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How Do External Shocks Affect the Economic Efficiency of Companies with Foreign Direct Investment?

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Abstract

This study aims to assess the effectiveness of export and import activities of domestic companies with foreign direct investment during external shocks. This research is relevant because the impact of spillover effects of foreign direct investment on domestic companies and economic uncertainty after the sanctions and the outbreak of the pandemic was ambiguous. The empirical base contains about 170,000 observations of 18,799 operating companies with a foreign capital share of at least 10% in 2012–2020, obtained from the Ruslana database – Bureau Van Dijk. For the purposes of the study, the companies are grouped by the industry and their roles in international trade. Efficiency assessment is conducted using data envelopment analysis (DEA), accounting for the spillover effects from foreign direct investment. The results of the study confirm that firms that trade in both directions demonstrate better performance. Next come the companies focused only on export or import. Companies that are not involved in international trade are the least efficient (hypothesis 1). Industries that benefit from foreign direct investment inflows include the more capital-intensive sectors (hypothesis 2). External shocks have a negative impact on the efficiency of companies with foreign direct investment (hypothesis 3). This understanding has important implications for long-term economic growth and the recovery of the Russian economy after the current external shocks.

Keywords: foreign direct investment, export, import, technical efficiency, DEA, spillover effects, panel regression analysis, sanctions, COVID-19 pandemic, external shocks

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Introduction

The Russian economy had not fully recovered from the sanction crisis yet, therefore the unexpected spread of COVID-19 was an additional powerful and damaging shock, which inevitably resulted in a dramatic drop in international trade and reduction in cross-border foreign direct investment (FDI). So, it is extremely important to understand how external shocks have influenced the performance of Russian companies with FDI involved in international trade. Besides, in spite of substantial evidence of a higher efficiency of multinational enterprises, the data on the spillover effects of FDI is ambiguous. Thus, a better understanding of the mechanisms that allow foreign presence to improve or impair domestic companies' performance during external shocks through generated vertical and horizontal effects is required. The ambiguous nature of influence of foreign direct investment's spillover effects, as well as economic and geopolitical uncertainty caused by external shocks account for the relevance of this study. This understanding is of significant consequence for the performance of companies with foreign direct investment that operate amid tough sanctions and the COVID-19 pandemic and for long-term economic growth and the general recovery of the Russian economy.

The purpose of this study is to assess the spillover effects of FDI and dealings in foreign trade on the performance indicators of Russian companies with FDI against the background of external shocks. One of the main questions is whether domestic companies' performance improves along with the increase in foreign direct investment and participation in international trade. How does this influence change when exposed to sanctions and pandemic?

Thus, we pose the problem of calculating the corporate technical efficiency indicator and of using these calculations as the basis for conclusions on the influence of FDI's side effects with regard to the industry-related specific nature and the dependence of involvement in international trade on the productive capacity of domestic companies with FDI amid external shocks.

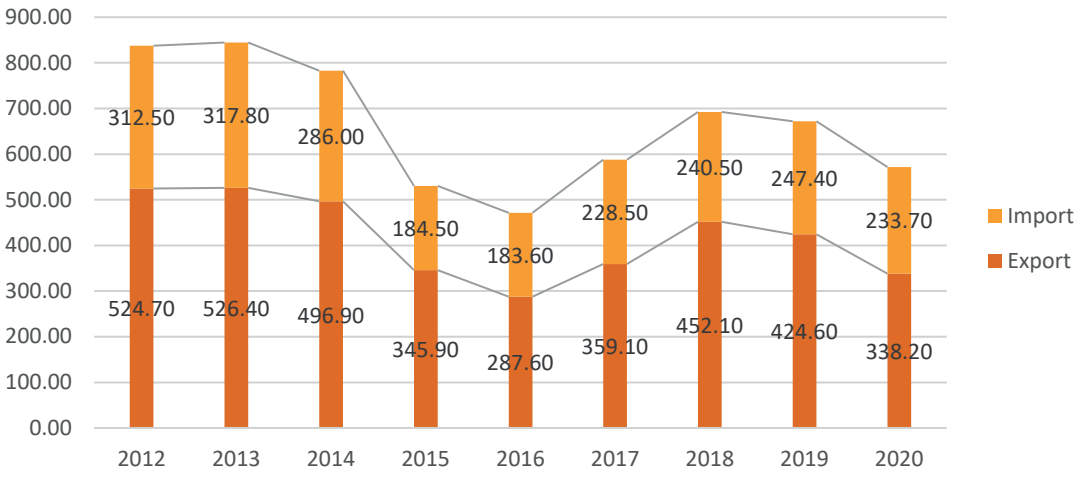
The paper continues the study of the influence of spillover effects of FDI and involvement in international trade on the performance of domestic companies with FDI during external shocks on the basis of studied domestic and foreign papers.

The empirical base comprises about 170,000 observations of 18 799 operating companies with a foreign capital share of at least 10% in 2012–2020, obtained from annual financial reporting offered by the Ruslana database – Bureau Van Dijk.

This paper substantiates a better performance of companies with foreign FDI as compared to firms operating in the domestic market; besides, companies involved in both export and import show a greater productive capacity than net exporters or importers. Mainly capital-intensive economy sectors stand to benefit from an FDI inflow. Corporate performance declines during external shocks.

External shocks have inevitably influenced the level of international trade of the Russian Federation. The dynamics of Russian export and import in 2012–2020 shows a decrease in Russia's external turnover from $837.2 billion in 2012 to $571.9 billion in 2020 (by 31.7%). At the same time, the visible trade balance was positive for the whole researched period. According to the Federal Customs Service [1], Russia's export and import indicators (Figure 1) peaked in 2013 ($526.4 billion and $317.8 billion respectively). The scope of external trade was reduced significantly in 2014–2016 due to 2014 economic sanctions against Russia and countermeasures, which changed the volume of exports and imports as well as the industry- and country-related structure [2].

Figure 1. Dynamics of exports and imports of the Russian Federation for 2012–2020, billion US dollars



Source: Compiled by the authors according to the Federal Customs Service of Russia.

As the Russian economy recovered in 2018, the export and import turnover increased to $452.1 billion and $240.5 billion, respectively. COVID-19 decreased the turnover to $338.2 billion and $233.7 billion. External turnover with the European Union, which is Russia's largest economic partner, was reduced notably from 41.6% in 2019 to 38.5% in 2020, amounting to $59.4 billion in terms of value, mainly due to a decrease in exports by 27.6% (the rate of curtailing of EU imports is significantly slower – 7.6%). The three leading partners are China, Germany and the Netherlands.

According to the Central Bank of the Russian Federation, the largest amount of FDI fell on 2013 and equaled $69.2 billion [3]. In the following two years, FDI in the Russian economy decreased ten-fold after the sanctions against Russia were implemented. However, in 2016 FDI grew almost four-fold, which may be due to the deferred demand effect and expectations of an economic and political upturn. As a result of the toughening of sanctions in 2018, foreign investment decreased again almost to the level of 2015. When the amount of FDI was restored in 2019, the pandemic outbreak caused its more than three-fold reduction. The number of investment projects was reduced almost to the 2014 level (141 projects in 2020 and 125 in 2014) [4]. The three leading investor countries in 2020 were Germany, China and the USA. The following Russian industries were the most attractive ones in the studied period: wholesale and retail (23.7% of all foreign direct investment), manufacturing (21.4%), in particular, metallurgical production (7.2%), production of food (4.3%), coke and refined petroleum products (2.5%). Mineral extraction accounted for 17.6% of FDI.

Thus, external shocks such as sanctions against Russia, the COVID-19 pandemic and economic and political uncertainty caused by them had a negative impact on Russia's external turnover, significantly decreasing the volume of export and import with the largest trading partners, as well as on the country's investment attractiveness. Thus, the issue of influence of foreign direct investment and involvement of domestic companies in international trade gains more relevance.

Literature Review and Research Hypotheses

Numerous economists are convinced that FDI and involvement in international trade raise productivity. It was substantiated theoretically that an increase in export leads to productivity gains, i.e., due to economy of scale. Competitive pressure is also intensified. It has been caused, in particular, by obtaining foreign direct investments through vertical and horizontal channels that comprise transfer of knowledge, manufacturing techniques and management methods, access to new, high quality or cheap resources. The increased competitive pressure prompts domestic companies to improve their efficiency. Companies unable to cope with intensified competition are forced out of the market.

Thus, based on theoretical and empiric research of the influence of foreign direct investment and involvement in international trade on performance of domestic companies, we put forward the following hypotheses in this paper:

H1. Companies engaged in both export and import are the most efficient ones. They are followed by the companies focused on either export or import only. The least effective are the companies that are not involved in international trade.

Paper by C. Sharma and R.K. Mishra [5] studies the interrelation between engagement in trade and performance indicators of Indian companies, and concludes that exporters, importers and traders involved in both export and import are more effective than other market players. H. Kasahara and B. Lapham [6] also write about the higher productivity of exporters and importers compared to domestic companies that are not involved in any trade. E. A. Fedorova et al. [2] confirm that companies engaged in export and import are the most effective ones, followed by importing companies, and then – by exporting companies. The enterprises not involved in international trade are the least effective. M. MuûLs and M. Pisu [7] think that the firms engaged both in import and export are the most productive ones, followed in descending order by the ones involved only in import, the ones involved only in export and non-traders.

H2. The industries that benefit from the FDI inflow comprise sectors that are more capital-intensive.

The general concept of FDI is based on the fact that the main investment motive is the relative advantages of the region and industry including, inter alia, the location of labour-intensive enterprises in the countries with low-cost labour. However, a number of researchers contest this notion. According to paper by J. Ran et al. [8], the greatest effect from FDI inflow is observed in capital-intensive economic sectors, such as chemical, oil and nonferrous metal industries, transport and electronics. D.E. Kuznetsov studied the interrelation between capital intensity of industries and foreign direct investment and found out the following dependence: there are more foreign investors in capital-intensive industries than in labour-intensive ones [9]. P. Antràs and S.R. Yeaple conclude that the trend of intensive multinational activity in certain industries has a strong correlation to connection between capital and labour in such industries, and that the relative significance of multinational corporations in economic activity is higher in capital-intensive commodities [10].

H3. External shocks have a negative impact on the performance of companies with FDI.

Since the Russian economy is export-oriented, one should take into consideration that sudden changes in the domestic and international political and economic environment will result in serious exogenous disturbances. E.A. Zapadnyuk asserts that the "influence of an external factor on the economic system is shocking (destructive and creative) only if it results in a destruction of structural ties of economic cohesion" [11]. Based on this speculation, we can define two external shocks for Russia within the studied

period: sanctions against Russia and the unexpected and quickly spreading COVID-19 pandemic.

A recent research study by Z.Wong et al. considers the influence of FDI on the efficiency of Chinese firms under the COVID-19 conditions [12]. The results confirm a positive influence of FDI on productivity of firms, however, in the absence of external shocks. E.A. Fedorova et al. estimated the influence of sanctions on the performance of importer companies and reached the conclusion that political uncertainty had a negative impact on the productivity of importing firms [2]. According to the research by S. Zarbi et al., the average efficiency of Iranian ports evaluated using data envelopment analysis (DEA) decreased after the imposition of sanctions [13]. N. Vujanović et al. also studied the spillover effects of FDI during crisis [14]. The dynamic panel analysis of data at the company level shows that the crisis impact stops the learning process due to spillover effects if companies face problems with access to external resources.

It is important to note that in scientific literature the evaluation of FDI's influence on the effectiveness of domestic companies during a crisis is controversial. According to the research by A. Bykova and C.M. Jardon, foreign capital significantly reduces the negative effect of an economic decline [15].

Research Methodology

Spillover effects may be applied to measure the influence of FDI on the effectiveness of domestic companies. Spillover effects of FDI may exert their influence through a range of channels. First, domestic firms may benefit from FDI available in the same industry. This results in intra-industry or horizontal spillover effects. Second, there may be spillover effects of foreign investment companies engaged in other industries. This results in interindustry or vertical spillover effects. This type of effects is often accounted for by the relations between the buyer and supplier and, consequently, may be targeted at upstream industries (reverse spillover effects) or downstream industries (direct spillover effects).

The following formulas are used to measure spillover effects:

$$HORIZ_{jt} = \frac{\sum_{i,i\in j, FS_{i,j,t}\geq 0,1} FS_{i,j,t} FA_{i,j,t}}{\sum_{i,i\in j} FA_{i,j,t}}; \quad (1)$$

$$FORW_{jt} = \beta_{kj,t} HORIZ_{jt}; \quad (2)$$

$$BACK_{jt} = \beta_{jk,t} HORIZ_{jt}. \quad (3)$$

Variables are described in Table 1.

Table 1. Description of variables

Variable	Description	Source
$HORIZ_{jt}$	Horizontal spillover effect	Calculated by the authors
$FORW_{jt}$	Vertical direct spillover effect	Calculated by the authors
$BACK_{jt}$	Reverse vertical spillover effect	Calculated by the authors
$FS_{i,j,t}$	Share of foreign capital in company i in industry j at time t	Ruslana database
$FA_{i,j,t}$	Value of non-current assets of company i within the time period t in sector j	Ruslana database
$\beta_{kj,t}$	Share of production output in industry k consumed by industry j within the time period t	The Leontief input-output model
$\beta_{jk,t}$	Share of production output in industry j consumed by industry k within the time period t	The Leontief input-output model

Source: Compiled by the authors.

In order to calculate the β coefficient, we use the Leontief input-output model in the same way that Fedorova et al. [16].

We insert variables in the extended Cobb-Douglas production function and estimate the following empirical model, which will be analyzed using the panel regression analysis:

$$\ln(Q_{it}) = \eta_0 + \eta_1 \ln(FS_{it}) + \eta_2 \ln(TA_{it}) + \\ + \eta_3 (NumEmployees_{it}) + \gamma_1 \ln(HORIZ_{it}) + \\ + \gamma_2 \ln(BACK_{it}) + \gamma_3 \ln(FORW_{it}) \quad (4)$$

where Q_{it} – revenue of company *i* for the time period *t*;

TA_{it} – total assets of company *i* for the time period *t*;

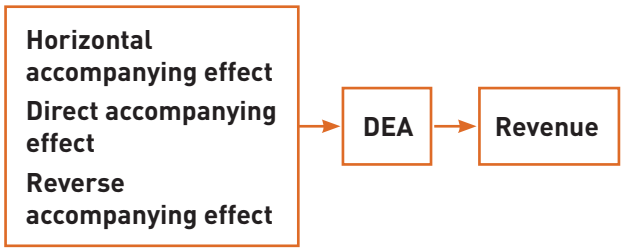
$NumEmployees_{it}$ – number of employees of company *i* for the time period *t*.

The effectiveness of domestic companies with FDI is estimated using the technical efficiency indicator of companies and applying the data envelopment analysis (DEA). It is a nonparametric method of measuring homogeneous

decision-making units (DMU) on the basis of several inputs and outputs, which provides an opportunity to compare companies by the efficiency of resource usage during the manufacturing of products with regard to technology. This methodology was proposed for the first time in 1978 by American scientists A. Charnes, W.W. Cooper and E. Rhodes [17] . They premised it on the ideas of M.J. Farrell set forth in a 1957 article.

The DEA is used quite frequently in scientific papers to analyze productive efficiency. For instance, M. Mirmozaffari et al. [18] apply data envelopment analysis (DEA) to measure productivity and effectiveness of pharmaceutical companies during the COVID-19 pandemic. In 2018 B.N. Rath [19] applied DEA to study the difference in growth of the total factor productivity (TFP) between manufacturing and service firms in India. S. Zarbi et al. [13] used data envelopment analysis to estimate the efficiency of Iranian ports under sanctions. In paper by E.A. Fedorova et al. [20], DEA is used to analyze the technical efficiency of companies from the defense industry complex.

Figure 2. DEA adjusted for FDI spillover effects



Source: Compiled by the authors.

Calculating corporate performance relying on research paper [2], we use the DEA model with accompanying spillover effects (Figure 2) in order to show the influence of FDI on performance of domestic companies. Corporate performance is measured as a ratio of corporate revenue (output parameter) to the following resources (input parameters): horizontal, vertical direct and vertical reverse spillover effects.

All calculations are made using the R program package.

Empiric Research Base

The empiric research base consists of 169,191 observations of 18,799 Russian companies with FDI in 2012–2020. They comprise 13 360 companies trading in the Russian market, 2464 – net importers and 174 – net exporters, as well as 2801 companies engaged in both export and import. In order to form this sample, we used the annual financial reporting data from the Ruslana database offered by Bureau Van Dijk. The data set contains information on the presence of foreign ownership in percent of shares held by foreign investors, corporate revenue, value of total assets, non-current assets, number of employees and export and import dummy variables (they take on a value of 1 if companies are exporters/importers, 0 – if they are engaged in the internal market only).

The information array has been processed according to the following criteria:

1) The company is operating as at the date of data collection;
2) There are at least 8 employees;
3) The foreign capital share is at least 10%.

The descriptive statistics for the information array are shown in Table 2.

Table 2. Descriptive statistics

Index	FS	TA. mln RUB	NumEmpl	FA. mln RUB	OR. mln RUB
count	150.432	150.432	150.432	150.432	150.432
mean	0.67	1.864.08	185	1.327.8	2.244.54
std	0.41	9.699.54	914	8.797.9	16.670.72
min	0.1	2.34	8	0.1	0.14
25%	0.1	27.60	17	10.5	15.86
50%	1	147.48	78	157.5	106.81
75%	1	757.63	85	625.2	636.12
max	1	639.669.56	66.728	783.334.9	983.470.67

Source: Compiled by the authors.

See the share of companies in the basic industries adjusted for the degree of their involvement in international trade in Table 3.

Table 3. Share of companies with FDI by industry, adjusted for the degree of involvement in international trade (2012–2020)

Industry	Total number of companies	Companies operating in the internal market, %	Exporters, %	Importers, %	Companies involved both in export and import, %
Agriculture, hunting, forestry and fishing	212	66.5	3.8	13.2	16.5
Mineral extraction	340	64.7	4.1	11.5	19.7
Power supply, gas supply and water supply	84	85.7	1.2	4.8	8.3
Chemicals and chemical products	244	36.5	2.5	17.2	43.9
Machinery	409	44.5	1.0	18.6	35.9
Transport equipment	197	29.9	0.0	14.2	55.8
Health care and social work	139	84.9	0.0	12.9	2.2
Hotels and restaurants	443	84.0	0.2	13.1	2.7
Wholesale	5035	55.2	1.2	22.1	21.6
Retail	847	74.6	0.0	13.9	11.5
Food, beverages and tobacco	291	43.0	1.4	10.7	45.0
Textile and textile goods	136	75.0	0.7	8.1	16.2
Construction industry	1080	89.7	0.1	5.5	4.7

Source: Compiled by the authors.

An overwhelming majority of companies with FDI in the considered industries are not engaged in international trade. A rather uniform distribution of companies operating in the internal and international markets is observed in the machinery, food, beverages and tobacco manufacturing, and the wholesale sector. Production of chemicals and chemical products as well as transport equipment are the leaders in the global market. The share of importers in the sample is generally very small, and in some industries there are no importers at all.

Table 4. Assessment of the impact of FDI on company revenue

Group	Companies operating in the internal market		Exporters		Importers		Companies involved both in export and import	
R^2	0.29		0.28		0.8262		0.36	
Constanta	0.86 (0.053)	***	1.9 (0.473)	***	2.47 (0.116)	***	3.45 (0.106)	***
Share of FDI	–0.01 (0.009)		0.17 (0.078)	*	–0.11 (0.014)	***	–0.04 (0.009)	***
Total assets	0.51 (0.003)	***	0.54 (0.034)	***	0.55 (0.008)	***	0.60 (0.007)	***
Number of employees	0.69 (0.005)	***	0.56 (0.045)	***	0.68 (0.011)	***	0.38 (0.008)	***
Horizontal spillover effect	–0.39 (0.056)	***	–0.25 (0.478)		–1.15 (0.102)	***	–0.75 (0.074)	***
Reverse vertical spillover effect	0.64 (0.025)	***	0.80 (0.178)	***	0.70 (0.035)	***	0.56 (0.025)	***
Direct vertical spillover effect	–0.32 (0.026)	***	–0.88 (0.245)	***	–0.29 (0.051)	***	–0.41 (0.042)	***

Note: *, **, *** – significance level of 10%, 5% and 1%.

Source: Compiled by the authors.

Research Results

See the results of panel regression (random effect model) in Table 4.

According to the obtained results, the amount of total assets and number of employees are of great significance for all companies. The share of foreign capital is positively most significant for importers, less significant for companies involved in export and import, and even less significant for exporters. The share of FDI turned out to be insignificant for companies operating in the internal market. The horizontal spillover effect has a negative impact on all groups, but at the same time is of greatest significance for importers and of no significance for exporters. A negative tendency is indicative of a reduction in revenue for the companies of the same industry when FDI increases. It may be caused by the so-called crowding-out effect [21], when the competition rising as a result of attracting FDI may harm domestic companies, at least in the short term, reducing their market share and production volume. The reverse vertical spillover effect is indicative of a positive tendency which reveals a positive influence of FDI on the companies pertaining to the industries upstream in the value chain. For instance, as a result of foreign investment in extractive industries, domestic companies obtain access to new or less expensive intermediate resources, which raises their productivity. Besides, this effect is of greatest significance for net exporters and importers. The direct vertical spillover effect turned out to be negatively significant for all companies, which is indicative of a negative influence of FDI inflow on companies from downstream industries. This may mean that domestic companies have no acquisition capacity when foreign companies transfer technology and knowledge. Thus, the results of panel regression show a dubious influence of FDI side effects on productivity of domestic companies.

We divided the sample into four groups in order to verify hypotheses H1 and H3: companies operating in the internal market; companies engaged in export only; net importers; companies involved in international trade as both exporters and importers. Applying the DEA methodology, we calculated the technical efficiency coefficient, where 0 represents ineffective companies, 1 – the most effective ones.

According to the obtained results (Table 4), the companies involved in both export and import are significantly more effective over the entire period. Net importers come second, then – net exporters and the companies not engaged in international trade are the last.

Table 5. Evaluation of the technical efficiency of companies with FDI, adjusted for spillover effects

Companies with FDI	2012	2013	2014	2015	2016	2017	2018	2019	2020
Companies operating in the internal market	0.1825	0.1808	0.1774	0.1828	0.2977	0.3365	0.2536	0.3161	0.2016
Exporters	0.1982	0.2037	0.1941	0.2011	0.3272	0.3689	0.3066	0.3751	0.2035
Importers	0.2095	0.2111	0.2002	0.2142	0.3454	0.3871	0.3602	0.4340	0.2257
Companies involved in both export and import	0.2651	0.2790	0.2540	0.2801	0.4142	0.4498	0.4559	0.4911	0.2677

Source: Compiled by the authors.

The lowest efficiency indicators were noted in 2014 due to FDI outflow from Russia after the imposition of sanctions. Adaptation of Russian companies to operating amidst a sanction-induced crisis, an active import phaseout policy, as well as the large FDI in the Russian economy in 2017 contributed to an increase of efficiency of companies with FDI in all four groups.

However, the COVID-19 outbreak had a negative effect on the productivity of the studied companies. As a result of restrictive measures aimed at the containment of coronavirus all over the globe, the companies' efficiency decreased on average by 44% as compared to the previous period and almost reached the 2014 level. The pandemic produced the least impact on the companies not engaged in international trade (–36%), which is explicable from the point of view of the global supply chain disruption.

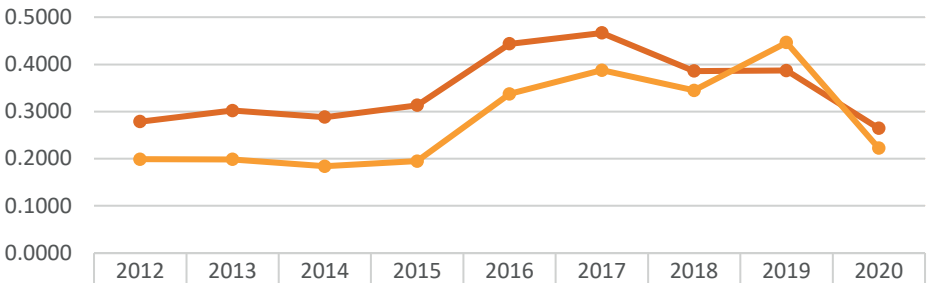
Thus, the results of the DEA model adjusted for spillover effects confirm hypothesis H1 and conform to the earlier studies about the influence of involvement in international trade on efficiency of domestic companies with FDI [2; 5; 6].

The obtained results also conform to papers by S. Zarbi et al. [13] and E.A. Fedorova et al. [2] and confirm hypothesis H3 about the negative influence of external shock on performance efficiency of companies with FDI.

In order to verify hypothesis H2, we defined the most and the least capital-intensive industries in the Russian economy. As per research by O.I. Dranko [22], the following activities have the highest capital input-output coefficient in the Russian economy: financial business, immovable property, agriculture, transport and communications, mineral extraction, health care, power supply and fishing. The least capital-intensive industries are manufacturing, hotels and restaurants, construction industry, trade and education. Thus, we determined two groups of Russian economic sectors: capital-intensive and labour-intensive ones.

As we see in Figure 3, in 2012–2020 the efficiency of capital-intensive economic activities was higher except for 2019. In 2012–2015, the average growth rate for the industries from this group was higher by 0.1016 (4.75%). Starting in the following year, the efficiency of labor-intensive industries grew quicker, and in 2019 this growth exceeded the indicators of the capital-intensive sector of the Russian economy.

Figure 3. Evaluation of the effectiveness of companies with FDI in capital-intensive and labor-intensive industries



	2012	2013	2014	2015	2016	2017	2018	2019	2020
Capital-intensive industries	0.2788	0.3022	0.2883	0.3134	0.4438	0.4668	0.3859	0.3869	0.2644
Labor-intensive industries	0.1990	0.1985	0.1841	0.1947	0.3374	0.3875	0.3448	0.4463	0.2222

Source: Compiled by the authors.

See the results of the DEA analysis with regard to industry affiliation in in Appendix A. The health care, chemical and chemical product, and transport equipment manufacturing sectors were the most efficient capital-intensive industries on average in the studied period. The leaders among labor-intensive industries were the food, beverages and tobacco, hotels and restaurants, retail and wholesale sectors.

In 2014 due to a decrease in Russia's investment attractiveness as a result of economic sanctions, a reduction in efficiency in both groups was observed. Besides the following capital-intensive industries suffered most of all: transport equipment (–8.1% as compared to the previous period); power, gas and water supply (–8.0%); mineral extraction (–7.4%). In labor-intensive industries the greatest decrease took place in the wholesale (–10.1%), textile and textile goods (–4.1%), food, beverages and tobacco (–2.7%) sectors.

2016 was favorable for all the studied industries and entailed a significant efficiency growth among domestic enterprises (by 41.6% in capital-intensive industries and 73.3% in labor-intensive ones). The reason for such growth was a significant (almost four-fold) increase in FDI due to the restoration of Russia's investment attractiveness and a decrease in economic and political uncertainty. It is important to note that the additional 2018 sanctions package had a negative impact on productivity.

Company efficiency decreased even more due to the pandemic. Besides, labor-intensive industries suffered more (indicators were halved in comparison to 2019). The largest drop in efficiency occurred in wholesale and retail (–56.1 and –50,2% respectively), then – in the leather, leather goods and footwear (–41.0%), food, beverages and tobacco (–37.4%) manufacturing sectors. Efficiency of the hotel and restaurant business was reduced by 27.6%. Construction industry (–17.4%) and textile industry (–10.8%) suffered the least of all.

The rate of decrease of capital-intensive economic activities in 2020 was 31.7%. Efficiency of the chemical industry (–49.4%) and agriculture (–37.1%) was almost halved. In the machinery and transport equipment manufacturing sector this indicator fell by 32.6 and 22.4%. The efficiency decrease rate of power companies equaled 27.0%, in mineral extraction – 24.2%), and in health care and social services –16.0%.

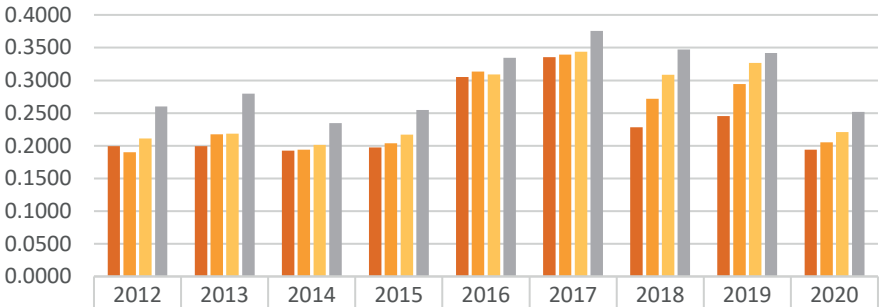
Thus, the results of our research concur with the conclusions made by J. Ran et al. [8], P. Antràs, S.R. Yeaple [10] and D.E. Kuznetsov [9] and confirm hypothesis H2 regarding the greater efficiency of capital-intensive industries with FDI as compared to labor-intensive ones.

We are now going to consider the influence of FDI availability on capital-intensive and labor-intensive industries with regard to the involvement of Russian companies in international trade using a range of Russian industries as an example.

The results of the DEA for the economic activity of mineral extraction and quarrying (Figure 4) is on average higher for the companies involved in both export and import. They are followed by the companies engaged only in export or import, with importers being more efficient than exporters. The companies oriented to the internal market show the lowest productivity indicators. All companies demonstrated an insignificant decrease in efficiency during the sanctions crisis and the coronavirus pandemic. However, in 2020, the companies engaged in international trade suffered most of all, unlike the companies operating inside Russia.

Over the entire period in question, exporting companies were the least efficient ones in the chemical industry (Figure 5), while companies involved both in export and import were the most efficient ones. Importers' indicators were higher than those of the firms not engaged in international trade. The greatest drop in efficiency took place in 2020. It affected both the companies operating in the internal market and the ones involved in international trade. The efficiency of the latter demonstrated a greater decrease (on average by 0.2575 vs. 0.1969 for the companies not operating in the global market).

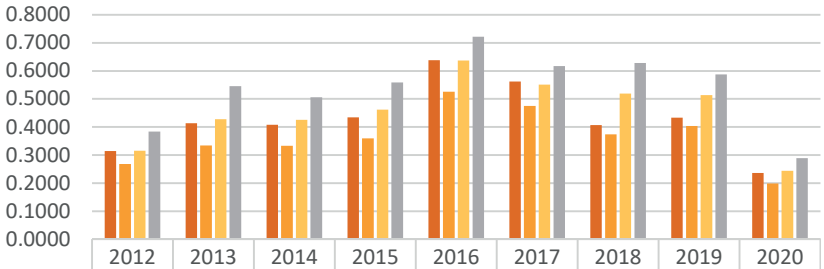
Figure 4. Efficiency of companies with FDI engaged in mining and quarrying



	2012	2013	2014	2015	2016	2017	2018	2019	2020
Companies operating in the internal market	0.1994	0.1993	0.1924	0.1975	0.3051	0.3355	0.2285	0.2454	0.1942
Exporters	0.1903	0.2176	0.1941	0.2036	0.3134	0.3394	0.2717	0.2942	0.2052
Importers	0.2112	0.2184	0.2013	0.2168	0.3092	0.3438	0.3088	0.3266	0.2209
Companies engaged in both export and import	0.2601	0.2798	0.2348	0.2545	0.3346	0.3754	0.3470	0.3418	0.2519

Source: Compiled by the authors.

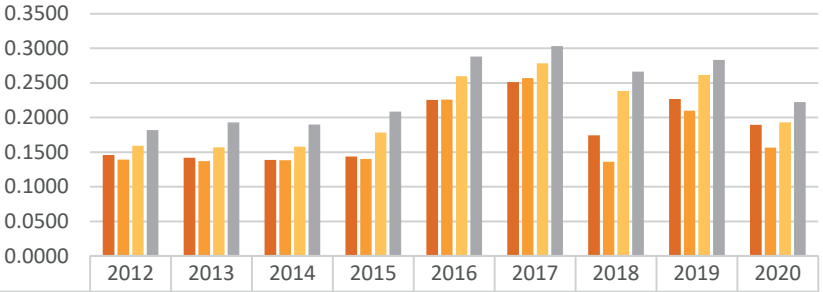
Figure 5. Efficiency of companies with FDI engaged in the production of chemicals and chemical products



	2012	2013	2014	2015	2016	2017	2018	2019	2020
Companies operating in the internal market	0.3142	0.4136	0.4078	0.4342	0.6382	0.5620	0.4070	0.4333	0.2364
Exporters	0.2677	0.3341	0.3335	0.3600	0.5261	0.4751	0.3733	0.4034	0.1991
Importers	0.3154	0.4281	0.4256	0.4623	0.6367	0.5514	0.5194	0.5137	0.2433
Companies engaged in both export and import	0.3833	0.5455	0.5063	0.5591	0.7221	0.6170	0.6283	0.5874	0.2895

Source: Compiled by the authors.

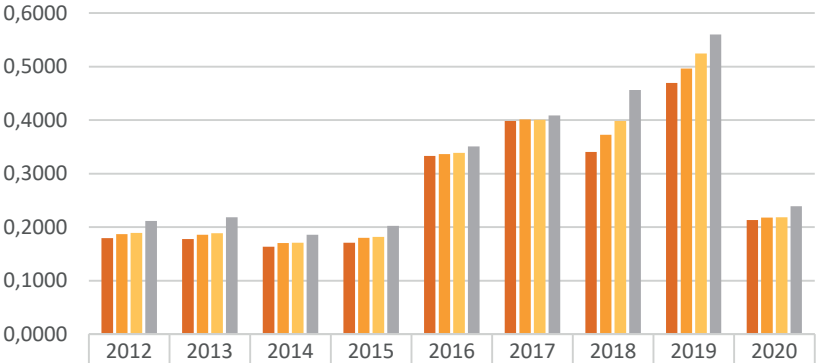
Figure 6. Efficiency of companies with FDI in the construction industry



	2012	2013	2014	2015	2016	2017	2018	2019	2020
Companies operating in the internal market	0.1460	0.1421	0.1387	0.1436	0.2253	0.2514	0.1743	0.2267	0.1893
Exporters	0.1392	0.1369	0.1384	0.1401	0.2260	0.2572	0.1360	0.2097	0.1567
Importers	0.1592	0.1571	0.1581	0.1782	0.2597	0.2785	0.2384	0.2616	0.1930
Companies engaged in both export and import	0.1818	0.1930	0.1898	0.2084	0.2883	0.3034	0.2665	0.2833	0.2222

Source: Compiled by the authors.

Figure 7. Efficiency of companies with FDI in wholesale trade



	2012	2013	2014	2015	2016	2017	2018	2019	2020
Companies operating in the internal market	0,1795	0,1777	0,1636	0,1710	0,3330	0,3981	0,3405	0,4696	0,2135
Exporters	0,1868	0,1858	0,1705	0,1801	0,3366	0,4016	0,3726	0,4967	0,2177
Importers	0,1895	0,1889	0,1711	0,1820	0,3389	0,4008	0,3983	0,5245	0,2187
Companies engaged in both export and import	0,2118	0,2187	0,1858	0,2026	0,3506	0,4086	0,4563	0,5599	0,2393

Source: Compiled by the authors.

The DEA analysis of the construction industry (Figure 6) showed that companies involved both in export and import were the most efficient ones over the whole period. Importing companies were less successful. Firms operating in the internal market come third. Exporters turned out to be the least productive. We would like to note that in 2018 the efficiency of exporting companies hit a record low value for the studied period (0.1360).

In the wholesale sector (Figure 7), productivity of all four groups of domestic companies with FDI was at almost the same level, meanwhile, the companies engaged both in export and import showed a slightly better result. In 2014–2017, there was a general growth in efficiency of all companies at approximately the same rate. However, in 2018 companies engaged in international trade evidently took the lead. Just like in most industries, companies involved both in export and import, net importers and net exporters were the most efficient. Companies operating in the internal market show less productivity. Companies engaged in international trade suffered a greater negative impact of the coronavirus pandemic.

According to the above results, in 2012-2020 the most efficient companies in the industries in question were companies with FDI involved in both export and import simultaneously. Exporters and importers come second and third, respectively, and companies operating in the internal market are in the last place, except for the manufacturers of chemicals and chemical fertilizers. In these sectors, such companies are in the second place.

All four groups show an insignificant drop in efficiency in 2014–2015 due to sanctions and Russian counter measures, which entailed an outflow of foreign direct investment. However, in 2016–2017 as a result of an increase in FDI in the Russian economy in all industries and in the observed groups of companies in particular there was a significant rise in efficiency succeeded by another reduction after a toughening of the existing sanctions and implementation of new ones in 2018. The COVID-19 pandemic in 2020 had an even greater negative impact on the efficiency of companies with FDI.

Summarizing the obtained results, we can make the following conclusions (Table 6):

The spillover effects of foreign direct investment are concentrated in the companies immediately involved in trade and do not affect all domestic companies in industries with FDI. At the same time, the companies involved in export and import are the most efficient ones, net importers come second, net exporters are slightly less productive, and companies not engaged in international trade are in the last spot;

Capital-intensive industry sectors benefit more from the inflow of foreign direct investment;

Efficiency of companies with FDI decreases when exposed to external shocks.

Table 6. Analysis of the research results

Hypotheses	Research methodology	Results
H1. Companies engaged both in export and import are the most efficient ones. They are followed by the companies focused only on export or import. Companies that are not involved in international trade are the least effective.	DEA accounting for spillover effects	(+) Confirmed
H2. The industries that benefit from FDI inflow are from more capital-intensive sectors		(+) Confirmed
H3. External shocks have a negative impact on performance of companies with FDI		(+) Confirmed

Source: Compiled by the authors.

Thus, the results of our research confirm the suggested hypotheses and may be of use for top managers of Russian companies, shareholders, members of the Board of Directors, as well as government officials, specialists of financial and analytical services and other concerned parties.

Conclusion

In this paper we analyzed the role of involvement in international trade for the successful operation of domestic companies with FDI using almost 170,000 observations based on financial reporting of 18,799 operating companies with an at least 10% share of foreign capital in 2012–2020 taken from the Ruslana database (Bureau Van Dijk). For this purpose, we have assessed the efficiency of companies with FDI, accounting for the degree of their involvement in international trade; the influence of foreign direct investment on companies' productivity with regard to the specific industry-related nature; the change in technical efficiency due to external shocks. We applied data envelopment analysis (DEA), taking into consideration FDI's spillover effects and using panel regression analysis as the research methodology. The research results confirm that companies engaged in both export and import showed the greatest productivity, importers are slightly less efficient;

they are followed by exporting companies, and companies operating only in the internal market have the lowest efficiency indicators.

Capital-intensive industries of the Russian economy benefit more from an FDI inflow. At the same time, the results of wholesale and mineral extraction fully confirm hypothesis 1, while in the chemical and chemical product manufacturing and in the construction industry domestic companies not engaged in international trade came second after those involved both in export and import, and were more efficient than net exporters and importers in the whole studied period.

The influence of external shocks turned out to be negative for all four groups in the considered industries. In 2014 there was a dramatic drop in efficiency of companies with FDI caused by introduction of economic sanctions against Russia, deterioration in relations with the West, increased geopolitical risks, oil price drop and rouble devaluation. The intensified sanctions in 2018 again caused an outflow of FDI and, as a result, a decrease in productivity of companies with foreign capital. The COVID-19 pandemic outbreak was comparable in its significant negative impact on indicators in all groups, besides, the negative impact was greater in labor-intensive industries of the Russian economy.

Thus, the hypotheses suggested in the research were confirmed, while the obtained results are of theoretical and practical importance for future generations, and may be of use for domestic companies in their search for possible ways of enhancing their efficiency and competitive performance by means of attracting foreign capital and entry into the international market. They may also be useful for government officials seeking to develop a set of additional measures aimed at support of domestic companies, improvement of investment attractiveness of the Russian economy and overcoming the negative influence of external shocks, such as political and economic sanctions against Russia and the unexpected COVID-19 pandemic, which is quickly spreading across the planet and destroying the structural ties of the global economic system.

References

1. Customs statistics of foreign trade documents. Federal Customs Service of Russia. URL: http://stat.customs.gov.ru/documents (accessed on 01.04.2022). (In Russ.).
2. Fedorova E.A., Nikolaev A.E., Shirokova Yu.S., Fedorov F.Yu. Export and import activities of Russian companies with FDI in the context of sanctions. *Finansovyi zhurnal = Financial Journal*. 2019;(3):75-90. (In Russ.). DOI: 10.31107/2075-1990-2019-3-75-90
3. External Sector statistics. Bank of Russia. URL: https://cbr.ru/statistics/macro_itm/svs/ (accessed on 01.04.2022). (In Russ.).
4. European investment attractiveness survey 2020: Russia. Moscow: Ernst & Young; 2021. 20 p. URL: https://assets.ey.com/content/dam/ey-sites/ey-com/ru_ru/news/2021/06/european-attractiveness-survey-2021-russia-ver-2.pdf (accessed on 01.04.2022). (In Russ.).
5. Sharma C., Mishra R.K. International trade and performance of firms: Unraveling export, import and productivity puzzle. *The Quarterly Review of Economics and Finance*. 2015;(57):61-74. https://doi.org/10.1016/j.qref.2015.02.001
6. Kasahara H., Lapham B. Productivity and the decision to import and export: Theory and evidence. *Journal of International Economics*. 2013;89(2):297-316. https://doi.org/10.1016/j.jinteco.2012.08.005
7. Muûls M., Pisu M. Imports and exports at the level of the firm: Evidence from Belgium. *The World Economy*. 2009;32(5):692–734. https://dx.doi.org/10.1111/j.1467-9701.2009.01172.x
8. Ran J., Voon J.P., Li G. How does FDI affect China? Evidence from industries and provinces. *Journal of Comparative Economics*. 2007;35(4):774-799. https://doi.org/10.1016/j.jce.2007.05.001
9. Kuznetsov D.E. Analysis of relation between capital intensive sectors and direct foreign investments. *Ekonomicheskoe razvitie Rossii = Russian Economic Developments*. 2019;26(11):23-30. (In Russ.).
10. Antràs P., Yeaple S.R. Multinational firms and the structure of international trade. In: Gopinath G., Helpman E., Rogoff K., eds. *Handbook of international economics*. Amsterdam: Elsevier B.V.; 2014:4:55-130. https://doi.org/10.1016/B978-0-444-54314-1.00002-1
11. Zapadnyuk E.A. The impact of global financial shocks on the world economy. *Belarus' i mirovye ekonomicheskie processy : sbornik nauchnyh statej= Belarus and world economic processes : collection of scientific articles*. Minsk; 2015;(12):189-197. URL: https://elib.bsu.by/bitstream/123456789/148928/1/189-197.pdf (In Russ.).
12. Wong Z., Chen A., Peng D., Kong Q. Does technology-seeking OFDI improve the productivity of Chinese firms under the COVID-19 pandemic? *Global Finance Journal*. 2022;51:100675. https://doi.org/10.1016/j.gfj.2021.100675
13. Zarbi S., Shin S.-H., Shin Y.-J. An analysis by window DEA on the influence of international sanction to the efficiency of Iranian container ports. *The Asian Journal of Shipping and Logistics*. 2019;35(4):163-171. https://doi.org/10.1016/j.ajsl.2019.12.003
14. Vujanović N., Stojčić N., Hashi I. FDI spillovers and firm productivity during crisis: Empirical evidence from transition economies. *Economic Systems*.

2021;45(2):100865. https://doi.org/10.1016/j.ecosys.2021.100865

15. Bykova A., Jardon C.M. Lean against the wind: The moderation effect of foreign investments during the economic recession in Russia. *Journal of Economics and Business*. 2017;93:1-14. https://doi.org/10.1016/j.jeconbus.2017.07.001
16. Fedorova E.A., Nikolaev A.E., Rashchupkina A.A., Fedorov F.Yu. Evaluation of the effectiveness of foreign direct investment impact on the activities of domestic companies during the sanctions period: Industry aspect. *Vestnik Moskovskogo universiteta. Seriya 6: Ekonomika = Moscow University Economic Bulletin*. 2020;(5):158-181. (In Russ.).
17. Charnes A., Cooper W.W., Rhodes E. Measuring the efficiency of decision making units. *European Journal of Operational Research*;1978:(2):429–444. https://doi.org/10.1016/0377-2217 (78)90138-8
18. Mirmozaffari M., Yazdani R., Shadkam E. et al. An integrated artificial intelligence model for efficiency assessment in pharmaceutical companies during the COVID-19 pandemic. *Sustainable Operations and Computers*. 2022;3:156-167. https://doi.org/10.1016/j.susoc.2022.01.003
19. Rath B.N. Productivity growth and efficiency change: Comparing manufacturing- and service-based firms in India. *Economic Modelling*. 2018;70:447-457. https://doi.org/10.1016/j.econmod.2017.08.024
20. Fedorova E.A., Tkachenko A.A., Fedorov F. Yu, Mazalov E.S. Evaluation of the technical efficiency of companies of the military-industrial complex. *Korporativnye Finansy = Journal of Corporate Research*.2015;4(36):140-149. https://doi.org/10.17323/j.jcfr.2073-0438.9.4.2015.138-148
21. 21. Lin P., Liu Z., Zhang Y. Do Chinese domestic firms benefit from FDI inflow? Evidence of horizontal and vertical spillovers. *China Economic Review*. 2009;20(4):677-691. https://doi.org/10.1016/j.chieco.2009.05.010
22. Dranko O.I. The capital requirements of the activity types of the Russian economy. *Audit i finansovyi analiz = Audit and Financial Analysis*. 2015;(3):67-70. URL: https://www.auditfin.com/fin/2015/3/fin_2015_31_rus_03_02.pdf (In Russ.).

Appendix A

Evaluation of the effectiveness of companies with FDI by type of economic activity

		2012	2013	2014	2015	2016	2017	2018	2019	2020
Capital-intensive industries	Agriculture, hunting, forestry and fishing	0.1481	0.1489	0.1608	0.1998	0.2899	0.3341	0.2299	0.2788	0.1754
	Mineral extraction and quarrying	0.2123	0.2181	0.2018	0.2112	0.3118	0.3445	0.2628	0.2757	0.2091
	Power supply, gas supply and water supply	0.3385	0.3345	0.3079	0.3149	0.4694	0.5074	0.3538	0.3694	0.2696
	Chemicals and chemical products	0.3436	0.4720	0.4522	0.4920	0.6720	0.5822	0.5226	0.5140	0.2600
	Machinery	0.2603	0.2567	0.2508	0.2740	0.3948	0.4501	0.3999	0.3917	0.2641
	Transport equipment	0.3223	0.3509	0.3225	0.3559	0.5163	0.5810	0.5493	0.5124	0.3976
	Health care and social work	0.4835	0.4885	0.4568	0.4784	0.6271	0.6287	0.4318	0.4192	0.3523
Labor-intensive industries	Hotels and restaurants	0.2857	0.2757	0.2698	0.2823	0.4142	0.4572	0.3115	0.3410	0.2469
	Wholesale	0.1887	0.1892	0.1701	0.1804	0.3382	0.4010	0.3786	0.5015	0.2202
	Retail	0.2173	0.2126	0.2085	0.2304	0.3577	0.3930	0.3286	0.4556	0.2270
	Food, beverages and tobacco	0.3927	0.3969	0.3861	0.3910	0.5887	0.5781	0.5421	0.5249	0.3288
	Textile and textile goods	0.1738	0.1710	0.1639	0.1630	0.2468	0.2687	0.1835	0.2376	0.2120
	Leather, leather goods and footwear	0.2525	0.2509	0.2465	0.2452	0.3341	0.3556	0.2165	0.2522	0.1488
	Construction industry	0.1484	0.1453	0.1422	0.1486	0.2302	0.2554	0.1821	0.2313	0.1910

Source: Compiled by the authors.

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