opportunities for exporting firms.

1 Literature review

It is worth noting that studies have indicated a productivity advantage for exporters. Bernard and Bradford Jensen (1999) conducted a seminal study in the United States and found that exporters tend to have higher productivity levels than non-exporters, even after controlling for various firm characteristics. Wagner (2007) examined German manufacturing firms and confirmed a positive productivity differential between exporters and non-exporters. The study highlighted that exporting firms exhibit higher productivity levels before engaging in exporting activities.

Several studies have indicated that innovation can be seen as a catalyst for productivity gains when a firm enters foreign markets. The situation with Russian exporting firms can be considered in terms of the substitution effect, which suggests that if investment resources are limited, firms are compelled to choose between export and innovation (Wakelin 1998).

The great trade collapse during the crisis that started in 2008 (which can be a "benchmark" of the consequences of a trade decrease in turbulent times) was initially the subject of analysis mainly at aggregated and macro levels. Further in-depth studies revealed an important role of Global Value Chains (GVC) connections in global trade collapse transmission. Drawing on the original European Firms in a Global Economy (EFIGE) database, Békés et al. showed very heterogeneous reactions of companies in terms of total sales and exports between 2008 and 2009.[1] Because of rapid and synchronized trade collapse, exporters suffered more than non-exporters, and internal (national) market demand played a stabilizing role for them. Many authors confirm that the position within GVC and internationalization degree/sophistication might influence export and non-export results during a crisis. Generally, it has been revealed that controlling firms, understood as firms with their own affiliates or at the top of the chain, experience a smaller sales reduction while controlled firms suffer more. For internationalized firms, governance capability, which is often a result of intangible assets allocation, was a strategic asset during the crisis (Brancati, Brancati, and Maresca 2017; Ferrantino and Taglioni 2014). Landini, Arrighetti, and Lasagni (2015) found that Italian companies investing in intangible assets had fewer opportunities to exit during the first

1. See: "Still Standing: How European Firms Weathered the Crisis. The third EFIGE policy report" by Gábor Békés, László Halpern, Miklós Koren, and Balázs Muraközy, Bruegel Blueprint Series 15, Brussels, 2011, available at https://wiiw.ac.at/still-standing-how-european-firms-weathered-the-crisis-dlp-2555.pdf.

phase of the crisis (until 2010). What is interesting, the researchers also confirm that intangible assets lost their stabilizing role and financial constraints gained importance as a factor explaining companies' exit in the second stage of the crisis (2011–2014). The literature related to GVC and its role during the crisis indicates that the modes of internationalization within the chain (*arm-length*, *hierarchical*, *quasi-hierarchical*, and *relational relations*) might influence companies' productivity and innovation performance (Agostino et al. 2015; Brancati, Brancati, and Maresca 2017). After analyzing Russian manufacturing firms' performance in 2007–2012, Golikova and Kuznetsov (2017) confirm that the crisis was less severe for companies that had been innovation-active before the crisis and their recovery was faster (in terms of sales growth). Moreover, they claim that companies globalized through diversified modes (import, export, FDI, formal relations with foreign partners) before the crisis went through the crisis more smoothly.

Furthermore, the researchers contend that the nature of the innovation process in Russian manufacturing exporting firms depends on organizational and managerial innovations, rather than on product or technological innovations. The former may be more easily "learned" from foreign partners than developing the capability to develop full-cycle innovations at the "technological frontier" (Golikova 2011).

Nunes, Lopes, and Dias (2013) reveal that companies operating within knowledge networks increase their resilience. Barajas, Shakina, and Fernández-Jardón (2017) address the issue of the intangibility of assets in companies' sustainable performance and survival during the crisis, examining the role of intangible-intensive strategy in the performance of companies during the crisis and their subsequent recovery. They confirm that intangible-intensive strategy helped companies to perform better during the 2008–2009 crisis (in terms of market value added). A large number of research papers confirm that financial (foreign/external) constraints make companies more vulnerable to shocks. On the basis of EFIGE data, Békés et al. confirmed this assumption with reference to sales decreases.[2]

Our current predictions are consistent with the assertion that sanctions could have the most detrimental impact on firms within the Russian manufacturing sector engaged in export activities and/or importing raw materials and components in the medium- and long-term perspectives (Golikova and Kuznetsov 2017).

We assume that from the macroeconomic point of view, the period between 2012 and 2015 can be seen as a regional crisis in Russia preceded by a much more severe global crisis in 2008–2009, followed by a recovery between 2009–2011. The crisis in Russia resulted from the economic and financial sanctions imposed by the EU and the USA, a decrease in oil prices, the depreciation of the ruble, which resulted in a high inflation rate, and a deterioration in the current account balance. We have mentioned companies' experience during the global trade crisis in 2008–2009 because we believe that Russian companies' experience might be similar. Many macroeconomic indicators describing aggregate demand, banking sector liquidity, and PMI between 2012 and 2015 justify our assumptions that this period can be treated as a regional crisis.

The latest literature concerning trade crises and factors influencing internationalization and company performance raises the following issues: involvement in GVCs, asset intangibility, innovations, and the role of financial constraints. The most often used measures of company performance during crises are productivity, sales, export share in total sales, and exit rates in the case of exporting and non-exporting companies.

Overall, the literature consistently suggests that exporters tend to demonstrate higher productivity levels compared to non-exporters. This advantage in productivity can stem from various factors, including learning from international markets, accessing economies of scale, adopting advanced technologies, and facing more intense competition.

Western sanctions imposed on Russia since 2014 have exerted a negative influence on the productivity of various Russian sectors. Examples include energy firms like Rosneft, Gazprom, and Novatek, defense companies Almaz-Antey, Sukhoi, and United Engine Corporation, numerous agricultural firms, automotive companies such as AvtoVAZ, firms engaged in high-tech goods development and production like Rostec, and pharmaceutical companies relying on the importation

2. See: "Still Standing: How European Firms…," op. cit.

of active pharmaceutical ingredients (APIs) from Western suppliers. The sanctions have limited these companies' ability to develop, upgrade and export their products to certain countries, compete in global markets, and import crucial strategic components from the West. This has led to disruptions in supply chains and potential declines in production.

The financial industry is another sector that has experienced significant impacts. Russian banks and financial institutions have encountered restrictions on accessing Western financial markets, thereby limiting their ability to raise capital and constraining their lending capabilities. This has had a broader effect on the economy, as businesses have grappled with the problem of securing finances for their investments and expansion, which has ultimately affected their overall productivity.

The depreciation of the ruble, which occurred during the period of 2014–2022, had a notable impact on the productivity of exporters and led to diverse effects across industries and individual firms in Russia. Factors such as import reliance, export orientation, access to alternative markets, and hedging strategies played an important role in determining the extent of those firms' impact. Moreover, the firms' ability to adapt and adjust their strategies in response to shifting exchange rates influenced their overall performance throughout this period.

According to Allianz Research, primarily due to stringent capital controls, banks, exporters, and households surrendered a significant portion (ranging from 50% to 80% depending on the sector) of their foreign exchange holdings to the Central Bank of Russia. In that situation, Russian authorities engaged in "rubelizing" the current account to prevent an excessive depreciation of the ruble.[3] Furthermore, Russia managed to accumulate reserves by maintaining restricted but ongoing commodities trade at a discount with non-Western countries, primarily China and India.

2 Data acquisition and hypothesis generation

Based on the literature review related to export and internationalization behavior, also during the crisis, we formulated the following hypotheses.

> **Hypothesis 1: The productivity advantage of exporters, measured by net income per employee, over that of non-exporters is particularly pronounced when an exchange rate depreciation shock occurs.**

Competing with the self-selection hypothesis (only most productive companies engage in international trade), the learning by exporting hypothesis (companies may increase productivity thanks to involvement in international trade) is less often confirmed (Wagner 2017). Thus, we can assume that even in turbulent times exporters are better equipped (in the medium term) to gain some kind of productivity premium. Some experience of Spanish and Greek companies during the crisis seems to confirm our assumption (Eppinger et al. 2015).

> **Hypothesis 2: The positive effect of exporting on firms' productivity is zero if they are not innovative.**

The second hypothesis is inspired by Rodrik's analysis of the positive effect of exchange rate undervaluation on growth in a world plagued by market failures and a weak contracting environment (Rodrik 2008). Since innovative producers are more exposed to these imperfections (production of new and modernized goods is more complex, involves many transactions, and is likely to be subject to liquidity constraints), their productivity is strongly enhanced by the increase in their income produced by a depreciation.

Additionally, it should be noted that firms can achieve innovation through cooperation with suppliers or the acquisition of existing technologies or patents (Bircan and De Haas 2015). Many Russian firms struggle with adopting technology effectively. According to the World Economic Forum's Global Competitiveness Report (2013–2014), which spans the time frame covered by our study, Russia ranked 126th out of 148 countries in terms of firm-level technology absorption. It was

3. See: "Rallying Ruble and the Weaponization of Finance." By Andreas (Andy) Jobst et al., Allianz Research, May 30, 2022, available at https://www.allianz-trade.com/content/dam/onemarketing/aztrade/allianz-trade_com/en_gl/erd/publications/the-watch/2022_05_30_Weaponization-of-Finance.pdf.

more profitable for Russian businesses to acquire "turnkey" products and outdated technologies from advanced countries rather than develop their own innovative products.

In its publication about Intellectual Property Indicators, the World Intellectual Property Organization reported that the filing numbers of foreign applicants in Russia dropped by 30% in 2022 due to foreign companies withdrawing from the market and reducing their investments.[4] However, the Eurasian patent system experienced increased popularity, reaching the highest number of Eurasian applications from foreign applicants since 2012 (i.e., 3,097).

3 Methodology and empirical results

In order to determine whether a firm is classified as exporting or non-exporting, various criteria can be used, depending on specific countries and organizations. Despite the common use of the threshold approach, the precise threshold percentage of revenue from exporting activities (e.g., 10% or 20%) may vary within the context of a firm's overall business operations. In some instances, classifying a firm as exporting or non-exporting might be dictated by legal and regulatory definitions established by government authorities or trade organizations. This could involve such requirements as obtaining export licenses, adhering to customs regulations, or fulfilling specific export-related obligations.

Firms may also identify themselves as exporting or non-exporting based on their own assessment of their international trade activities. This could include indicators like the presence of dedicated export departments, engagement with foreign markets, participation in international trade events, or the implementation of specific export strategies.

We use data on around 1,000 Russian firms to analyze how their exporting status affected their net income per employee in 2014—i.e., at the beginning of a crisis marked by a significant depreciation of the Russian ruble. The data comes from a newly constructed survey-based database which combines information about firms' internationalization from the EFIGE questionnaire with financial variables retrieved from the Amadeus database.

Since the fact of being an exporter can be established by means of a binary variable, its impact on firms' performance will be investigated with the treatment-effects model. The treatment-effects model estimates the effect of an endogenous binary treatment, z_i, on a continuous outcome variable, y_i, observed for both $z_i = 1$ and $z_i = 0$, where $z_i = 1$ means that a company is an exporter while $z_i = 0$ implies that a company does not sell abroad. The model is composed of the regression function and the selection equation. The former is of primary interest because it measures the treatment effect, which is conditional on the independent variables xi and the exogenous determinants of treatment assignment, w_i:

$$y_i = \beta x_i + \delta z_i + \varepsilon_i. \tag{1}$$

The selection equation models the treatment assignment decision z_i as the outcome of an unobserved latent variable z_i^*, which is assumed to be a function of the exogenous covariates w_i and the random component u_i:

$$z_i^* = \gamma w_i + u_i. \tag{2}$$

The observed assignment decision is $z_i = 1$ if $z_i^* > 0$, and $zi = 0$ otherwise.

It is assumed that the determinants of the program assignment decision are factors that affect also the outcome variable, y_i.

The estimated value of δ is the average treatment effect which is the average over the entire population of the individual treatment effects. The treatment effect for individual i is defined as the difference between the potential outcome that may occur when i is treated and the potential outcome that may occur when i is not treated.

In this paper the dependent variable, y_i, is net income per employee in 2014, which shows the efficiency of the use of labor resources by a company. This measure is used as a proxy for produc-

4. See: "World Intellectual Property Indicators 2022." WIPO, Geneva, available at https://www.wipo.int/edocs/pubdocs/en/wipo-pub-941-2022-en-world-intellectual-property-indicators-2022.pdf, doi: 10.34667/tind.47082.

tivity which could not be calculated on the basis of data available in the firms' financial statements gathered in the Amadeus dataset. The vector of independent variables, x_i, is composed of three variables. The value of one-year lagged net income per employee, labeled *lagged profit*, reflects the impact of all the omitted characteristics of a firm which are either time-invariant or change only very slowly. The variable of interest is *exporter*, which is coded 1 for exporting firms. The set of sectoral dummies is included as control variables, but the estimated coefficients are not reported in order to save space.

Since exporting and profitability can be both caused by firms' unobserved characteristics, the problem of endogeneity has to be tackled. In order to overcome this problem, we use instrumental variables estimators which allow for the endogenous treatment variable. We use the age of a firm (age) as the exogenous determinant of being an exporter. In other model specifications used in this paper we found the following exogenous variables to be viable instruments: a dummy variable membership in a group that is coded 1 when a firm belongs to a group of companies (i.e., a parent company and its subsidiaries), a dummy variable foreign ownership that is equal to 1 if there are foreigners among the owners of a firm. It seems natural to assume that firms that are part of big or multinational companies are more likely to participate in global value chains and international trade.

Another instrument is the percentage of employees with higher education (labeled *employees with higher education*). It was shown by Blyde (2016) that in Chile training employees can substantially increase the probability of a firm becoming an exporter.

Finally, we included a binary variable reflecting family ownership as the instrument for determining exporter status. This dummy is coded 1 if a firm is controlled by an individual or family-owned.

The technique of maximum likelihood was used in the estimation and the results are reported in column (1) of table 1. They show a negative and non-significant impact of exporting status on firms' productivity measured by net income per employee. This result can be questioned, however, on the grounds that the influence of exporting on productivity might be firm-specific. To test whether this is true, we generalized our regression approach by allowing for a heterogeneous response to treatment and maintaining the assumption of treatment endogeneity.

The model can be written as follows:

$$y_i = \beta x_i + \delta z_i + \varepsilon \qquad \text{where} \qquad E(\varepsilon|z) \neq 0 \tag{3}$$

$$y_j = \beta x_j + \delta z_j + \varepsilon \qquad \text{where} \qquad E(\varepsilon|z) \neq 0 \tag{4}$$

$$y = y_i + w(y_i - y_j) \tag{5}$$

Equations (3) and (4) are potential outcome equations which describe linear relationships between the outcomes (productivity of exporting firms and productivity of non-exporting firms, respectively) and the covariates x. Equation (5) is the so-called "potential outcome model" since y is the observed outcome. Note that the adopted framework implies the heterogeneous reaction function of y_i to treatment z.

The model is fit by probit and two-stage least squares to obtain consistent estimation of average treatment effects. We followed the procedure described by Cerulli (2014) to obtain consistent estimation of average treatment effects. The procedure comprised three stages: running a probit of w on x and z to get the predicted probability of w; running an OLS on the predicted probability of w to get the fitted values of w; running a second OLS of y on the fitted values of w obtained in the second step. This probit-two-stage-least-squares procedure is more efficient than the direct two-stage-least-squares procedure and more reliable than the probit-ordinary-least-squares procedure. The results are presented in column 2 of table 1.

The estimation results of a model that allows for a heterogeneous response of productivity to exporting status prove that a positive relationship between these two variables exists. The *exporter* dummy in column 2 of table 1 is statistically significant. The average treatment effect, which is equal to the estimated coefficient, has the value of around 13, meaning that net income per employee in a typical company would increase by 13 thousand euros if all firms were exporters. The average treatment effect on the treated (ATET), which is reported in the bottom part of the

table, shows that, on average, the net revenue per employee of companies that were actual exporters was higher by 11 thousand euros than that of non-exporters. The probit estimates of the selection equation suggest that age, foreign ownership and membership in a group are the factors that increase the probability that a firm is an exporter.

As argued above, exporters offering innovative products are likely to be less vulnerable to an exchange rate depreciation shock. To explore this issue, we redefined the dummy variable for export activities. In column 3 of table 1, the binary variable *exporter* takes on the value of 1 if a firm exports goods or services and introduces product innovations. In column (4) of table 1 the dummy *exporter* is coded 1 if a company exports and introduces process innovations.

The results shown in the last two columns of table 1 confirm that innovative and exporting firms generate higher net income per employee. The *exporter* dummy is significant in columns (3) and (4), and the values of the estimated coefficients are similar in columns (2–4), meaning that innovations do not boost the productivity of exporters. It should be noted that the value of the ATET in columns (3) and (4) is similar to the one reported in column (2) although it is somewhat higher for exporters implementing process innovations; being an innovative exporter leads to an increase in net income per employee by EUR 9.9–11.2 thousand. The question which therefore arises is whether an innovation per se has an impact on productivity. The answer is provided in the appendix (table 1A), which reports the results of the estimates of a treatment model in which the treatment variable was the dummy equal to 1 if a firm introduced product (columns (1) and (3)) or process (columns (2) and (4)) innovations. Both types of innovation turned out to be insignificant; moreover, the sign of the coefficient of the dummy for the process innovations was negative. The evidence

Table 1. Productivity of Exporters and Innovators

Treatment variable	**Export** (1)	**Export** (2)	**Export, Product Innovation** (3)	**Export, Process Innovation** (4)
Lagged profit	0.067***	0.063***	0.063***	0.063***
	(0.007)	(0.001)	(0.002)	(0.002)
Exporter	−13.642	13.024**	11.558**	12.252***
	(22.790)	(5.742)	(4.503)	(4.428)
Constant	5.472	1.129	−0.959	−1.131
	(7.760)	(3.618)	(2.036)	(2.038)
Selection equation				
Age	0.013***	0.012***	0.010***	0.011***
	(0.002)	(0.002)	(0.002)	(0.002)
Membership in a group		0.449***		
		(0.114)		
Foreign ownership		0.567***	0.538***	0.663***
		(0.185)	(0.180)	(0.181)
Employees with higher education			0.004*	
			(0.002)	
Lagged profit	−0.0002	−0.0002	−0.00005	−0.0002
	(0.0003)	(0.0003)	(0.0002)	(0.0002)
Constant	−0.840***	−1.055***	−1.281***	−1.196***
	(0.184)	(0.192)	(0.213)	(0.201)
R-squared	0.137	0.230	0.317	0.315
Observations	996	996	996	996
ATET	−13.642	11.144	9.909	11.226

Note: Dummies for sectors were included; method of estimation — probit for the selection equation and the two-stage least squares for the regression equation; robust standard errors are reported in parentheses.

*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

in tables 1 and 1A implies that Russian exporting firms achieved higher net income per employee than non-exporters, regardless of their engagement in innovative activities.

Novertheless, the conclusion that innovations do not improve the productivity of exporters is likely to be misguided because the survey from which the data used in this paper came did not distinguish between innovations offered for local or foreign sale. It cannot be taken for granted that product or process innovations were not confined to sales in the domestic market. To overcome this difficulty, we used a negative answer to the question whether firms were engaged in innovation. The consequences of a lack of new products or processes apply to both domestic and foreign markets—i.e., a non-innovative firm cannot be an innovative exporter.

We redefined the treatment variable *exporter* in three ways. In column (1) of table 2 it was coded 1 if a firm was exporting and introduced neither product nor process innovations. In column (2) and (3) *exporter* equaled 1 if an exporter did not introduce product or process innovations respectively. The dummies for exporting firms that did not introduce innovations were uniformly insignificant in table 2. In addition, the ATET halved in value compared with the increase in revenue per employee produced by the exporter status that was reported in table 1. The results provide support for the hypotheses in this paper. Exporting boosted productivity, measured by net income per employee, during a period marked by a sharp depreciation of the ruble. However, this positive effect was zero for exporting firms that did not develop new products or processes.

It is interesting to note that there are differences between the determinants of the probability that a firm is an exporter or an exporter that does not introduce innovations. A comparison of table 1 and 2 reveals that the coefficient of the percent of employees with higher education changed the sign from positive to negative. Moreover, foreign ownership increases the probability of exporting but it does not affect the probability that a firm is an exporter that does not introduce innovations.

Table 2. Productivity of Exporters and Non-Innovators

Treatment variable	**Export, No innovation** (1)	**Export, No product innovation** (2)	**Export, No process innovation** (3)
Lagged profit	0.068***	0.068***	0.068***
	(0.008)	(0.008)	(0.008)
Exporter	4.264	3.471	4.466
	(3.571)	(2.364)	(3.582)
Constant	−0.184	−0.280	−0.403
	(1.479)	(1.492)	(1.540)
Selection equation			
Age	0.006***	0.008***	0.005***
	(0.002)	(0.002)	(0.001)
Employees with higher education	−0.008**	−0.007**	
	(0.004)	(0.004)	
Controlled by a family		0.288*	
		(0.148)	
Lagged profit	−0.003	−0.003	−0.003
	(0.002)	(0.002)	(0.002)
Constant	−1.521***	−1.409***	−1.497***
	(0.314)	(0.280)	(0.240)
R-squared	0.171	0.171	0.171
Observations	996	996	996
ATET	5.627	4.637	5.338

Note: Dummies for sectors were included; method of estimation—probit for the selection equation and the two-stage least squares for the regression equation; robust standard errors are reported in parentheses.
*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

To ensure the reliability of the results, we applied a second estimation method, which consists in ignoring the binary nature of w and in running an ordinary least squares (OLS) regression of w on x and z. The predicted values of w were used in the regression equation, estimated by OLS, to obtain the predicted values of y. The estimates obtained by applying the direct-two-stage-least-squares procedure are presented in table 3. The results in column (1) confirm that exporting firms in Russia were more productive in 2014 compared with non-exporters and earned by about 7 thousand euros more than the latter. In columns (2–4) the dummy *exporter* takes the value of 1 if an exporting firm did not introduce product innovations (column (3)), process innovations (column (4)), or either of them (column (2)). The coefficients on the *exporter* dummies in columns (2–4) are insignificant, which indicates that net income per employee is not higher in exporting firms that did not develop innovations.

Table 3. Productivity of Exporters and Non-innovators; Sensitivity of Results to Estimation Method

Treatment variable	Export (1)	Export, No innovation (2)	Export, No product innovation (3)	Export, No process innovation (4)
Lagged profit	0.062***	0.068***	0.068***	0.068***
	(0.001)	(0.008)	(0.008)	(0.008)
Exporter	9.248***	2.478	2.220	1.498
	(3.401)	(2.352)	(2.046)	(2.151)
Constant	3.211	0.045	−0.033	0.047
	(3.439)	(1.460)	(1.472)	(1.469)
R-squared	0.233	0.171	0.171	0.171
Observations	996	996	996	996
ATET	7.025	3.668	3.227	2.230

Note: Dummies for sectors were included. Method of estimation—probit (columns 1 and 2) and OLS (columns 3 and 4) for the selection equation and the two-stage least squares for the regression equation; robust standard errors are reported in parentheses.

*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

4 Some risks predictions and business opportunities for Russian exporting firms in the wake of Western sanctions

Since April 2022, the Federal Customs Service and the Central Bank of Russia have not published foreign trade statistics, including data on exports, imports, and trade within the Eurasian Economic Union (EAEU). The "mirror" statistics from Russia's partner countries indicate that by May 2022, the peak of the decline in imports had been passed due to logistical restoration and partial payments. Additionally, this may be attributed to the initial influx of parallel imports, an increase in the import of goods from "friendly" countries, and the commencement of utilizing the Belarusian "channel" for imports.

Our risk factor predictions are grounded in investigations that utilized the mirror statistical method, which involves analyzing the national statistics of Russia's 10 primary trading partners in 2022.[5] Additionally, we considered estimations from the IMF and World Bank, along with insights from Golikova and Kuznetsov's research on Russian manufacturing firms, as well as the analysis conducted by Davydov, Sihvonen, and Solanko (2021) on European firms' perception of Russia-related sanctions imposed after 2014.

Different types of risks and unique threats to Russian exporting firms due to international sanctions need to be emphasized. Among these, it is worth mentioning the following:

5. See: "Infographic—Impact of sanctions on the Russian economy." Last updated: 2023-10-12, https://www.consilium.europa.eu/en/infographics/impact-sanctions-russian-economy/ (accessed 2022-10-01).

- challenges in logistics
- issues related to importing intermediates and equipment
- restrictions on access to foreign technologies and credits
- risk factors that apply to the firms or their securities
- disconnection from the Visa and MasterCard payment systems
- removal of key Russian banks from the SWIFT banking system
- freezing of customs cooperation between the Baltic countries and Russia
- reduction of the EU's energy dependence on Russia from 40% to 7%
- obstacles in attracting investments and the necessity to halt or delay the implementation of some investment projects
- the threat of secondary sanctions for foreign companies closely cooperating with Russian firms

It should be recognized that all the aforementioned sanctions have a cumulative effect and are of greater significance for innovative firms, often reliant on imported parts or equipment. The experience of 2014 indicates that larger firms are more engaged in globalization activities than SMEs, which suffer more severe consequences due to the costs of economic sanctions.

Although the situation with economic sanctions in 2022 was dynamic, it had the potential to deliver more significant global shocks than ever before and was easier to evade. Some countries had provided a substantial potential loophole that Russia was able to use for obtaining construction materials, technical knowledge, and making international transaction payments. In response to Western sanctions, Russia imposed an export ban on over 200 products, including telecoms, medical, vehicle, agricultural, and electrical equipment, effective until the end of 2022. This move altered the direction of its foreign trade.

Let us take a closer look at the business opportunities that Russian exporting firms can take advantage of:

- shifting the direction of exports to increase trade with the Middle East, Africa, and partners from EAEU member states and Cuba;
- expanding business operations in sectors like food, agriculture, health, and pharma, which are exempt from imposed restrictive measures;
- revitalizing the Black Sea grain corridor to facilitate Russian grain and fertilizer exports by addressing existing obstacles;[6]
- utilizing payment systems such as China's UnionPay and Kazakh cards; and
- reducing dependence on the US dollar and euro by acquiring loans in Chinese yuan-denominated and Indian rupee-denominated lending.

It is interesting to speculate how long some trade partners from China, India, Turkey, EAEU member states, and Cuba might continue to assist Russian firms in dealing with and minimizing the impacts of Western sanctions. It appears that they are more focused on establishing a solid reputation as strong and reform-oriented economies.

Conclusion

This paper has formally addressed the issue of export premium and heterogeneity in terms of productivity within exporting and non-exporting firms. The results align with findings from other related studies and statistical frameworks regarding revenue-based productivity, which can reflect variations in technical efficiency or product and factor market imperfections.

Assuming a positive relationship between the export premium and productivity across exporting and non-exporting firms, we assert that, in general, exporters do not achieve higher profits. Nevertheless, we found that Russian exporters exposed to an exchange rate depreciation shock in 2014 were able to achieve higher net income per employee than non-exporters. Consequently, the first hypothesis was confirmed.

6. See: "Russia Grain and Oilseed Exports Expand." International Agricultural Trade Report by Rachel Trego, USDA Foreign Agricultural Service, May 8, 2023, available at https://fas.usda.gov/sites/default/files/2023-05/Russia-IATR-final_1.pdf.

Depreciation can indeed increase companies' productivity, especially when it expands the Russian market and reduces the propensity to import (which is supported by government import-substitution policies). Hence, it becomes challenging for export companies to enhance productivity.

However, the prior introduction of product or process innovations is a necessary condition for a beneficial impact of exporting. Exporting firms that were not involved in innovative activities did not experience an increase in their workers' productivity. This, in turn, supported our second hypothesis.

The present research can be helpful in light of the impact of the outbreak of the next economic crisis and the diversion of the trade conducted by Russian exporting firms due to Western sanctions.

References

Agostino, M., A. Giunta, J.B. Nugent, D. Scalera, and F. Trivieri. 2015. "The Importance of Being a Capable Supplier: Italian Industrial Firms in Global Value Chains." *International Small Business Journal* 33 (7):708–730. doi: 10.1177/0266242613518358.

Barajas, A., E. Shakina, and C. Fernández-Jardón. 2017. "Acceleration Effect of Intangibles in the Recovery of Corporate Performance After-Crisis." *Research in International Business and Finance* 42:1115–1122. doi: 10.1016/j.ribaf.2017.07.046.

Bernard, A.B., and J. Bradford Jensen. 1999. "Exceptional Exporter Performance: Cause, Effect, or Both?" *Journal of International Economics* 47 (1):1–25. doi: 10.1016/S0022-1996(98)00027-0.

Berthou, A., E. Dhyne, M. Bugamelli, A.-M. Cazacu, C.-V. Demian, P. Harasztosi, T. Lalinsky, J. Meriküll, F. Oropallo, and A.C. Soares. 2015. "Assessing European Firms' Exports and Productivity Distributions: the CompNet Trade Module." *ECB Working Paper* (1788):1–57. doi: 10.2866/995315.

Bircan, C., and R. De Haas. 2015. "The Limits of Lending: Banks and Technology Adoption Across Russia." *CESifo Working Paper Series* (5461):1–73. doi: 10.2139/ssrn.2639610.

Blyde, J. 2016. "Exports and Labor Skills: the Role of Training." *MPRA Paper* (72150):1–20.

Brancati, E., R. Brancati, and A. Maresca. 2017. "Global Value Chains, Innovation and Performance: Firm-Level Evidence from the Great Recession." *Journal of Economic Geography* 17 (5):1039–1073. doi: 10.1093/jeg/lbx003.

Cerulli, G. 2014. "Ivtreatreg: a Command for Fitting Binary Treatment Models with Heterogeneous Response to Treatment and Unobservable Selection." *The Stata Journal* 14 (3):453–480. doi: 10.1177/1536867x1401400301.

Davydov, D., J. Sihvonen, and L. Solanko. 2021. "Who Cares About Sanctions? Observations from Annual Reports of European Firms." *OFIT Discussion Paper* (5):1–35. doi: 10.2139/ssrn.3830979.

Eppinger, P.S., N. Meythaler, M.-M. Sindlinger, and M. Smolka. 2015. "The Great Trade Collapse and the Spanish Export Miracle: Firm-Level Evidence from the Crisis." *Institut for Økonomi, Aarhus Universitet. Economics Working Papers* (10):1–35.

Ferrantino, M.J., and D. Taglioni. 2014. "Global Value Chains in the Current Trade Slowdown." *World Bank — Economic Premise* (138):1–6.

Gajewski, P., and G. Tchorek. 2017. "What Drives Export Performance of Firms in Eastern and Western Poland?" *Lodz Economics Working Papers* (1):1–21.

Golikova, V., K. Gonchar, and B. Kuznetsov. 2012. "Does International Trade Provide Incentives for Efficient Behaviour of Russian Manufacturing Firms?" *Post-Communist Economies* 24 (2):277–289. doi: 10.1080/14631377.2012.675163.

Golikova, V., and B. Kuznetsov. 2017. "Perception of Risks Associated with Economic Sanctions: the Case of Russian Manufacturing." *Post-Soviet Affairs* 33 (1):49–62. doi: 10.1080/1060586X.2016.1195094.

Golikova, V.V. [Голикова Виктория Владимировна] 2011. "Empiricheskiye dokazatel'stva obuchayushchikh effektov eksporta." [Эмпирические доказательства обучающих эффектов экспорта] In *Seriya WP1. Institutsional'nyye problemy rossiĭskoĭ ekonomiki* [Серия WP1 Институциональные проблемы российской экономики], edited by V.V. Golikova, K.R. Gonchar and B.V. Kuznetsov [В.В. Голикова, К.Р. Гончар, Б.В. Кузнецов]. Moskva: Izd. dom Vysshe̋ shkoly ekonomiki [Изд. дом Высшей школы экономики].

International Study Group on Exports and Productivity. 2008. "Understanding Cross-Country Differences in Exporter Premia: Comparable Evidence for 14 Countries." *Review of World Economics / Weltwirtschaftliches Archiv* 144 (4):596–635. doi: 10.1007/s10290-008-0163-y.

Johanson, J., and J.E. Vahlne. 1990. "The Mechanism of Internationalisation." *International Marketing Review* 7 (4):11–24. doi: 10.1108/02651339010137414.

Krugman, P. 1980. "Scale Economies, Product Differentiation, and the Pattern of Trade." *The American Economic Review* 70 (5):950–959.

Landini, F., A. Arrighetti, and A. Lasagni. 2015. "Economic Crisis and Firm Exit: Do Intangibles Matter?" *LUISS School of European Political Economy Working Paper* (10):1–29.

Melitz, M.J., and S.J. Redding. 2014. "Heterogeneous Firms and Trade." In *Handbook of International Economics*, edited by G. Gopinath, E. Helpman and K. Rogoff, 1–54. Elsevier.

Nunes, S.r., R. Lopes, and J. Dias. 2013. "Innovation Modes and Firm's Performance: Evidence from Portugal." 53rd Congress of the European Regional Science Association: "Regional Integration: Europe, the Mediterranean and the World Economy," Palermo, Italy, 27–31 August 2013.

Pini, M., and G. Tchorek. 2022. "Comparative Analysis of Export Determinants in Italian and Polish Firms: the Moderating Role of Non-Family Management." *Journal of Entrepreneurship, Management & Innovation* 18 (2):41–67. doi: 10.7341/20221822.

Rodrik, D. 2008. "The Real Exchange Rate and Economic Growth." *Brookings Papers on Economic Activity* 2008:365–412.

Shishkin, A.V., and A.V. Latyshov. [Шишкин А.В., А.В. Латышов] 2015. "Vneshnyaya torgovlya Rossii v 2014 g.: vzglyad iz-pod sanktsiy." [Внешняя торговля России в 2014 г.: взгляд из-под санкций] *Mezhdunarodnaya torgovlya i torgovaya politika* [Международная торговля и торговая политика] (2):44–56.

Tovar-García, E.D., and C.A. Carrasco. 2019. "Export and Import Composition as Determinants of Bilateral Trade in Goods: Evidence from Russia." *Post-Communist Economies* 31 (4):530–546. doi: 10.1080/14631377.2018.1557913.

Wagner, J. 2007. "Exports and Productivity: a Survey of the Evidence from Firm-level Data." *The World Economy* 30 (1):60–82. doi: 10.1111/j.1467-9701.2007.00872.x.

Wagner, J. 2017. "Productivity Premia for Many Modes of Internationalization. A Replication Study of Békés and Muraközy (Economics Letters, 2016)." *International Journal for Re-Views in Empirical Economics* 1 (4):1–6. doi: 10.18718/81781.4.

Wakelin, K. 1998. "Innovation and Export Behaviour at the Firm Level." *Research Policy* 26 (7):829–841. doi: 10.1016/S0048-7333(97)00051-6.

Appendix

Table 1A. Productivity of Innovators

Treatment variable	Product innovation (1)	Process innovation (2)	Product innovation (3)	Process innovation (4)
Lagged profit	0.067***	0.067***	0.067***	0.067***
	(0.007)	(0.007)	(0.007)	(0.007)
Exporter	−1.826	4.290	−1.894	1.763
	(2.879)	(4.140)	(2.171)	(2.764)
Constant	2.024	−0.878	2.065	0.189
	(2.332)	(2.414)	(2.068)	(2.006)
R-squared	0.171	0.170	0.171	0.171
Observations	996	996	996	996
ATET	−1.826	4.290	−1.894	1.763

Note: Dummies for sectors were included. Method of estimation—probit (columns 1 and 2) and OLS (columns 3 and 4) for the selection equation and two-stage least squares for the regression equation; robust standard errors are reported in parentheses

*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.