Anna A. Fedyunina [a] iD ✉, *Nikolay A. Gorodnyi [b]* iD, *Yuri V. Simachev [c]* iD, *Igor M. Drapkin [d]* iD

[a, b, c] HSE University, Moscow, Russian Federation
[d] Ural Federal University, Ekaterinburg, Russian Federation

HOW HAS THE COVID-19 PANDEMIC ACCELERATED E-COMMERCE IN RUSSIA: EVIDENCE FROM FIRM-LEVEL DATA WITH SPATIAL FACTORS [1]

Abstract. The retail and wholesale sector has been hit hard by the coronavirus pandemic, leading to a major sector transformation. In this study, we analyse the factors of firm-level e-commerce adoption and expansion in response to the COVID-19 pandemic and pay special attention to the regional level determinants of e-commerce. We use the data provided by the EBRD-EIB-WB Enterprise Survey that includes about 18,000 observations for firms in Central and Eastern Europe (CEE) and Central Asia (CA) and approximately 1000 observations in Russia. We use the probit and weighted probit estimation techniques. Our central hypothesis states that while large cities are usually seen as drivers of the expansion of e-commerce, lagging regions are catching up with the leading regions in the adoption of e-commerce. The study shows that firms in regions with lower levels of e-commerce before COVID-19 and firms in large cities were more likely to adopt e-commerce during the pandemic, which evidences a convergence in e-commerce between Russian regions. In contrast to the firms in CEE and CA countries, export market orientation and supply chain signals do not foster e-commerce adoption in Russia. This can be explained by weak development of subcontracting networks and low participation of small and medium-sized firms in cooperative relationships in Russia. Regarding policy implications, we argue that policy measures should focus on the distribution of low-cost solutions aiming to decrease entry barriers, liberalise domestic markets for entrance of foreign platforms in Russia, and support the development of domestic platforms.

Keywords: e-commerce, online sales, Russian regions, COVID-19, Russian firms, adoption to COVID-19

Acknowledgments

ИССЛЕДОВАТЕЛЬСКАЯ СТАТЬЯ

А. А. Федюнина ᵃ⁾ iD ✉, *Н. А. Городный* ᵇ⁾ iD*, Ю. В. Симачёв* ᵛ⁾ iD*, И. М. Драпкин* �г⁾ iD

ᵃ, ᵇ, ᵛ⁾ Национальный исследовательский университет «Высшая школа экономики», г. Москва, Российская Федерация

�г⁾ Уральский федеральный университет имени первого Президента России Б. Н. Ельцина, г. Екатеринбург, Российская Федерация

Как пандемия COVID-19 ускорила развитие электронной коммерции в России: анализ данных на уровне компаний с учетом пространственных факторов

Аннотация. Розничная и оптовая торговля серьезно пострадали от пандемии коронавируса, которая привела к значительной трансформации сектора. В настоящей статье исследуются факторы, влияющие на внедрение и расширение электронной коммерции на уровне компаний в ответ на вызовы пандемии COVID-19, при этом особое внимание уделяется региональным особенностям развития онлайн-торговли. Для этого проанализированы данные исследования EBRD-EIB-WB Enterprise Survey, которое включает около 18 000 наблюдений компаний Центральной и Восточной Европы (ЦВЕ) и Центральной Азии (ЦА), в том числе примерно 1000 наблюдений в России. Для проведения анализа были использованы такие методы оценки, как пробит-модель и взвешенная пробит-модель. Согласно гипотезе исследования, в то время как крупные города обычно рассматриваются как движущие силы развития электронной коммерции, отстающие регионы догоняют лидеров по внедрению электронной коммерции. Фирмы в регионах с более низким уровнем развития электронной коммерции (до распространения COVID-19), а также компании в крупных городах чаще делали выбор в пользу онлайн-торговли во время пандемии, что свидетельствует о конвергенции электронной коммерции между российскими регионами. В отличие от компаний в странах ЦВЕ и ЦА, такие факторы, как экспортная ориентация и изменения в цепочках поставок, не влияют на развитие электронной коммерции в России вследствие недостаточного развития субподрядных сетей и низкого уровня кооперации предприятий малого и среднего бизнеса. Что касается мер поддержки коммерческого сектора, необходима дальнейшая разработка доступных решений, направленных на снижение входных барьеров, либерализацию внутренних рынков для внедрения в России иностранных платформ и развитие отечественных торговых онлайн-площадок.

Ключевые слова: электронная коммерция, онлайн-продажи, российские регионы, COVID-19, российские фирмы, адаптация к COVID-19

1. Introduction

Subnational disparities have always been an important issue in economic studies and industrial policy. The COVID-19 pandemic has exacerbated inequalities between and within countries and evolved to be a kind of "catalyst" for the adoption and increasing use of digital technologies at the firm level (Sanguinet et al., 2021; Amankwah-Amoah et al., 2021). These impacts are particularly relevant in large economies, such as the Russian Federation, which have heterogeneous territories and business and economic activity concentrated in a few large urban centres. The article aims to shed light on the issue of e-commerce adoption and expansion at the subnational level in the Russian economy and to explain the different factors of e-commerce usage based on an assessment of the micro-level database. Furthermore, the article discusses the peculiarities of the usage of e-commerce in Russian firms in comparison with companies in Central and Eastern Europe and Central Asia. The article concludes with a discussion of the implications for industrial policy aimed at the digitalisation of Russian enterprises.

The coronavirus pandemic and the resulting economic crisis hit businesses and entire industries hard. The temporary closure of stores, social distancing rules and contact restrictions significantly destroyed or affected physical shopping and inter-firm contracts. E-commerce has become the only feasible option for many firms and consumers, has demonstrated its resilience to growing demand (Villa, Monzón, 2021; Koch, Frommeyer, Schewe, 2020). E-commerce sales increased by 19 % due to COVID-19 in 2020 worldwide and by 58.5 % in Russia (Statista, 2021a; Statista, 2021b). According to the Federal State Statistics Service (Rosstat), sluggish growth of online sales in retail in Russia, from 0.7 % in 2014 to 2 % in 2019, has accelerated significantly and reached 3.9 % in 2020.

Nascent empirical evidence suggests that e-commerce accelerated recovery from the COVID-19 crisis (Han et al., 2022; Bhatti et al., 2020; Taher, 2021). It has been shown that companies that implemented e-commerce before the COVID-19 crisis were not only more resilient in the crisis, but also demonstrated high growth rates of sales and positive profits in 2020 (Simachev et al., 2021). However, penetration of e-commerce and the effects of the COVID-19 crisis on e-commerce have not been uniform across industries. Worldwide and, particularly, Russian online sales surged the most in the sectors of food and personal care, including groceries and hygiene products. Among others sectors that benefit due to lockdowns are the sales of electronics, sports goods, toys and do-it-yourself goods including construction materials; fashion industry experienced a negative hit in the first part of 2020, but managed to bounce back and grow (Statista 2021a, Statista 2021b, OECD 2020).

At the country level, during the pandemic, expansion of e-commerce has been observed in both developed and developing countries; existing empirical evidence covers Belgium, Japan, China, Russia (Lodni, Najmaei, Mansori, 2021; Becker et al., 2021; Kawasaki, Wakashima, Shibasaki, 2022; Zhao et al., 2021; Revinova, Ivashchenko, 2021). According to Alfonso et al. (2021), the pandemic has intensified a catching-up process in e-commerce growth among countries. If before the pandemic e-commerce growth was determined by gross domestic product (GDP), income and innovation capacity, during the pandemic e-commerce growth has been faster in countries with longer lockdowns, stricter measures and low pre-COVID-19 e-commerce volumes. In other words, the lower the level of e-commerce in a given country in 2019, the higher its growth rate during the

COVID-19 pandemic. However, Alcedo et al. (2022) found that the share of online transactions in total consumption increased more in economies with higher pre-pandemic e-commerce shares, exacerbating the digital divide across economies. In our view, diverging results might arise as soon as authors use different measures of e-commerce, particularly, Alfonso et al. (2021) use the macro-level data on e-commerce share in GDP, while Alcedo et al. (2022) use aggregated micro-transaction-level data from Mastercard, scaled to represent total consumer spending.

In this article, we empirically estimate factors of introduction and expansion of online sales in Russian firms during the crisis caused by COVID-19.

First, in line with existing international evidence, we expect to find the convergence of e-commerce adoption at the level of Russian regions. Taking the micro-level nature of our data, we hypothesise that:

H1. If a firm is located in a region with a higher level of e-commerce adoption, it had a lower probability to introduce or expand online sales during the COVID-19 pandemic.

Second, taking into account the evidence of higher e-commerce growth in areas with longer lockdowns and stricter measures, we expect to find that firms in Russian large cities were adopting and expanding e-commerce more intensively in comparison to firms in small towns, thus, we state that:

H2. If a firm is located in a large city, it had a higher probability to introduce or expand online sales during the COVID-19 pandemic.

It should be noted that the confirmation of the hypotheses might not be obvious. Empirical evidence says that not all Russian firms see the feasibility of implementing digital technologies. In relation to this, the large divide in adoption of digital technologies is found between large and small firms as well as between high income and low income Russian regions (Kuzyk, Simachev, Fedyunina, 2020; Zemtsov, Barinova, Semenova, 2019).

The rest of the paper is organised as follows. Section 2 reviews the existing empirical literature on factors of adoption of digital technologies, particularly, e-commerce, in firms. Section 3 provides data, descriptive statistics and discusses methods of the study. Section 4 describes empirical model and results. Section 4 concludes with policy implications for regional and federal level authorities oriented towards increasing e-commerce adoption and ensuring higher resilience to shocks.

2. Review of Factors of E-Commerce Adoption in Firms

Empirical papers usually find that standard determinants of digital technology adoption at the firm level include size, industry and regional characteristics (Stiakakis, Kariotellis, Vlachopoulou, 2009). Other important determinants at the firm level also include type of ownership and the presence of foreign technologies within a firm (Rasiah, 2003; Wang, Wang, 2015). In particular, Vishwasrao and Bosshardt (2001) consider the case of Indian manufacturing firms and note that foreign technologies and foreign ownership type are those variables, which significantly affect the adoption of new technologies within the firm. The export activity of companies is also taken into account when evaluating digital technology adoption. In addition to this, some other studies also discuss a positive effect of export activity on digital technology adoption, suggesting that exporting leads to technology premium as they use more advanced technologies (Cirera et al., 2021; Hooks et al., 2022). Regarding regional-level determinants, it was found that national and regional policies play an important role in firm's decision to adopt digital technologies (Llopis-Albert, Rubio, Valero, 2021). In particular, public policies (including those regulating industry-level technological requirements, supporting technology transfer offices, stimulating public research and development (R&D) institutions and attracting talents) might shape and co-create the regional eco-system that facilitates entrepreneurial discovery and pushes digital technology adoption.

The literature on the factors of e-commerce adoption worldwide is only growing and almost non-existent in Russia. Most of the papers consider e-commerce determinants at the micro level. In particular, studies considering firm behaviour find that organisation, technology and environment factors are important for e-commerce adoption. According to various authors (Kareen, 2018; Choshin, Ghaffari, 2017; Yeng, Osman, Othman, 2015; Kurnia et al., 2015; Ramdani, Chevers, Williams, 2013), the size of the firm, top manager support, availability of knowledge and information, innovation capacity, pressure from business competitors and trading partners are seen as important factors for e-commerce adoption. Zhao et al. (2021) considered consumer attitude towards online purchases and found that e-commerce expansion depends on consumer's income, behaviour of neighbours and friends as well as availability of payment security. Regarding the municipal level, Han et al. (2022) mention that logistics capacity significantly explained the decline

and recovery of e-commerce sales during and after the outbreak in Chinese cities. In the case of Russia, Borkova and Noskova (2019) state that e-commerce is a relatively new phenomenon for Russian economy characterised by hyper concentration in Moscow and weak development in other regions. Other researchers (Simachev et al., 2021; Maslova, 2020) discussed the factors of development and transformation of e-commerce in Russia and found that the major factor of e-commerce adoption is the size of the firm: large enterprises are more willing to adopt e-commerce as they have well-established logistics chains and larger resources such as human capital, storage facilities.

Empirical papers estimating the impact of COVID-19 on the adoption and expansion of e-commerce are relatively rare and use mainly survey data. In particular, Scutariu et al. (2021) use cross-sectional survey of 165 Malaysian companies and hierarchical clustering analysis to identify e-commerce models of economic activity, while Dinesh and MuniRaju (2021) analyse consumer behaviour during COVID-19 based on survey of 195 Indian consumers. Since this study is based on a relatively large sample of firms, we apply econometric techniques, which are standard for empirical studies exploring the determinants of digital technology adoption. Next section presents our data, the model and discusses the methods of the study in details.

3. Data, Methods and Empirical Model

The analysis of long-term trends in the expansion of e-commerce in Russia shows that the effects of the pandemic are almost absent at first sight. Indeed, the expansion of e-commerce accelerated after the world crisis of 2008–2009, then slowed after the Ukrainian crisis, and remained at this level in 2015–2020 (Figure 1). This holds for three different indicators of e-commerce in Russia, particularly, shares of business receiving and placing orders online and share of revenue from e-commerce in total business turnover.

However, based on the regional data from Rosstat, we see significant spatial differences in e-commerce before and after the pandemic. Before the pandemic, the leaders in e-commerce were the two largest Russian agglomerations, Moscow and St. Petersburg, which became particularly different after 2018: share of online sales in retail in Moscow in 2019 was 4.3 %, in St. Petersburg — 4.5 %, while the average in Russia was 2.0 %, which is very close to the values for all other regions and average in federal districts (Figure 2). In absolute terms, the leader in e-commerce growth in 2020 are again Moscow (+5.0 p.p. to 9.3 %). However, in
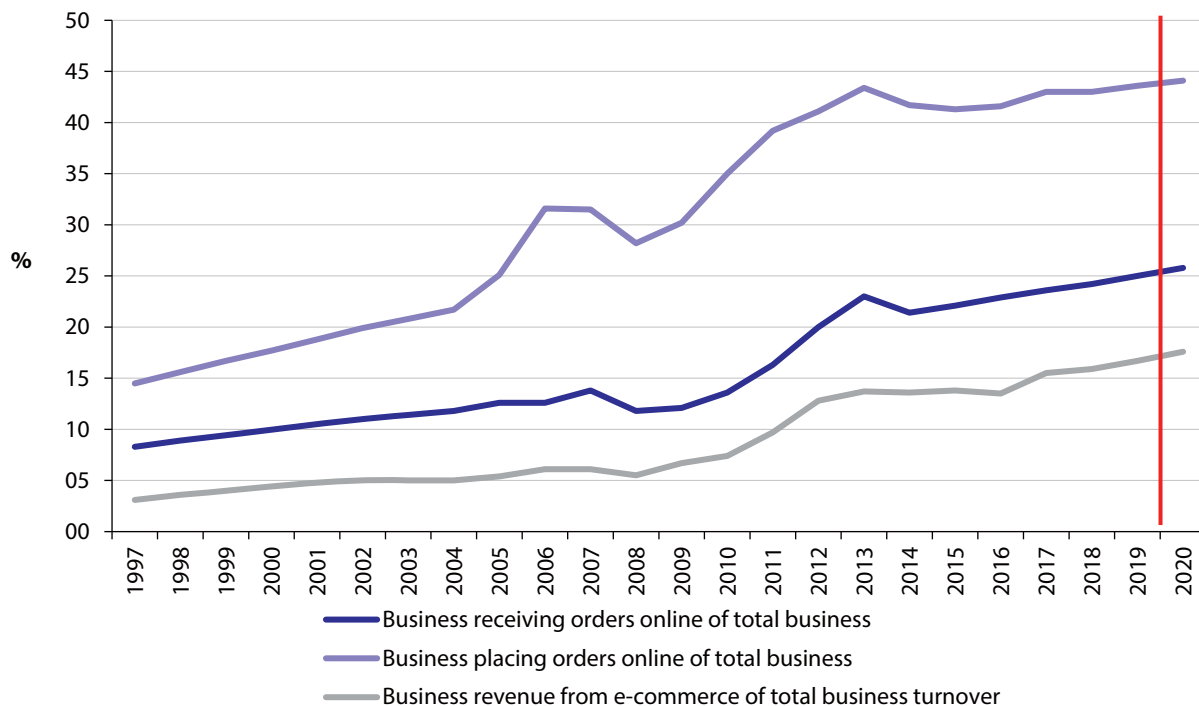
Fig. 1. *Russian E-commerce indicators (source: compiled by authors based on data from Euromonitor: E-Commerce (Goods): Euromonitor. Retrieved from: https://www.euromonitor.com/e-commerce-goods (Date of access: 09.02.2022))*
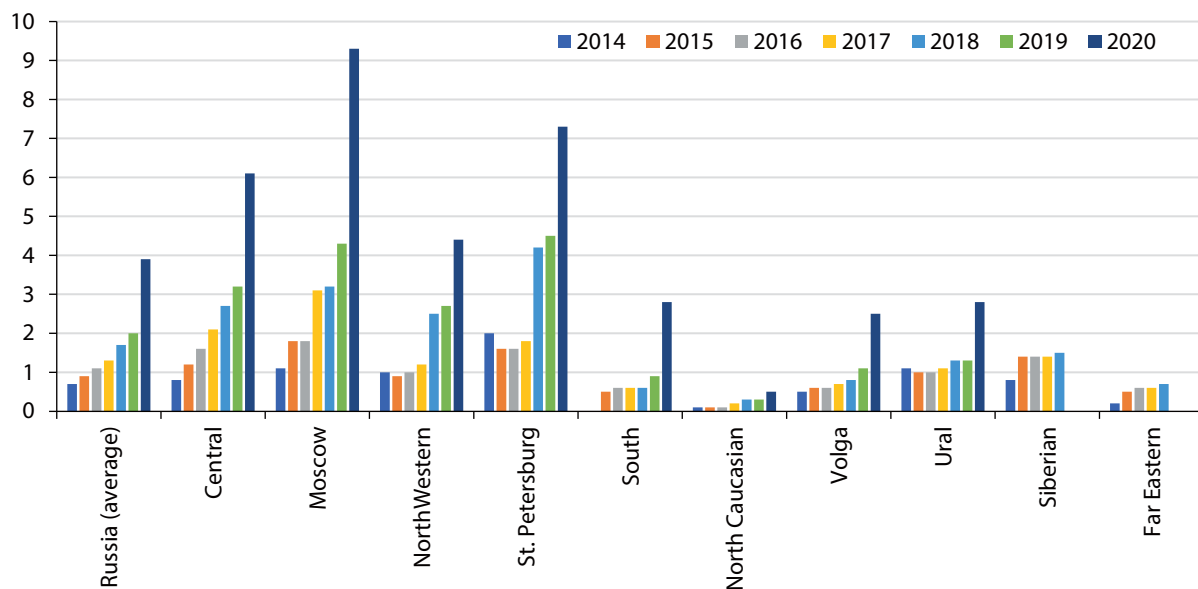
Fig. 2. *Share of online sales in retail sales in Russia, federal districts and major cities (*numbers for the Siberian and Far Eastern Federal Districts are not available for 2019 and 2020) (source: compiled by authors based on data from Rosstat: Russian regions. Socio-economic indicators 2020: Federal State Statistics Service (Rosstat). Retrieved from: https://gks.ru/bgd/regl/b20_14p/Main. htm (Date of access: 05.02.2022))*

relative terms, the share of online sales in retail in 2020 relative to 2019 is the highest in the Republic of Sakha (Yakutia) (increased from 0.1 % in 2019 to 2 % in 2020), the Republic of Kalmykia (from 0.1 to 0.8 %), Orenburg region and Kamchatka territory (from 0.3 to 1.7 %). These results might be interpreted as a preliminary evidence of the catch-up process in e-commerce among Russian

regions due to the effects of COVID-19 in a similar vine with the country-level catch-up.

To test two hypotheses that we stated in the introduction, we use two waves of data collected by the EBRD-EIB-WB Enterprise Survey[1] and combine

---

[1] EIB-EBRD-WB Enterprise Survey: European Bank for Reconstruction and Development (EBRD), European

Fig. 3. *Distribution of regions in the sample (source: compiled by authors based on data from EBRD-EIB-WB database, Rosstat: Russian regions. Socio-economic indicators 2020: Federal State Statistics Service (Rosstat). Retrieved from: https://gks.ru/bgd/regl/b20_14p/Main.htm (Date of access: 26.05.2022))*

the data collected during the sixth round in 2018–2019 with the data collected for the same firms in a short follow-up COVID-19 survey after April 2020. This approach allows us to know w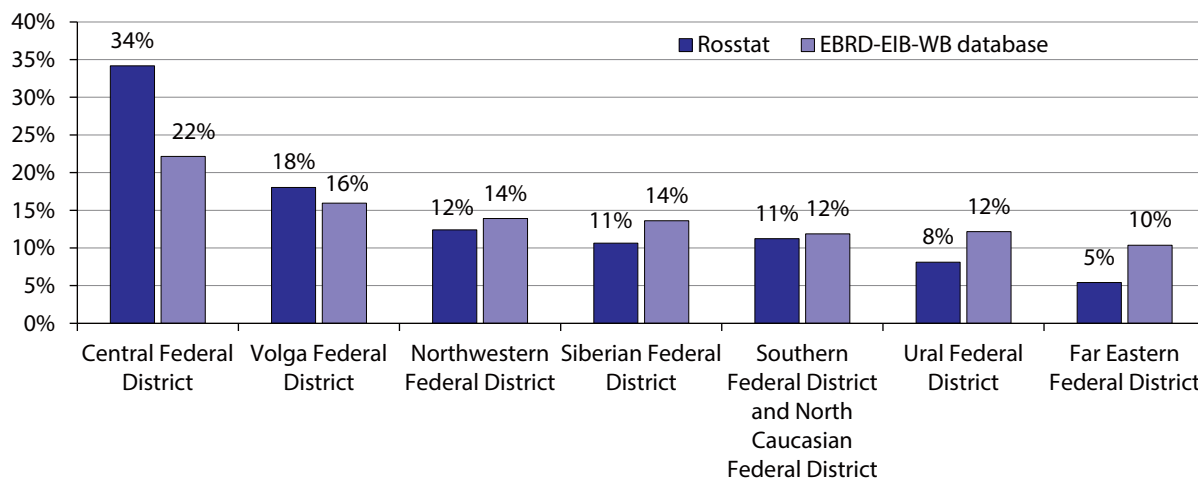hether a firm introduced or extended online sales during the COVID-19 pandemic relative to previous year and control for detailed pre-crisis information about firm's characteristics and financial indicators. Our final dataset includes 18558 firm observations, including 1016 observations in Russia.

Evidence on the role of the territory (federal district and city size) will provide us an understanding of the impact of the pandemic on the inequality of e-commerce usage in Russian regions, but this is not enough to have clear policy recommendations. It is important to discuss the factors of e-commerce adoption and expansion in Russia in a comparative perspective with other countries. We will discuss factors of e-commerce adoption and expansion in Russian firms in a comparison with a group of Central and Eastern European (CEE) and Central Asian (CA) countries, including: Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Latvia, Lithuania, Moldova, Mongolia, Montenegro, North Macedonia, Poland, Romania, Serbia, Slovak Republic, Slovenia. These countries have much in common with Russia, including common history and cultural links. Similar patterns of regional and sectoral economic development make these countries a good comparison group for Russia, which is widely used in many different studies. Particularly, the EBRD-EIB-WB Enterprise Survey considers all these countries to examine the progress that the

CEE and CA firms have made in the modern history and investigates the adaption and resilience of firms during the pandemic.

The dependent variable is a change in online sales in response to COVID-19 in comparison to 2019 measured as a binary response. The independent variables include indicators of the external environment — size of the city, GDP per capita and pre-COVID-19 level of e-commerce in the federal district where a firm operates. We recognise that variables at the regional rather than federal district level may ensure more accurate estimates, but unfortunately, such data are not available. We also include firm-level independent variables, particularly, market orientation of a firm, characteristics of its supply chains and production capabilities. In addition, we also explicitly control for size, age, foreign and government ownership and industry. Definitions of the variables and descriptive statistics are presented in Table 1.

According to Figure 3, which compares the distribution of the sample by federal districts with the Rosstat, our sample is slightly skewed, since the Central Federal District is underrepresented — it corresponds to 22 % of observations in our sample, but 34 % in the number of firms according to Rosstat. However, the sample used in the study is built according to the EBRD-EIB-WB Enterprise Survey methodology, which takes care about representativeness of the sample. In particular, to build the sample, the methodology uses three levels of stratification: industry, firm size, and region, where regional stratification is done across federal districts[1]. In order to make inferences about the

Investment Bank (EIB) and World Bank (WB). Retrieved from: https://www.enterprisesurveys.org/en/covid-19 (Date of access: 09.02.2022)

[1] Regional stratification considers seven territories: Central Federal District, South (combining Southern Federal District and North Caucasian Federal District), Northwestern Federal

Descriptive statistics of the variables

Variable	Description	Mean	Std. Dev.	Min	Max
Dependent variable					
Online sales	Dummy variable = 1 if there are positive or no changes, 0 if negative changes (Did this establishment experience change in online sales in response to the COVID-19 outbreak?)	0.274	0.446	0	1
Independent variables					
Market of operation					
Exporter	Coming back to fiscal year 2018, what percentage of this establishment's sales were: dummy = 1 if > 10 %, 0 — otherwise	0.212	0.409	0	1
Indirect exporter	Coming back to fiscal year 2018, what percentage of this establishment's sales were: (direct export) — dummy = 1 if >10, 0 — otherwise	0.091	0.288	0	1
Characteristics of supply chains:					
Demand	Comparing demand for the current month with the same month in 2019, did it increase, remain the same, or decrease? Dummy = 1 if increase or remain the same, 0 — otherwise	0.522	0.5	0	1
Supply	Comparing supply for the current month with the same month in 2019, did it increase, remain the same, or decrease? Dummy = 1 if increase or remain the same, 0 — otherwise	0.601	0.49	0	1
Direct_imp	In fiscal year 2018, what percentage of this establishment's purchases of material inputs or supplies were: Of foreign origin => dummy = 1 if > 10 %, 0 — otherwise	0.58	0.494	0	1
Production capabilities					
Certificates	Dummy = 1 if this establishment has an internationally recognised quality certification, 0 — otherwise	0.283	0.451	0	1
Foreign_tech	Dummy = 1 if this establishment at present uses technology licensed from a foreign-owned company, excluding office software, 0 — otherwise	0.157	0.363	0	1
Adjustment	During the last three years, has this establishment introduced new or improved products or services? Dummy = 1 if positive answer, 0 — otherwise	0.316	0.465	0	1
Control variables					
Foreign_owned	What percentage of this firm is owned by each of the following: Private foreign individuals, companies or organisations — dummy = 1 if > 10 %, 0 — otherwise	0.098	0.298	0	1
Government_owned	What percentage of this firm is owned by each of the following: Government or State — dummy = 1 if > 10 %, 0 — otherwise	0.008	0.09	0	1
Age	In what year did this establishment begin operations? Dummies = 1 if Age (< 10); Age (10-19); Age (20-29); Age (> 30)				
Size before COVID-19	At the end of fiscal year 2018, how many permanent, full-time individuals worked in this establishment? Dummies = 1 if micro (< 15); small (15-100); medium (101-250); huge (> 250)				
Industry	Dummies for Non-Metallic Mineral Products; Food; Garments; Other Manufacturing; Other Services; Retail; Rubber & Plastics Products; Textiles				
Regional variables only for Russia					
City size	Dummies = 1 if population of city: Less than 5,000, 50,000 to 250,000, over 250,000 to 1 million, over 1 million				
GDP per capita (log)	Logarithm of Gross Domestic Product per capita in federal district, 2019	13.769	0.757	12.901	15.385
E-commerce	Share of online sales in retail in 2019, %	1.579	0.835	0.6	2.7

Source: compiled by the authors.

Table 2

Comparison of sample averages

Variable	All countries	Russia	Central Federal District	Far Eastern Federal District	Northwestern Federal District	Siberian Federal District	Southern Federal District and North Caucasian Federal District	Ural Federal District	Volga Federal District
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
Online sales	0.27	0.54	0.42	0.56	0.48	0.59	0.50	0.83	0.49
Exporter	0.21	0.05	0.07	0.03	0.08	0.02	0.03	0.05	0.03
Indirect Exporter	0.09	0.12	0.04	0.15	0.31	0.09	0.03	0.13	0.13
Demand	0.52	0.32	0.33	0.35	0.28	0.25	0.33	0.34	0.40
Supply	0.60	0.36	0.43	0.40	0.33	0.33	0.29	0.23	0.43
Direct Importer	0.58	0.46	0.51	0.66	0.56	0.19	0.16	0.49	0.58
Certificates	0.28	0.08	0.10	0.02	0.11	0.03	0.08	0.16	0.04
Foreign technology	0.16	0.10	0.13	0.15	0.08	0.02	0.05	0.17	0.10
Adjustment	0.43	0.51	0.42	0.68	0.60	0.58	0.56	0.38	0.43
Foreign owned	0.10	0.04	0.09	0.03	0.04	0.01	0.03	0.01	0.04
Government owned	0.01	0.01	0.03	0.00	0.01	0.00	0.00	0.01	0.01

Source: Authors calculations, data from the EBRD-EIB-WB database.

population of firms, our estimation methodology will implement estimation with weights as a robustness check.

In order to compare indicators across different regions of Russia, we analyse the mean values for the whole sample of countries, for Russia and for regions separately (Table 2). First, we found that the share of firms adopted or expanded online sales during the pandemic is two times higher in Russia on average (54 %) than in our sample of CEE and CA countries (27 %). Moreover, the share of firms, which adopted or expanded online sales in all considered Russian federal districts, is also much higher than in the sample of CEE and CA countries, the highest is in the Ural Federal District (83 %) and the lowest in the Central Federal District (42 %). Second, we revealed that among firms in CEE and CA countries (in comparison to Russia), there is a significantly higher share of exporters, firms with international certificates, as well as firms that observed an increase or the same level of demand and supply comparing the month of the survey with the same month in 2019. Dispersion of the same indicators for different Russian regions is rather low, indicating that both more and less advanced federal districts as well as federal districts with different average geographical and institutional conditions lag far behind the averages for CEE and CA countries. Based on this, we suggest that these indicators (exporters, certificates, demand and supply) might to a large extent explain the introduction and expansion of online sales among companies in Russia and CEE and CA countries in our sample. This will be tested and discussed in the next section of the paper.

Descriptive statistics regarding the size of the cities shows that the share of firms increasing online sales in response to the pandemic is larger in cities with the population over 1 million and decreases with the city size. These findings are in line with recent evidence discussed above stating that firms in places with better infrastructure and higher incomes (which are usually large cities) are more keen on e-commerce adoption and expansion (Figure 4).

Equation (1) shows our model for estimating factors affecting online sales during the COVID-19 pandemic for Russian firms with regional variables, while equation (2) describes our model for the sample of firms in CEE and CA countries and particular subsample of only CEE countries. The latter allows us to have a comparative analysis of the specifics of e-commerce adoption in Russia and CEE and CA countries.

$$RUOnlineSales = \beta_1 Exporter +$$
$$+\beta_2 Indirect_{exporter} + \beta_3 Demand +$$
$$+\beta_4 Supply + \beta_5 Direct_{importer} +$$
$$+\beta_6 Certificates + \beta_7 Foreign_{tech} +$$
$$+\beta_8 Adjustment_{past} + \gamma + \delta + \varepsilon, \qquad (1)$$

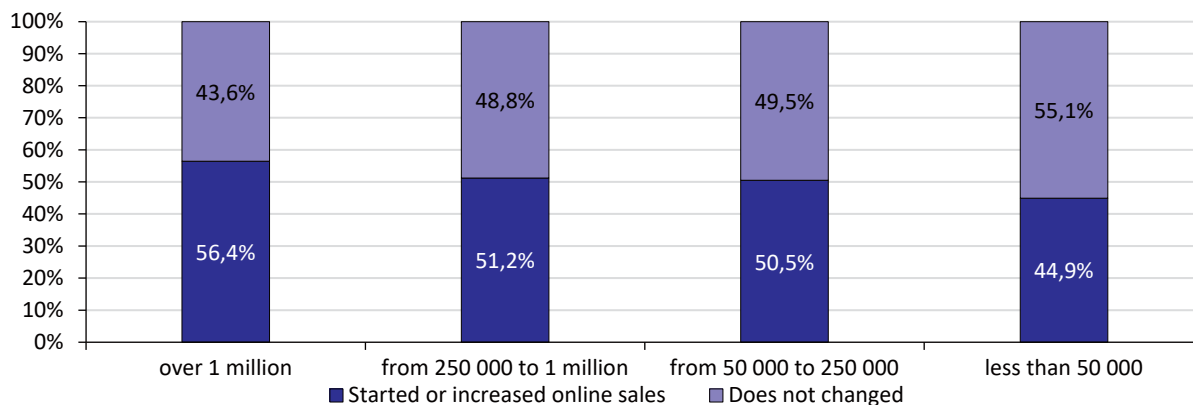District, Far Eastern Federal District, Siberian Federal District, Ural Federal District and Volga Federal District.

Fig. 4. *Adoption and expansion of online sales with regard to the city size in Russia in response to the COVID-19 outbreak*

$$OnlineSales = \beta_1 Exporter +$$
$$+ \beta_2 Indirect_{exporter} + \beta_3 Demand +$$
$$+ \beta_4 Supply + \beta_5 Direct_{importer} +$$
$$+ \beta_6 Certificates + \beta_7 Foreign_{tech} +$$
$$+ \beta_8 Adjustment_{past} + \gamma + \varepsilon, \qquad (2)$$

where γ — set of control variables, δ — set of regional variables for Russia.

Following Baer and Brown (2007), Salwani et al. (2009), Li et al. (2021), we use the probit model to estimate the probability for a firm to adopt or expand e-commerce during the COVID-19 pandemic. To have a clear interpretation of the results, we report marginal effects at the sample mean of all other variables instead of standard coefficients.

As a robustness check, we will use the weighted probit estimation that reports estimates of model parameters identical to conventional probit estimates, but uses information from the survey design (provided by the EBRD-EIB-WB database) to correct variance estimates. In order to save space, we discuss the results of robustness check, but do not provide parameter estimates.

Before empirical estimation, we check for the multicollinearity in the models using the variance inflation factors (VIFs) statistics. All models show VIF values less than 5, which is considered an appropriate result and suggests that there is no multicollinearity in models. Particularly for specification (1) with regional dummies, the VIF statistic equals 1.24, indicating that there is no multicollinearity between the variables.

4. Estimation Results

Empirical results of the analysis of factors of e-commerce adoption and expansion as the effect of COVID-19 are reported in Table 2. Model specifications (1)–(3) show estimation results for Russia with different regional variables, specifications (4) — (6) show results for Russia, CEE and CA countries. The overall percentage of correctly classified cases is 66.9–69.9 % for the specifications (1)–(3) with Russian firms and spatial factors and 74.4–75.6 % for the samples of CEE and CA countries, which shows the very good classificatory power of the models.

First, we discuss the role of regional-level indicators as determinants of e-commerce adoption and extension in Russian regions and then analyse firm-level determinants of e-commerce in Russia in a comparative international perspective.

The obtained results allow us to confirm hypotheses 1 and 2. According to Table 3, firms in federal districts with higher share of online sales have smaller chances to adopt or expand online sales. At first sight, this supports previous findings at the country level on catching-up process in e-commerce. However, it is important to note that, overall, e-commerce in Russia is lagging behind developed countries, thus, finding of catch-up in e-commerce at the regional level in Russia can be alarming and requires further discovery. In addition, we found that if a firm is located in the city with a population over 1 million, it adopts or expands online sales by 12.3–12.4 % as a result of the COVID-19 crisis keeping other things constant. This finding supports existing evidence suggesting that e-commerce is usually emerging and spreading primarily in large cities. We suggest that only firms in regions with a low level of e-commerce see opportunities and go online, while firms in regions where some companies have already gone online see high risks of expanding e-commerce. We discuss these results in terms of implications for federal and regional policy in the conclusion section.

Comparative analysis of firm-level determinants of e-commerce adoption and expansion shows that Russian firms are different from the findings based on total sample of firms in CEE and CA countries and subsample of firms in CEE countries. Regarding market orientation, we find that exporters and indirect exporters were less likely to

Effects of COVID-19 on e-commerce adoption and expansion

VARIABLES	(1) Russia with regional dummies	(2) Russia with GDP and E-commerce	(3) Russia with E-commerce	(4) Russia	(5) CEE and CA countries	(6) CEE countries
Exporter	0.0258	0.0540	0.0543	0.0361	−0.0481***	−0.0441***
	(0.0758)	(0.0781)	(0.0782)	(0.0806)	(0.00880)	(0.00880)
Indirect Exporter	0.0859*	0.0685	0.0689	0.0705	−0.0166	−0.0318***
	(0.0491)	(0.0474)	(0.0475)	(0.0480)	(0.0112)	(0.0117)
Demand	−0.00589	0.0242	0.0239	0.0327	0.0211**	0.0239***
	(0.0430)	(0.0440)	(0.0441)	(0.0443)	(0.00868)	(0.00898)
Supply	−0.192***	−0.231***	−0.227***	−0.242***	−0.0463***	−0.0267***
	(0.0415)	(0.0425)	(0.0426)	(0.0426)	(0.00879)	(0.00917)
Direct Importer	0.0518*	0.0377	0.0451	0.0415	0.0364***	0.0417***
	(0.0315)	(0.0315)	(0.0312)	(0.0308)	(0.00666)	(0.00693)
Certificates	0.00278	0.00652	0.00217	−0.00473	−0.0625***	−0.0567***
	(0.0605)	(0.0616)	(0.0616)	(0.0629)	(0.00786)	(0.00796)
Foreign technology	−0.0575	−0.0431	−0.0433	−0.0466	0.0268***	0.0276***
	(0.0532)	(0.0534)	(0.0533)	(0.0544)	(0.00897)	(0.00905)
Adjustment	0.251***	0.229***	0.225***	0.233***	0.0823***	0.0945***
	(0.0257)	(0.0267)	(0.0266)	(0.0265)	(0.00669)	(0.00674)
Foreign owned	−0.0448	−0.0782	−0.0778	−0.124	−0.0149	−0.00741
	(0.0789)	(0.0826)	(0.0830)	(0.0814)	(0.0117)	(0.0116)
Government owned	−0.362*	−0.407*	−0.398*	−0.472**	−0.0893**	−0.0760**
	(0.208)	(0.218)	(0.218)	(0.213)	(0.0350)	(0.0350)
Age (<10)	base	base	base	base	base	base
Age (10-19)	0.0302	0.0180	0.0191	0.0135	−0.0422***	−0.0421***
	(0.0345)	(0.0360)	(0.0360)	(0.0365)	(0.00963)	(0.0104)
Age (20-29)	−0.0296	−0.0742*	−0.0748*	−0.0762*	−0.0572***	−0.0428***
	(0.0444)	(0.0450)	(0.0450)	(0.0456)	(0.00961)	(0.0102)
Age (>30)	−0.0369	−0.0848	−0.0740	−0.0662	−0.0683***	−0.0502***
	(0.0929)	(0.0958)	(0.0955)	(0.0928)	(0.0120)	(0.0124)
Size: micro (<15)	base	base	base	base	base	base
Size: small (15-100)	−0.0278	−0.0115	−0.0120	−0.00890	0.0473***	0.0394***
	(0.0347)	(0.0365)	(0.0364)	(0.0366)	(0.00718)	(0.00743)
Size: medium (101-250)	−0.0731	−0.0441	−0.0423	−0.0429	0.0928***	0.0862***
	(0.0470)	(0.0485)	(0.0486)	(0.0487)	(0.0105)	(0.0109)
Size: large (>250)	−0.0965	−0.0678	−0.0626	−0.0539	0.109***	0.0897***
	(0.0624)	(0.0627)	(0.0628)	(0.0629)	(0.0146)	(0.0154)
Size of city: less than 50,000	base	base	base			
Size of city: 50,000 to 250,000	0.0566	0.0618	0.0571			
	(0.0706)	(0.0735)	(0.0740)			
Size of city: over 250,000 to 1 million	0.0447	0.0459	0.0381			
	(0.0637)	(0.0651)	(0.0657)			
Size of city: over 1 million	0.0544	0.124**	0.123**			
	(0.0613)	(0.0620)	(0.0626)			
GDP per capita (log)		0.00438				
		(0.0215)				
E-commerce		−0.0566***	−0.0645***			
		(0.0186)	(0.0196)			
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Regional dummies	Yes	No	No	No	No	No

The end of the Table 3 is on the next page.

The end of the Table 3

VARIABLES	(1) Russia with regional dummies	(2) Russia with GDP and E-commerce	(3) Russia with E-commerce	(4) Russia	(5) CEE and CA countries	(6) CEE countries
Pseudo R^2	0.17	0.12	0.12	0.11	0.03	0.03
Observations	1 016	1 016	1 016	1 016	19 327	17 542
Correctly classified, %	69.88 %	66.93 %	66.93 %	64.67 %	74.37 %	75.59 %
+Marginal effects are reported						
++Robust standard errors in parentheses						
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$						

Source: calculated by the authors based on data from the EBRD-EIB-WB database (EIB-EBRD-WB Enterprise Survey: European Bank for Reconstruction and Development (EBRD), European Investment Bank (EIB) and World Bank (WB). Retrieved from: https://www.enterprisesurveys.org/en/covid-19 (Date of access: 09.02.2022)).

launch or expand online sales: being an exporter decreases the probability to adopt or expand online sales for 4.4–4.8 % for the whole sample and firms in developed countries, but not for Russia. During the first waves of COVID-19, exporters suffered from border closures that sharply declined exports. This might significantly affect e-commerce adoption for exporters in developed countries, which is also mentioned by Hasanat et al. (2019). Insignificance of export status for e-commerce adoption in Russia might be explained by lower orientation of Russian firms on exports and, particularly, sharper expansion of domestic online sales in comparison to stagnant cross-border online sales after the beginning of the COVID-19 pandemic in Russia (Statista, 2021b).

Regarding characteristics of supply chains, we find that increasing supply is statistically significant in all specifications, including those on Russian data, but increasing demand is statistically significant only for CEE and CA. In particular, firms with increasing supply were less likely to adopt or extend online sales by 4.6 % in the world on average and by 19.2–24.2 % in Russia depending on the specification. Simultaneously, increasing demand pushed firms to adopt or extend online sales in the full sample and subsample of developed countries, respectively, but not in Russia. At first sight, findings on effects of supply and demand might be controversial. However, in our opinion, there is a clear explanation. Increasing supply might be seen as a signal that firms were restoring reserves of materials and other supplies and preparing for further (second, third depending on the timing of the interview in considered countries) waves of the pandemic. Thus, increasing supply did not determine changes in demand for firms' products and services and became statistically insignificant for e-commerce. Increasing demand, in turn, pushes firms to adopt or expand e-commerce, especially

under the strict measures implemented during the COVID-19 pandemic. Some comments are needed to explain the insignificance of the demand effect on e-commerce adoption in Russia. We hypothesise that Russian firms introduced e-commerce not only in the case of increasing demand for its products, but also as a measure to support weak demand or an attempt to find new consumers when traditional (offline) channels of sales were not working or unavailable due to the COVID-19 restrictions.

We revealed that production capabilities have divergent effects on firms' adoption and expansion of online sales. According to the empirical results, firms, which introduced new or improved products or services in the past, were more likely to adopt or expand e-commerce; the effect varies between 8.2–9.5 % for the sample of CEE and CA countries and increases up to 22.5–25.1 % for Russia. This might be considered as an evidence of catch-up in e-commerce and confirm the findings suggesting that firms with better adaptation skills are more resilient during crises (Simachev et al., 2021). Firms with foreign technologies have higher chances to adopt or expand online sales in the total sample and subsample of developed countries, respectively, but are insignificant for Russia. Firms with international certifications were less likely to launch or expand online sales by 5.7–6.3 % in the total sample and subsample of developed countries, respectively. Effects of certificates are insignificant for Russia. We suppose that firms with certificates were more resilient in the crisis and adopted online sales before COVID-19.

Among other firm-level factors of online sales adoption, we find that government ownership negatively affects the probability to adopt or expand e-commerce in Russia and other countries in all specifications. We believe this is because companies with government ownership introduce new technologies, including e-commerce, not because

of market shocks, but as directed by the state. In addition, the introduction of new technologies in government-owned companies might require more time. Finally, our results suggest that young firms (in Russia and CEE and CA countries) and large firms (in CEE and CA countries, but not Russia) are more likely to launch or expand e-commerce. These results might be seen controversial, but they are supported by empirical literature on the diffusion of digital technologies (Andrews, Nicoletti, Timiliotis, 2018; Veugelers, Rückert, Weiss, 2019). Indeed, young firms are usually seen as firms with flexible management and fast organisational changes, while large firms usually have more financial resources to afford the adoption of e-commerce.

To check the robustness of the results, we use weighted probit estimation to correct the sample and thus to get a reflection of the distribution of firms across the regions. According to the results, all parameters keep the statistical significance and have similar size that confirms the robustness of the findings.

5. Conclusions and Policy Implications

During the COVID-19 crisis, e-commerce surged in most of the countries. However, the effects of e-commerce adoption and expansion were not equal both between and within economies. Our study examines the effects of the COVID-19 pandemic on firm-level e-commerce adoption and expansion in Russian regions in a comparative perspective with CEE and CA countries. Specifically, using the data from two waves of the EBRD-EIB-WB Enterprise survey, we empirically estimated the role of three subnational indicators, including regional level of e-commerce, size of the city and GRP per capita and a set of firm-level indicators, including market orientation, supply chain characteristics, production capabilities, size, age and ownership. Our findings contribute to the literature by providing empirical evidence on the digitalisation factors of Russian firms using the case of e-commerce technology and by discussing the role of subnational factors in adoption and expansion of e-commerce and its policy implications for federal and regional authorities and development institutions.

We revealed that e-commerce is growing faster in firms working in cities with a population over 1 million, but there is a convergence in online sales: the share of online sales is growing more in regions where online sales were lower before the COVID-19 pandemic. Taking into account the fact that the level of online sales in Russia is still significantly lower than that of developed countries,

the signs of convergence should be alarming. Less rapid growth of e-commerce adoption in the leading regions may determine a general slowdown in the digitalisation pace in e-commerce in Russia, which will hinder the development of consumer demand and the provision of related services to consumers. The results of the estimation of e-commerce determinants at the firm level allow us to clarify the meso-level evidence. We found that Russia differs significantly from CEE and CA countries in terms of determinants of e-commerce adoption and expansion. As in other countries, young companies and companies with experience of product and services innovations are more likely to adopt e-commerce in Russia, while companies with state ownership, on the contrary, are less likely. However, we showed that other factors determining e-commerce in CEE and CA are insignificant for Russian firms. In particular, we found that export market orientation and supply chain signals (increase in demand and import) do not foster e-commerce adoption in Russia during the COVID-19 pandemic. In addition, there is no statistical differences in e-commerce adoption for small and large Russian firms; possession of an international certificate does not affect e-commerce. Both results contradict evidence for CEE and CA countries and findings of previous empirical studies. This might signal about poor domestic value chains in the Russian economy and slight integration of national firms into the global value chains.

Based on our empirical findings, we discuss policy implications oriented towards fostering e-commerce in Russian regions and catching up with the developed countries.

The evidence of convergence in e-commerce at low overall level of e-commerce might significantly hinder long-term prospects of e-commerce in Russia. Our results present an additional concern, namely, that e-commerce is accelerating in large cities (over 1 million), but all other cities demonstrate no differences in the speed of the e-commerce adoption. This means that the growth rate of e-commerce in medium-sized cities does not differ from the growth rate in small cities (towns). As medium-sized cities are often administrative centres of Russian regions and small cities usually have poorer infrastructure, this means that e-commerce growth rates in Russia are probably not as high as might be. The latter certainly depends on the level of infrastructure, dynamics of income levels and public policy at the federal and regional levels that might affect e-commerce acceleration in the post-pandemic period in the following directions.

From the perspective of industrial policy, support and development programmes for firms both at the federal and regional level should focus on comprehensive solutions and help firms implement modern technologies, including e-commerce. This is especially important for mature firms that are less likely to introduce organisational innovations and expand e-commerce, as well as for small firms that usually tend to lack the resources for innovations. There is a need to encourage firm cooperation and promote best practices, especially in the diffusion of low-cost technologies such as e-commerce that can have a significant impact on business operations.

From the perspective of digital development policy, it is important to find the balance between opening national market for international e-commerce platforms and the development of domestic platforms. The first requires the regulation towards reasonable restrictions on market power of foreign platform companies in Russia and simultaneous liberalisation of cross-border e-commerce. The latter should be oriented towards support of creation of new e-commerce solutions, spread of e-commerce in new domestic segments and attraction of new firms to enter them. It is also important to decrease regulatory and financial barriers for firms to enter e-commerce, particularly, decrease costs of acquiring. We suppose that only a combination of industrial policy and digital development policy might ensure further sustainable and geographically dispersed development of e-commerce in the post-pandemic period.

References

Alcedo, J., Cavallo, A., Dwyer, B., Mishra, P. & Spilimbergo, A. (2022). *E-commerce During Covid: Stylized Facts from 47 Economies* (No. w29729). National Bureau of Economic Research. DOI: 10.3386/w29729.

Alfonso, V., Boar, C., Frost, J., Gambacorta, L. & Liu, J. (2021). E-commerce in the pandemic and beyond. *BIS Bulletin, 36(9),* 1-9.

Amankwah-Amoah, J., Khan, Z., Wood, G. & Knight, G. (2021). COVID-19 and digitalization: The great acceleration. *Journal of Business Research, 136,* 602-611. DOI: 10.1016/j.jbusres.2021.08.011.

Andrews, D., Nicoletti, G. & Timiliotis, C. (2018). *Going digital: What determines technology diffusion among firms?* Background Paper 2018 Global Forum on Productivity, 74.

Baer, A. G. & Brown, C. (2007). Adoption of e-marketing by direct-market farms in the Northeastern United States. *Journal of Food Distribution Research, 38(2),* 1-11. DOI: 10.22004/ag.econ.43492.

Becker, J., Weekx, S., Beutels, P. & Verhetsel, A. (2021). COVID-19 and retail: The catalyst for e-commerce in Belgium? *Journal of Retailing and Consumer Services, 62,* 102645. DOI: 10.1016/j.jretconser.2021.102645.

Bhatti, A., Akram, H., Basit, H. M., Khan, A. U., Raza, S. M. & Naqvi, M. B. (2020). E-commerce trends during COVID-19 Pandemic. *International Journal of Future Generation Communication and Networking, 13(2),* 1449-1452. DOI: 10.1016/j.chb.2016.09.026.

Borkova, E. A. & Noskova, P. O. (2019). Modern development of the electronic trade market in the macroeconomic conditions of Russia. *Rossiyskoe predprinimatelstvo [Russian journal of entrepreneurship], 20(4),* 917-926. DOI: 10.18334/rp.20.4.40598 (In Russ.)

Choshin, M. & Ghaffari, A. (2017). An investigation of the impact of effective factors on the success of e-commerce in small-and medium-sized companies. *Computers in Human Behavior, 66,* 67-74. DOI: 10.1016/j.chb.2016.09.026.

Cirera, X., Comin, D., Cruz, M., Lee, K. M. & Soares Martins-Neto, A. (2021). *Firm-level technology adoption in Vietnam.* Policy Research Working Paper; No. 9567. World Bank, Washington, DC, 58.

Dinesh, S. & MuniRaju, Y. (2021). Scalability of e-commerce in the COVID-19 era. *International Journal of Research-GRANTHAALAYAH, 9(1),* 123-128. DOI: 10.29121/granthaalayah.v9.i1.2021.3032.

Han, B. R., Sun, T., Chu, L. Y. & Wu, L. (2022). COVID-19 and E-commerce Operations: Evidence from Alibaba. *Manufacturing & Service Operations Management, 24(3),* 1388-1405. DOI: 10.1287/msom.2021.107.

Hasanat, M. W., Hoque, A., Shikha, F. A., Anwar, M., Hamid, A. B. A. & Tat, H. H. (2020). The impact of coronavirus (COVID-19) on e-business in Malaysia. *Asian Journal of Multidisciplinary Studies, 3(1),* 85-90.

Hooks, D., Davis, Z., Agrawal, V. & Li, Z. (2022). Exploring factors influencing technology adoption rate at the macro level: A predictive model. *Technology in Society, 68,* 101826. DOI: 10.1016/j.techsoc.2021.101826

Kareen, P., Purwandari, B., Wilarso, I. & Pratama, M. O. (2018, August). E-commerce adoption in SME: A systematic review. In: *2018 6th International conference on cyber and IT service management (CITSM)* (pp. 1-7). IEEE. DOI: 10.1109/CITSM.2018.8674285

Kawasaki, T., Wakashima, H. & Shibasaki, R. (2022). The use of e-commerce and the COVID-19 outbreak: A panel data analysis in Japan. *Transport Policy, 115,* 88-100. DOI: 10.1016/j.tranpol.2021.10.023.

Koch, J., Frommeyer, B. & Schewe, G. (2020). Online Shopping Motives during the COVID-19 Pandemic — Lessons from the Crisis. *Sustainability, 12,* 10247. DOI: 10.3390/su122410247.

Kurnia, S., Choudrie, J., Mahbubur, R. M. & Alzougool, B. (2015). E-commerce technology adoption: A Malaysian grocery SME retail sector study. *Journal of Business Research, 68(9),* 1906-1918. DOI: 10.1016/j.jbusres.2014.12.010.

Kuzyk, M. G., Simachev, Yu. V. & Fedyunina, A. A. (2020). Adaptation of Russian industrial companies to the challenges of digital transformation. In: *A. L. Kudrin, A. D. Radygin, S. G. Sinelnikov-Murylev (Eds.), Rossiyskaya ekonomika v 2019 gody: trendy i perspektivy. Vyp. 41 [Russian Economy in 2019. Trends and Prospects. Vol. 41]* (pp. 499-513). Moscow: Publishing house of Gaidar Institute. (In Russ.).

Li, X., Sarkar, A., Xia, X. & Memon, W. H. (2021). Village Environment, Capital Endowment, and Farmers' Participation in E-Commerce Sales Behavior: A Demand Observable Bivariate Probit Model Approach. *Agriculture, 11(9),* 868. DOI: 10.3390/agriculture11090868

Llopis-Albert, C., Rubio, F. & Valero, F. (2021). Impact of digital transformation on the automotive industry. *Technological forecasting and social change, 162,* 120343. DOI: 10.1016/j.techfore.2020.120343.

Lodni, C., Najmaei, M. & Mansori, S. (2021). The Effect of COVID-19 Pandemic on the German E-Grocery Industry with Respect to Challenges for Retailers and Customer Satisfaction. *Journal of Marketing Management and Consumer Behavior, 3(3),* 1-31.

Maslova, J. N. (2020). Major trends in the development and transformation of cross-border electronic commerce during the covid-19 pandemic. *Uchenye zapiski Sankt-Peterburgskogo imeni V. B. Bobkova filiala Rossiyskoy tamozhennoy akademii [Scientific letters of Russian customs academy St.-Petersburg branch named after Vladimir Bobkov], 2(74),* 66-70. (In Russ.)

OECD. (2020). *Connecting businesses and consumers during COVID-19: trade in parcels. OECD Policy Responses to Coronavirus (COVID-19).* Ramdani, B., Chevers, D. & Williams, D. A. (2013). SMEs' adoption of enterprise applications: A technology-organisation-environment model. Journal of Small Business and Enterprise Development, 20(4), 735-753. DOI: 10.1108/JSBED-12-2011-0035

Rasiah, R. (2003). Foreign ownership, technology and electronics exports from Malaysia and Thailand. *Journal of Asian economics, 14(5),* 785-811. DOI: 10.1016/j.asieco.2003.10.006.

Revinova, S. Yu. & Ivashchenko, E. A. (2021). E-commerce in China amid COVID-19 pandemic restrictions. *RUDN Journal of Economics, 29(4),* 699–715. DOI: 10.22363/2313-2329-2021-29-4-699-715.

Salwani, M. I., Marthandan, G., Norzaidi, M. D. & Chong, S. C. (2009). E-commerce usage and business performance in the Malaysian tourism sector: empirical analysis. *Information management & computer security, 17(2),* 166-185. DOI: 10.1108/09685220910964027.

Sanguinet, E. R., Alvim, A. M., Atienza, M. & Fochezatto, A. (2021). The subnational supply chain and the COVID-19 pandemic: Short-term impacts on the Brazilian regional economy. *Regional Science Policy & Practice, 13,* 158-186. DOI: 10.1111/rsp3.12442.

Scutariu, A. L., Şuşu, Ş., Huidumac-Petrescu, C. E. & Gogonea, R. M. (2021). A Cluster Analysis Concerning the Behavior of Enterprises with E-Commerce Activity in the Context of the COVID-19 Pandemic. *Journal of Theoretical and Applied Electronic Commerce Research, 17(1),* 47-68. DOI: 10.3390/jtaer17010003.

Simachev, Yu. V., Fedyunina, A. A., Ershova, N. V. & Misikhina, S.G. (2021). Russian retail before, during and after the COVID-19 Crisis. *EKO [ECO], 5,* 29–52. DOI: 10.30680/0131-7652-2021-5-29-52. (In Russ.)

Statista. (2021a). *E-commerce worldwide. Key Figures of E-Commerce.*

Statista. (2021b). *E-commerce in Russia. Key Figures of E-Commerce.*

Stiakakis, E., Kariotellis, P. & Vlachopoulou, M. (2009). From the digital divide to digital inequality: A secondary research in the European Union. In: *International Conference on e-Democracy* (pp. 43-54). Springer, Berlin, Heidelberg. DOI: 10.1007/978-3-642-11631-5_4.

Taher, G. (2021). E-Commerce: advantages and limitations. *International Journal of Academic Research in Accounting Finance and Management Sciences, 11(1),* 153-165.

Veugelers, R., Rückert, D. & Weiss, C. (2019). *Bridging the Divide: New evidence about firms and digitalization* (No. 2019/17). Bruegel Policy Contribution.

Villa, R. & Monzón, A. (2021). Mobility restrictions and e-commerce: Holistic balance in madrid centre during COVID-19 lockdown. *Economies, 9(2),* 57. DOI: 10.3390/economies9020057.

Vishwasrao, S. & Bosshardt, W. (2001). Foreign ownership and technology adoption: evidence from Indian firms. *Journal of development economics, 65(2),* 367-387. DOI: 10.1016/S0304-3878(01)00141-9.

Wang, J. & Wang, X. (2015). Benefits of foreign ownership: Evidence from foreign direct investment in China. *Journal of International Economics, 97(2),* 325-338. DOI: 10.1016/j.jinteco.2015.07.006.

Yeng, S. K., Osman, A. & Othman, Y. H. (2015). E-commerce adoption among small and medium enterprises (SMEs) in Northern State of Malaysia. *Mediterranean Journal of Social Sciences, 6(5),* 37-43. DOI: 10.5901/mjss.2015.v6n5p37.

Zemtsov, S., Barinova, V. & Semenova, R. (2019). The risks of digitalization and the adaptation of regional labor markets in Russia. *Foresight and STI Governance, 13(2),* 84-96. DOI: 10.17323/2500-2597.2019.2.84.96.

Zhao, K., Shi, H., Zhang, Y. Y. & Sheng, J. (2021). Fresh produce E-Commerce and online shoppers' purchase intention. *The Chinese Economy, 54(6),* 415-429. DOI: 10.1080/10971475.2021.1890359.

About the Authors

Anna A. Fedyunina — Cand. Sci. (Econ.), Vice-Director of the Centre for Industrial Policy Studies, HSE University; Scopus Author ID: 56062931900; http://orcid.org/0000-0002-2405-8106 (11, Pokrovsky Boulevard, Moscow, 109028, Russian Federation, e-mail: afedyunina@hse.ru).

Nikolay A. Gorodnyi — Junior Research Fellow, Centre for Industrial Policy Studies, HSE University; Scopus Author ID: 57284590100; http://orcid.org/0000-0003-2580-0760 (11, Pokrovsky Boulevard, Moscow, 109028, Russian Federation, e-mail: na.gorodnyi@hse.ru).

Yuri V. Simachev — Cand. Sci. (Eng.), Director of the Centre for Industrial Policy Studies, HSE University; Scopus Author ID: 36126955200; http://orcid.org/0000-0003-3015-3668 (11, Pokrovsky Boulevard, Moscow, 109028, Russian Federation, e-mail: yusimachev@hse.ru).

Igor M. Drapkin — Dr. Sci. (Econ.), Professor, Department of International Economics and Management, Ural Federal University; Scopus Author ID: 57191611854; http://orcid.org/0000-0002-5989-8463 (19, Mira St., Ekaterinburg, 620002, Russian Federation, e-mail: i.m.drapkin@mail.ru).

Информация об авторах

Федюнина Анна Андреевна — кандидат экономических наук, заместитель директора Центра исследований структурной политики, Национальный исследовательский университет «Высшая школа экономики»; Scopus Author ID: 56062931900; https://orcid.org/0000-0002-2405-8106 (Российская Федерация, 109028, г. Москва, Покровский бульвар, д. 11; e-mail: afedyunina@hse.ru)

Городный Николай Антонович — младший научный сотрудник Центра исследований структурной политики, Национальный исследовательский университет «Высшая школа экономики»; Scopus Author ID: 57284590100; http://orcid.org/0000-0003-2580-0760 (Российская Федерация, 109028, г. Москва, Покровский бульвар, д. 11; e-mail: na.gorodnyi@hse.ru)

Симачёв Юрий Вячеславович — кандидат технических наук, Директор Центра исследований структурной политики, Национальный исследовательский университет «Высшая школа экономики»; Scopus Author ID: 36126955200; http://orcid.org/0000-0003-3015-3668 (Российская Федерация, г. Москва, 109028, Покровский бульвар, д. 11; e-mail: yusimachev@hse.ru)

Драпкин Игорь Михайлович — доктор экономических наук, профессор, Уральский федеральный университет имени первого Президента России Б. Н. Ельцина; Scopus Author ID: 57191611854; http://orcid.org/0000-0002-5989-8463 (Российская Федерация, 620002, г. Екатеринбург, ул. Мира 19; e-mail: i.m.drapkin@mail.ru).