



NATIONAL RESEARCH UNIVERSITY
HIGHER SCHOOL OF ECONOMICS

*Inna S. Lola, Murat Bakeev,
Anton Manukov*

**THE DETERMINANTS OF THE
DIVIDE IN THE REGIONAL SPREAD
IN THE USE OF ONLINE CHANNELS
FOR CONSUMER RETAIL
PURCHASES**

BASIC RESEARCH PROGRAM

WORKING PAPERS

SERIES: SCIENCE, TECHNOLOGY AND INNOVATION

WP BRP 119/STI/2021

Inna S. Lola¹, Murat Bakeev², Anton Manukov³

THE DETERMINANTS OF THE DIVIDE IN THE REGIONAL SPREAD IN THE USE OF ONLINE CHANNELS FOR CONSUMER RETAIL PURCHASES³

The paper discusses interregional differentiation in the distribution of electronic purchases among the population in Russia. The aim of the work is to find out what factors are primarily responsible for interregional gaps in the level of online channel use in consumer retail purchases. The study focuses on regional drivers and barriers for the spread of e-commerce. The results show that shares of users of stationary computers (desktops), users of smartphones, and gross regional product per capita are the main positive factors, and lack of trust in e-commerce channels is the main obstacle, while Internet access, age structure, educational level, urbanization, aggregated regional preferences for personal purchases and physical availability of retail trade outlets were found to be irrelevant.

Keywords: e-commerce, digital divide, trust, income, Russia.

JEL: O33, L81, O52.

¹ National Research University Higher School of Economics, Russian Federation. Institute for Statistical Studies and Economics of Knowledge, Centre for Business Tendency Studies. Deputy Director.: ilola@hse.ru

² National Research University Higher School of Economics, Russian Federation. Institute for Statistical Studies and Economics of Knowledge, Centre for Business Tendency Studies. Analyst.: mbakeev@hse.ru

³ National Research University Higher School of Economics, Russian Federation. Institute for Statistical Studies and Economics of Knowledge, Centre for Business Tendency Studies. Leading Analyst.: amanukov@hse.ru

⁴ The article was prepared within the framework of the Basic Research Program at the National Research University Higher School of Economics (HSE).

Introduction

The COVID-19 crisis in 2020 has highlighted the importance of e-commerce to the global economy. The introduction of social distancing, quarantine and other restrictive measures in response to the pandemic led to a fundamental shift in the structure of global demand for online purchases of goods, as well as to an increase in the use of digital communication tools and remote consumption. There is a various evidence, which shows that the coronavirus crisis turned out to be an additional driver of e-commerce growth (OECD, 2020; Statista, 2020; BIS, 2020).

Moreover, this crisis has showed the relevance of e-commerce research from a variety of perspectives - not only in terms of measurement of the scale of the phenomenon, but also in terms of the various factors that determine it. The work on post-pandemic e-commerce adoption data is expected to shed more light on this issue by analyzing the impact of an exogenous pandemic shock in 2020. Our research is based on pre-pandemic data and can be viewed as a subtotal that will require further study and verification beyond 2020.

Our decision for this paper is to study the inter-regional differences in the level of adoption of business-to-consumer (B2C) e-commerce. Thus, we are missing out on institutional factors, since in our case the electronic commerce regulation regime is homogeneous in all regions of the country, as well as the role of cross-cultural differences associated with language and national traditions, which, for example, are considered by some authors through approaches similar to Hofstede (Hallikainen and Laukkanen, 2018; Pavlou and Chai, 2002). At the same time, in our opinion, consideration of interregional differences in the level of distribution of electronic commerce in a country has an advantage due to the absence of the need to control the influence of a wide range of intercountry gaps, which are weakly manifested at the interregional level. In addition, we do not take into consideration those factors, which manifest themselves only at the individual level, such as cognitive and non-cognitive personality characteristics.

The object of the research is the constituent entities of the Russian Federation (Russia) (all regions - 85 in total). Estimates of the volume of the Russian e-commerce market in different sources differ. For example, according to eMarketer estimates, the Russian e-commerce retail market in 2019 rounded out the ten largest national e-commerce markets, representing emerging economies in this top along with China and India (eMarketer, 2019). At the same time, UNCTAD places Russia slightly lower - 17th in the list of leading countries in terms of B2C sales in 2018 (UNCTAD, 2020). It can be noted that the values of the UNCTAD B2C e-commerce index (The

UNCTAD B2C E-commerce Index)⁵, which measures the economy's ability to provide e-commerce infrastructure, for Russia increased significantly in 2019 compared to 2017-2018 (UNCTAD, 2019). This contrasted, for example, with the situation on the Indian market and indicated certain positive shifts, although a strong gap from the leaders of the rating remained. In general, despite weak macroeconomic dynamics and a long stagnation of real incomes of the population, online B2C sales in the second half of the 2010s in Russia grew rapidly, and the situation on the e-commerce market in the country, in our opinion, can be considered representative for a group of developing countries other than China.

Thus, despite the limitation of the scope of our study by one country, its results can be extrapolated to explain the interregional differences in the level of adoption of e-commerce in other developing economies, with a possible adjustment for the impact of additional drivers that can only be identified by cross-country analysis.

Therefore, we focus on the following research question:

RQ: What factors primarily determine the interregional gaps in the level of e-commerce channel usage in retail purchases?

Literature Analysis and Conceptual Framework

The theory of drivers of e-commerce spread is included in the broader field of research into the factors of adoption of information and communication technologies (ICT) in general. Weber and Kauffman (2011) provide a good analysis of the theoretical directions in this broad, interdisciplinary field that were developed by the 2010s.

They divide existing theories into three large groups: theories of diffusion of innovations, theories involving behavioral perspectives and theories involving economic perspectives. The former are based on basic intuitions and conceptual ideas presented by Rogers (1995), with an emphasis on qualitatively different stages in the dynamics of technology implementation and different channels for their dissemination. The second ones focus on the incentives, barriers, motivations and preferences of individual users in their decision making, offering an interdisciplinary behavioral interpretation of the process of technology implementation. The latter ones are based on the approaches, models and intuitions popular in economics, including rational choice and utility maximization models, industrial organization, network externalities, path

⁵ The index consists of four indicators closely related to e-commerce, namely: the proportion of the population aged 15 and over that owns an account with a financial institution or mobile money service provider, the proportion of the population using the Internet, the Postal Service Reliability Index and the number of protected Internet-servers per 1 million people.

dependence theory, firms with heterogeneous characteristics, as well as an assessment of the net present value of the introduction of innovations, etc.

In terms of its conceptual content, our research is closest to the second direction. This approach is perhaps the most universal, and, in our opinion, it is the most relevant for the set goal, since it allows taking into account heterogeneous groups of factors, although we also study them not at the individual, but at the aggregated regional level, which leaves a certain imprint on operationalization of the research design. The most popular representative of the “behavioral” approach is the technology acceptance model (TAM), according to which two key parameters affect an individual's intention to use a technology: perceived utility and perceived ease of use. As the bibliometric study Villa *et al.* (2018) shows, TAM is widely represented in the literature on factors of implementation of e-commerce practice, but we are interested in more complex models developed from its basis - above all, the unified theory of acceptance and use of technology (UTAUT), which combines the intuitions of various theories and approaches into a single explanatory model (Weber and Kauffman, 2011). Despite the fact that we do not use UTAUT or its modifications in the form proposed in the literature directly in this work, we consider the role of various regionally aggregated parameters that can affect the expected utility associated with the use of electronic shopping channels, which can be determined by needs, costs and available alternatives.

As Villa *et al.* (2018) note, along with TAM in this area of research, an alternative model, the Technology Organization Environment (TOE), is gaining some popularity. The TOE framework defines three channels that can influence the use of technology at the level of organizations: technological, organizational, and environmental. Li and Xie (2012) provide a list of specific drivers of implementation within these channels: the technological level includes the macro-technological environment and technical strength of firms, the organizational level includes corporate strategy, the level of globalization, managerial attitudes and external pressure, and the external environment is divided into institutional, economic and socio-cultural aspects. Whereas “behavioral” theories such as TAM or UTAUT represent the operationalization of drivers and barriers to implementing e-commerce at the level of individual actions, TOE is primarily suitable for studying the diffusion of technology practices at the organizational level and focuses on isolated channels of influence. TOE is also a source of inspiration for our analysis – by grouping the studied factors, we single out the technological level, as well as the economic and socio-cultural aspects as the most relevant channels for analysis at the regional level.

If we talk about technological infrastructure, then in the 2010s, access to fixed high-speed Internet has largely ceased to be a significant barrier to the spread of e-commerce in developed and many developing countries, including Russia, remaining an urgent problem mainly for the group of LDCs. Nevertheless, the technological infrastructure accessibility agenda is still relevant, firstly, from the point of view of the availability of a stable Internet connection in rural areas and, secondly, from the point of view of the existing gaps in the spread of high-speed mobile Internet, which remained at a noticeable level throughout the study period. Technological innovations such as the introduction of 5G networks into mobile communications (Xiang *et al.*, 2017) maintain a persistent digital divide even within the mobile Internet user group, which could potentially affect households' engagement in online shopping. In modern literature, the role of mobile applications in the implementation of ICT-based economic practices, including e-commerce, is widely studied from different angles (Cao *et al.*, 2015; Hassan and Wood, 2020; Verkijika, 2018; Shaikh and Karjaluoto, 2015).

Based on the above, in this paper we study three potential infrastructure and technological drivers: fixed Internet access, mobile Internet access, and high-speed mobile Internet access. The results of the analysis should show whether the access to the Internet ceased to be a major obstacle to the spread of e-commerce in the 2010s in the context of developing countries like Russia, and whether it is worth considering separately different ways of accessing the Internet.

The existing inequality in access to ICTs has been conceptualized using the notion of the digital divide (Lucendo-Monedero *et al.*, 2019; Doong and Ho, 2012). By the 2010s, as the Internet spread around the world, the digital divide has come to be viewed rather from a different angle than it was understood at the turn of the century, and the actual use of digital services got more attention than the technological access to the Internet (Lucendo-Monedero *et al.*, 2019). Thus, along with the technological drivers, we start from considering separately the level of Internet using via various electronic devices as an additional driver, which may be important in explaining the interregional variances as well. In particular, we rely on statistics of the regional use of stationary computers (desktops), laptops, tablets, and smartphones to access the Internet.

Social and sociocultural factors of the spread of e-commerce have long attracted the attention of researchers in this field, and a large number of theoretical and empirical approaches to their study can be found in the literature. According to Villa *et al.* (2018), one of the key drivers attracting the attention of authors is consumer confidence in online channels. Obviously, trust in itself is not a fundamental variable and is determined by various social and economic characteristics, however, in our opinion, it can be considered as a stable parameter. Based on this

logic, one of the barriers we looked at was the lack of trust in e-commerce channels, the empirical source for analyzing the impact of which was the publicly available Rosstat data on the most popular reasons for users' refusal to make purchases through online channels in Russia, aggregated at the regional level. Along with a lack of trust, a popular reason there is the preference for personal physical purchases, which we also considered as a possible independent barrier reflecting certain social and socio-cultural channels of influence.

Along with these specific factors, we have included in consideration the more general social moderators that shape the regional social environment: education, age, and urban population. Both education and age are viewed in the specialized literature as potential positive social moderators (Weber and Kauffman, 2011; Ho *et al.*, 2007). The level of education was indirectly assessed through the number of students in higher educational institutions of the region per population unit, and age – through the resident population aged 15-29 years per unit of population.

The urban-rural divide also attracts wide attention in the context of studying the barriers to the spread of e-commerce, but its assessment is not so obvious and different interpretations are possible here. First, it can be seen as one of the social moderators along with education and age. Second, we can turn to the economic implications of this gap. For example, Forman and Goldfarb (2005) have proposed two alternative theories of the relationship between urbanization and the spread of ICT:

1) the global village theory, according to which isolated settlements are more interested in using electronic communication channels and, therefore, will adopt them faster;

2) urban leadership theory, which, in turn, suggests that high population density creates favorable externalities in favor of earlier adoption of new technologies in cities.

In the context of developed countries, studies using approaches from spatial economics and new economic geography are gaining popularity as part of the study of this aspect of the problem (for example, Kirby-Hawkins *et al.*, 2019; Freathy and Calderwood, 2016). For example, a geo-demographic analysis of online grocery shoppers in the United Kingdom, conducted by Kirby-Hawkins *et al.* (2019), suggests that major online grocery shoppers come from higher social strata and are more likely to live in rural areas rather than urban areas, which indirectly supports the “global village” theory (Forman and Goldfarb, 2005) in this small segment of e-commerce.

In addition, the same study found strong evidence that online shopping predominated in areas with fewer physical stores and less urbanized areas with limited access to retail stores. In

their cross-country study, Kshetri *et al.* (2014) also argue that high concentration of physical stores reduces the cross-elasticity of demand between conventional and electronic channels. The higher concentration of physical stores in the region means the need to travel less distance to reach the store, which makes physical shopping more convenient than e-shopping.

Based on this logic, we decided to include into our framework also the variable representing the availability of retail outlets. As can be seen from Centers for Disease Control and Prevention (2017), the calculation of this indicator per unit of population or area may result in somewhat distorted indicators that do not reflect the real picture. One of the options suggested there is to take instead a roadway mile-based denominator. It is not free from possible distortions as well, but it is better because it is not subject to changes in population size, on the one hand, and there is less risk that uninhabited areas will dilute the measure of outlet density. Following this suggestion, we analyzed the potential relationship between the data collected by Rosstat on the number of retail outlets per the length of federal, regional and municipal highways in the region and the prevalence of e-commerce among the population. At the same time, among retail outlets, only those that provide a wide assortment were singled out and small outlets, while very small outlets with non-specialized goods were excluded as unequal substitutes.

Finally, the research model included gross regional product (GRP) per capita as the main economic factor. Income is one of the fundamental economic factors considered in the context of research on e-commerce drivers (Weber and Kauffman, 2011). In particular, it affects the economic opportunities and structure of consumer preferences, which could potentially guide their decisions in the use of digital practices such as online shopping.

Our conceptual framework is summarized in Figure 1. Of course, this is not an exhaustive list of possible factors, but it includes the main factors for which data are publicly available at the regional level.

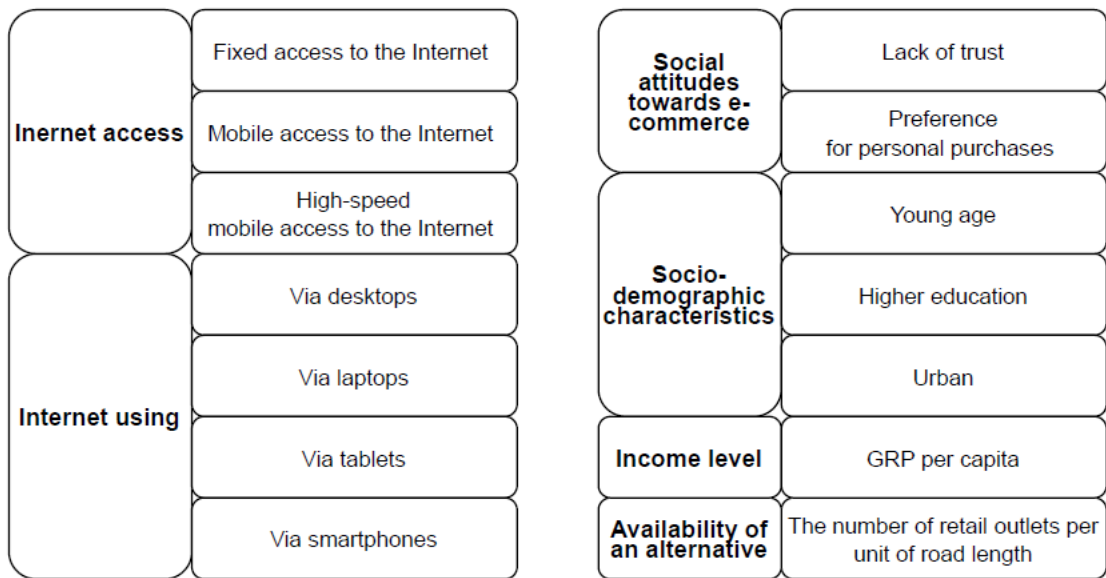


Figure 1. Studied potential factors of the inter-regional differentiation in the use of online channels for consumer retail purchases

Data and Methodology

The empirical basis of the study is the quantitative and survey data collected annually by the Federal State Statistics Service (Rosstat), as well as by the Ministry of Digital Development, Communications and Mass Media of the Russian Federation (MinTsifry). Data collection was carried out through the websites of Rosstat and the Unified Interdepartmental Information and Statistical System (EMISS).

The dependent variable characterizes the share of the population who used the Internet to order goods and (or services) in the total population of all constituent entities of the Russian Federation in the period from 2014 to 2019. Accordingly, our findings apply to the B2C (business to customer) e-commerce. The set of potential explanatory variables is described in Table 1, based on the conceptual framework from Figure 1 and including a control variable of the index of physical volume of retail trade turnover, which represents overall retail activity in the region.

Table 1. Description of the variables*Source: Rosstat, EMISS⁶*

Full name of an indicator	Short name	Source of data
Share of the population using the Internet to order goods and (or) services in the total population (percentage; years)	Online shoppers	Rosstat
The number of active subscribers of fixed access to the Internet (units; at the end of a year) divided by the number of resident population (people; on average in a year)	Fixed access	MinTsifry
The number of active subscribers of mobile radiotelephone communication using Internet access services (units; at the end of a year) divided by the number of resident population (people; on average in a year)	Mobile access	MinTsifry
The number of active subscribers of mobile radiotelephone communications using Internet access services with a declared speed of more than 256 Kbit / s (units; at the end of a year) divided by the number of resident population (people; on average in a year)	High-speed mobile access	MinTsifry
Household use of stationary computers to access the Internet (as a percentage of the total number of households in the region)	Desktops	Rosstat
Household use of laptops to access the Internet (as a percentage of the total number of households in the region)	Laptops	Rosstat
Household use of tablets to access the Internet (as a percentage of the total number of households in the region)	Tablets	Rosstat
Household use of smartphones to access the Internet (as a percentage of the total number of households in the region)	Smartphones	Rosstat
Lack of trust as the main reason for the resident population's refusal to use the Internet to order goods and services (percentage of the total population aged 15-72 years who do not use the Internet to order goods and services)	Lack of trust	Rosstat
Preference for personal purchases as the main reason for the resident population's refusal to use the Internet to order goods and services (percentage of the total population	Preference for physical shopping	Rosstat

⁶ URL: <https://rosstat.gov.ru/>; URL: <https://fedstat.ru/>;

aged 15-72 who do not use the Internet to order goods and services)		
Resident population aged 15-29 at the beginning of the year (percentage; as of January 1)	Young	Rosstat
Number of students in state and municipal educational institutions of higher education (people; value of the indicator per year) divided by the number of resident population (people; on average in a year)	Education	Rosstat
Share of urban population in total population at the beginning of the year (percentage; as of 1 January)	Urban	Rosstat
Gross regional product per capita (ruble; value of the indicator for the year)	GRP	Rosstat
The number of retail outlets (pharmacies and pharmacy stores; hypermarkets; shops; discounters; other stores; specialized non-food stores; specialized grocery stores; supermarkets; department stores; units; annual value of the indicator) divided total length of federal, regional and municipal highways (thousand kilometers, at the end of the year)	Retail outlets access	Rosstat
Index of physical volume of retail trade turnover (percentage; to the corresponding period of the previous year)	Retail turnover	Rosstat

The dependent variable in the study, as well as the set of associated with the prevalence of Internet connectivity, have been formed since the first half of the 2010s. The advantage of working in the Russian context is that due to the increased attention to digital technologies on the agenda of state policy and statistics in Russia in the 2010s we have access to indicators characterizing various aspects of the spread of e-commerce in the country in the regional context. In particular, along with traditional data on the number of Internet users, there is publicly available data reflecting the most popular reasons for users' refusal to make purchases through online channels, including preference for personal purchases and lack of trust in e-commerce channels. Data for individual subjects on these indicators have been available since 2014, which largely determined the choice of the time period for analysis in this work.

Factor analysis based on rotated factor loadings was the preliminary stage of the study. If the analysis reveals a high degree of connection between some factors, they can be combined by the method of principal components into certain composite variables, provided that they are

amenable to interpretation. In particular, we were interested in the relationship between variables from the “Internet access” and “Internet using” blocks due to their high proximity to each other at the conceptual level.

The main stage of the work included analysis using panel regression. Additionally, the Durbin–Wu–Hausman test was carried out to choose between fixed and random effects models, as well as the modified Wald test for the presence of heteroscedasticity, the Woolridge test for the presence of autocorrelation, and the calculation of Variance inflation factors (VIF) to indicate the presence of multicollinearity.

The following panel data model was used in the empirical analysis:

$$Online\ shoppers_{it} = \beta_{1it} + \sum_{k=2}^K \beta_{kit} x_{kit} + \varepsilon_{it}$$

where $Online\ shoppers_{it}$ – is the share of the population using the Internet to order goods and (or) services in the total population, and β_{1it} – is a dummy variable for the i -th region of the Russian Federation and the t -th year. X_{kit} ($k \geq 2$) – is the value of the predictor X_k for the i -th region of the Russian Federation and the t -th year.

Results

Table 2 presents descriptive statistics of the studied variables for the period from 2014 to 2019.

Table 2. Descriptive statistics

Source: authors' calculations

Variable	Mean	Std. Dev.	Min	Max
Online shoppers	24.77	11.43	5.40	80.10
Fixed access	0.24	0.43	0.00	3.64
Mobile access	1.05	2.21	0.00	20.96
High-speed mobile access	0.97	2.11	0.00	20.12
Desktops	38.51	7.86	0.00	71.40
Laptops	37.05	9.75	0.00	78.80
Tablets	20.67	9.07	0.00	59.10
Smartphones	49.67	16.05	0.00	88.40
Lack of trust	18.09	6.56	2.50	38.90
Preference for physical shopping	54.09	9.07	22.20	76.00
Young	18.54	2.48	0.00	27.60
Education	0.03	0.07	0.00	0.47
Urban	70.11	13.22	29.00	100.00
GRP	504813.60	588234.50	100526.40	5710467.00
Retail outlets access	2.25	4.01	0.00	83.34
Retail turnover	98.75	7.48	0.00	111.00

Let us first to present the results of factor analysis (Table 3). The first two factors made it possible to combine groups of variables into composite variables, which are amenable to interpretation. First, the “fixed access”, “mobile access”, and “high-speed mobile access” variables were united into a single “Internet access” variable using the principal components method. Second, the “use of laptops” and “use of tablets” variables were united into a single “use of portable computers” variable using the same method.

Table 3. Rotated factor loadings (pattern matrix)*Source: authors' calculations*

Variable	Factor 1	Factor 2	Factor 3
Fixed access	0.9797	0.1472	0.0214
Mobile access	0.9828	0.1244	0.0416
High-speed mobile access	0.9762	0.1139	0.0514
Desktops	0.1925	0.2519	-0.3860
Laptops	0.1503	0.8411	0.0387
Tablets	0.2450	0.8148	0.1406
Smartphones	0.1780	0.3473	0.7947
Lack of trust	-0.0388	-0.0676	0.0453
Preference for physical shopping	-0.0465	-0.3233	0.2159
Young	-0.0526	-0.2383	-0.1295
Education	0.9714	0.0454	-0.0097
Urban	0.3193	0.6293	-0.2099
GRP	0.0460	0.8022	0.1811
Retail outlets access	0.1944	0.1955	-0.0048
Retail turnover	-0.0071	-0.0360	0.8154

After the factor analysis, tests for multicollinearity, heteroscedasticity, autocorrelation, as well as the Durbin–Wu–Hausman test were performed.

Results of VIF calculation are presented in Table 4. We can see that the variables “Internet access” and “Education” have very high VIFs, and other variables demonstrate considerably low VIFs, which means that the multicollinearity problem may be relevant in the case of former two variables. We pay attention to this fact by considering a model, which does not include these variables along with another model, where these variables are still present.

Table 4. Variance inflation factors*Source: authors' calculations*

Variable	VIF
Internet access	14.66
Education	14.03
Portable computers	2.87
GRP	2.10
Smartphones	2.05
Urban	2.01
Young	1.83
Retail turnover	1.76
Desktops	1.25
Retail outlets access	1.19
Preference for physical shopping	1.17
Lack of trust	1.05

Modified Wald test results for groupwise heteroskedasticity in regression model indicated the presence of heteroscedasticity, which was addressed by using heteroscedasticity-consistent standard errors. Wooldridge test for autocorrelation in panel data did not indicate the presence of autocorrelation. Finally, the Durbin–Wu–Hausman test results suggested that using a fixed-effects model is a preferable option in our case.

In the Table 5, the results of regression analysis are presented, including FE and RE models with and without the variables with high variance inflation factors. According to the results obtained, among the significant variables in the FE models are the control variable (the index of the physical volume of retail trade), as well as the gross regional product per capita, the lack of trust in e-commerce, the use of desktops for Internet access, and the use of smartphones for Internet access, while the rest turned out to be insignificant. The variables with high variance inflation factors turned to be insignificant in the models, where they are present. The RE models did not differ from the FE models in terms of the list of significant variables.

Table 5. Regression Analysis Results

Source: authors' calculations

Variables	FE model 1	FE model 2	RE model 1	RE model 2
Internet access	-5.029 (3.552)	-	2.825 (1.976)	-
Desktops	0.294*** (0.0655)	0.287*** (0.0655)	0.227*** (0.0589)	0.212*** (0.0578)
Portable computers	1.127 (0.928)	0.855 (0.900)	0.813 (0.719)	0.714 (0.702)
Smartphones	0.111** (0.0526)	0.0963* (0.0515)	0.175*** (0.0394)	0.179*** (0.0389)
Lack of trust	-0.173** (0.0681)	-0.162** (0.0681)	-0.188*** (0.0605)	-0.193*** (0.0602)
Preference for physical shopping	0.0280 (0.0516)	0.00316 (0.0506)	0.0178 (0.0452)	0.0185 (0.0450)
Young	-0.485 (0.747)	-0.096 (0.709)	-0.313 (0.319)	-0.438 (0.316)
Education	491.6 (236.3)	-	-40.29 (29.26)	-
Urban	-0.323 (0.413)	-0.314 (0.408)	-0.0189 (0.0617)	-0.0148 (0.0596)
GRP	1.32e-05*** (2.45e-06)	1.34e-05*** (2.45e-06)	7.73e-06*** (1.23e-06)	8.24e-06*** (1.20e-06)
Retail outlets access	2.166 (2.293)	1.816 (2.088)	0.181 (0.415)	0.355 (0.404)
Retail turnover	0.219** (0.0929)	0.224** (0.0931)	0.407*** (0.0785)	0.409*** (0.0779)
Constant	41.60 (37.41)	52.55 (36.64)	-7.668 (13.87)	-7.455 (13.77)
R ²	0.667	0.663	0.632	0.638

Robust standard errors are shown in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Discussion and Conclusions

What do the results of the analysis indicate? First, the role of the Internet access drivers in the second half of the 2010s turned out to be irrelevant. Our results show that the prevalence of various forms of Internet connection is not associated with the higher presence of online shoppers in the population. Fixed, mobile and high-speed mobile types of connection turned out to be similar, as the results of factor analysis showed, and so we can consider them within a single variable.

At the same time, the use of different devices to access the Internet turned out to be quite important. Higher use of desktops and smartphones in the region is associated with higher use of e-commerce. However, for laptops and tablets, which were combined into one variable based on the factor analysis, such a relationship was not observed. These results show that the understanding of the digital divide associated with the infrastructural aspects of the Internet access is no longer relevant, and taking into account the level of dissemination of Internet usage practices now is more important.

If we are talking about the social barriers specific to e-commerce included in the models – preference for physical shopping and lack of trust in e-commerce channels, the latter seem to have had a significant negative impact on the prevalence of online shoppers in Russian regions. It should be noted that, as shown in Table 2, the preference for physical shopping is a more popular reason for refusal to use e-commerce: if the lack of trust was indicated as a determining reason on average across regions by about 18% of respondents, then the preference for physical purchases was approximately 54% on average across all the regions. However, the significance of physical shopping preference in differentiating the use of e-commerce by consumers was not identified at the interregional level, which indicates a less fundamental nature of this factor. It is obvious that trust is also explained by a combination of certain social and economic factors, and the close attention to this factor in the literature, as our results show, is absolutely justified.

The social moderators included in the model, such as the level of education, age and the share of the urban population, also turned out to be irrelevant in our case. It can be assumed that none of these variables is an unambiguous predictor of e-commerce use, and from the point of view of studying the social structure of e-commerce users, further research is needed to identify more accurate dividing lines. The availability of retail outlets was found to be insignificant as well, which suggests that the cross-elasticity of demand between conventional and electronic channels is not a critical factor in our case.

As the results show, GRP per capita turned to be a strong significant variable. Several possible lines of explanation can be suggested here. First, high income can act as a proxy for persistent infrastructure gaps, as it allows potential users to commit additional costs to gain access to technological innovation (Beise, 2011; Dekimpe *et al.*, 2000). In the case of e-commerce, it can be not only access to the Internet, but also access to banking services. Second, the general level of economic development can affect the rate of spread of technological practices in the conceptual format of the innovation diffusion model (Kshetri *et al.*, 2014). Thirdly, the level of income determines the structure of consumption, which, in turn, can be imposed on the selected formats of purchases. For example, online grocery shopping remains a limited niche practice in the Russian market when compared to other goods, so e-commerce may also be less relevant to the poorer households, which have food in a significant portion of their consumption.

Thus, according to our results, the use of desktops, smartphones and income are key positive factors explaining interregional differences in the propensity of the population to make electronic purchases, while the lack of trust is the main negative factor. Accordingly, our first recommendation for further research in the field is a study of factors that determine the use of digital devices for Internet access besides the infrastructural ones. Our second recommendation is a more detailed study of the mechanisms of influence of the level of income, using various models – economic, behavioral, models of diffusion of innovation and others. In addition, further work should reveal more broadly the mechanisms for increasing the level of trust in e-commerce, as well as track the factors of its spread – not only at the individual, but also at the interregional and interstate levels.

References

- Beise, M. (2011), *Lead markets: Country-specific success factors of the global diffusion of innovations*, Physica-Verlag, Heidelberg.
- BIS. (2020), *E-commerce in the pandemic and beyond*, available at: <https://www.bis.org/publ/bisbull36.pdf> (accessed 25 March 2020).
- Cao, Y., Lu, Y., Gupta, S. and Yang, S. (2015), “The effects of differences between e-commerce and m-commerce on the consumers' usage transfer from online to mobile channel”, *International Journal of Mobile Communications*, Vol. 13 No. 1, pp. 51-70.

Centers for Disease Control and Prevention. (2017), *Guide for Measuring Alcohol Outlet Density*. Atlanta, GA: US Dept of Health and Human Services, available at: <https://www.cdc.gov/alcohol/pdfs/CDC-Guide-for-Measuring-Alcohol-Outlet-Density.pdf> (accessed 25 March 2020).

Dekimpe, M. G., Parker, P. M. and Sarvary, M. (2000). “Global diffusion of technological innovations: A coupled-hazard approach”, *Journal of Marketing Research*, Vol. XXXVII, pp. 47–59.

Doong, S. H. and Ho, S. C. (2012), “The impact of ICT development on the global digital divide”, *Electronic Commerce Research and Applications*, Vol. 11 No. 5, pp. 518-533.

eMarketer. (2019), *Global Ecommerce 2019*, available at: <https://www.emarketer.com/content/global-ecommerce-2019> (accessed 21 December 2020).

Forman, C. and Goldfarb, A. (2005), “How do industry features influence the role of location on Internet adoption?” *Journal of the Association for Information Systems*, Vol. 6 No. 12, 11.

Freathy, P. and Calderwood, E. (2016), “Coping with change: the implications of e-commerce adoption for island consumers”, *Regional Studies*, Vol. 50 No. 5, pp. 894-908.

Hallikainen, H. and Laukkanen, T. (2018), “National culture and consumer trust in e-commerce”, *International Journal of Information Management*, Vol. 38 No. 1, pp. 97-106.

Hassan, H. E. and Wood, V. R. (2020), “Does country culture influence consumers' perceptions toward mobile banking? A comparison between Egypt and the United States”, *Telematics and Informatics*, Vol. 46, 101312.

Ho, S. C., Kauffman, R. J. and Liang, T. P. (2007), “A growth theory perspective on B2C e-commerce growth in Europe: An exploratory study”, *Electronic Commerce Research and Applications*, Vol. 6 No. 3, pp. 237-259.

ITU. (2014), *Manual for Measuring ICT Access and Use by Households and Individuals*, available at: https://www.itu.int/dms_pub/itu-d/opb/ind/D-IND-ITCMEAS-2014-PDF-E.pdf (accessed 21 December 2020).

- Kirby-Hawkins, E., Birkin, M. and Clarke, G. (2019), “An investigation into the geography of corporate e-commerce sales in the UK grocery market”, *Environment and Planning B: Urban Analytics and City Science*, Vol. 46 No. 6, pp. 1148-1164.
- Kshetri, N., Bebenroth, R., Williamson, N. C. and Sharma, R. S. (2014), “Cross-national heterogeneity in e-retail spending: a longitudinal analysis of economic, technological and political forces”, *Electronic Commerce Research*, Vol. 14, pp. 585–609.
- Li, P. and Xie, W. (2012), “A strategic framework for determining e-commerce adoption”, *Journal of Technology Management in China*, Vol. 7 No. 1, pp. 22-35.
- Lucendo-Monedero, A. L., Ruiz-Rodríguez, F. and González-Relaño, R. (2019), “Measuring the digital divide at regional level. A spatial analysis of the inequalities in digital development of households and individuals in Europe”, *Telematics and Informatics*, Vol. 41, pp. 197-217.
- OECD. (2020), *E-commerce in the time of COVID-19*, available at: <http://www.oecd.org/coronavirus/policy-responses/e-commerce-in-the-time-of-covid-19-3a2b78e8/> (accessed 25 March 2020).
- Pavlou, P. A. and Chai, L. (2002), “What drives electronic commerce across cultures? A cross-cultural empirical investigation of the theory of planned behavior”, *Journal of Electronic Commerce Research*, Vol. 3 No. 4, pp. 240-253.
- Rogers, E. (1995). *Diffusion of Innovations*, The Free Press, New York, NY.
- Salemink, K., Strijker, D. and Bosworth, G. (2017), “Rural development in the digital age: A systematic literature review on unequal ICT availability, adoption, and use in rural areas”, *Journal of Rural Studies*, Vol. 54, pp. 360-371.
- Shaikh, A. A. and Karjaluoto, H. (2015), “Mobile banking adoption: A literature review”, *Telematics and informatics*, Vol. 32 No. 1, pp. 129-142.
- Statista. (2020), *Coronavirus impact on retail e-commerce website traffic worldwide as of June 2020, by average monthly visits*, available at: <https://www.statista.com/statistics/1112595/covid-19-impact-retail-e-commerce-site-traffic-global/> (accessed 25 March 2020).

UNCTAD. (2019), *UNCTAD B2C E-commerce Index 2019*, available at:
https://unctad.org/en/PublicationsLibrary/tn_unctad_ict4d14_en.pdf (accessed 21 December 2020).

UNCTAD. (2020), *UNCTAD Estimates Of Global E-Commerce 2018*, available at:
https://unctad.org/en/PublicationsLibrary/tn_unctad_ict4d15_en.pdf (accessed 21 December 2020).

Verkijika, S. F. (2018), “Factors influencing the adoption of mobile commerce applications in Cameroon”, *Telematics and Informatics*, Vol. 35 No. 6, pp. 1665-1674.

Villa, E., Ruiz, L., Valencia, A. and Picón, E. (2018), “Electronic commerce: factors involved in its adoption from a bibliometric analysis”, *Journal of Theoretical and Applied Electronic Commerce Research*, Vol. 13 No. 1, pp. 39-70.

Weber, D. M. and Kauffman, R. J. (2011), “What drives global ICT adoption? Analysis and research directions”, *Electronic Commerce Research and Applications*, Vol. 10 No. 6, pp. 683-701.

Xiang, W., Zheng, K. and Shen, X. S. (Eds.). (2016). *5G mobile communications*, Springer, Cham.

Inna S. Lola

National Research University Higher School of Economics, Russian Federation. Institute for Statistical Studies and Economics of Knowledge, Centre for Business Tendency Studies. Deputy Director.: ilola@hse.ru

Any opinions or claims in this Working Paper do not necessarily reflect the views of HSE.

© **Lola, Bakeev, Manukov 2021**