The Influence of Migration Processes Caused by the Russian-Ukrainian War on the Development of E-Commerce in Ukraine

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Abstract

Migration processes caused by the Russian-Ukrainian war caused crises in almost all branches of the national economy. However, e-commerce continues to gain momentum and create conditions for Ukrainian businesses, accelerating its integration into the European digital space. Considering the significant share of migrants from Ukraine in EU countries, the issue of bringing all online trading platforms to EU standards, which regulate activities in the field of e-commerce, is being brought up to date. The paper's purpose is to forecast the e-commerce market in Ukraine and the EU in the context of migration processes. The research methodology is based on an interdisciplinary approach, combining general scientific and unique economic and mathematical methods. As a result of the study, a system of models was proposed, which considers various scenarios of migration processes and their impact on the development of e-commerce in Ukraine. Migration processes have a positive effect on the development of the activities of all e-commerce market participants in Ukraine and contribute to rapid adaptation to EU conditions and standards in the field of e-commerce.

Keywords [1]

e-commerce, migration processes, online shopping platforms, European digital space

1. Introduction

The full-scale Russian-Ukrainian war, which Russia started on February 24, 2022, caused the largest migration wave of the 21st century. As a result of the Russian invasion, more than 5 million refugees, mostly women, children, and the elderly, crossed the borders of Romania, Poland, Slovakia, and Hungary in the first months of the war (Fig. 1). Since the COVID-19 pandemic was not yet under control at the time of the migration wave, and the vaccination rate in Ukraine was one of the lowest in Europe [1; 2], this situation represented a significant epidemiological risk that EU host countries assumed. The war and the migration processes accompanying it have a significant impact on electronic commerce because electronic commerce is the interaction of business entities regarding the purchase and sale of goods and services (material and informational) using information networks (Internet, cellular network, internal local network of companies). During the COVID-19 pandemic, the demand for e-commerce increased tenfold, making it relatively easy for the global community to adapt to the real-time but the impact of war has consequences that are worth exploring.

The Smart Shopper study showed that in 2021 the share of online shopping increased across all age categories of shoppers. The most significant rowth was among Ukrainians aged 18-24 and 45-54 years old – 43% of buyers of this age prefer online shopping. At the time of the study, one of the main reasons for the active growth of Ukrainian e-commerce was the COVID-19 pandemic, when many offline stores

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did not work. Now a full-scale war with Russia plays a significant role. During the war, many shops and shopping centers closed, and buyers had no choice. Also, for security reasons, some shoppers may be afraid to visit crowded places and prefer to shop online. Online stores also faced difficulties due to the war, but, as the experience of our client shows, many merchants coped and restored their work [4].

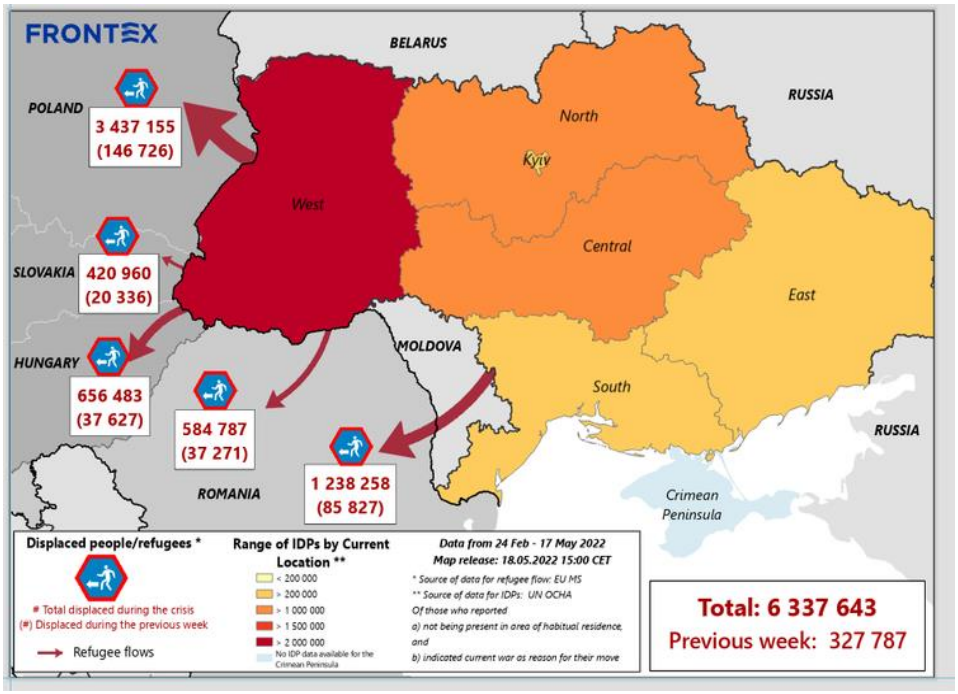

Figure 1: Number of refugees from Ukraine to the EU [3]

At the beginning of March 2022, electronic commerce almost "went to the bottom". On the day of the Russian invasion, all online stores lost an average of 82.7% of sessions. In the first week, Ukrainian online retailers lost almost all their income. On average, it collapsed by 92%. But in the middle of March, revenues began to grow along with a significant increase in the number of sessions. By the end of May, some categories even returned to pre-war indicators (pet products and cosmetics along with household and hygiene products) [5]. After an almost complete halt in online trading in the first weeks of the war, retailers gradually fine-tuned logistics, moved warehouses, and adjusted to changes in demand. However, despite individual surges in consumer demand and an increase in the average check, the full recovery of the sector began only in the summer. Some Ukrainians who moved to a safer place are faced with the absence of their usual brands in offline stores and choose from what they have. At the same time, many acts contrary to the strict hierarchy of needs and switch to Ukrainian brands to support society. This gives a new stage in the development of e-commerce. Electronic commerce is widely studied in scientific and specialized literature, connected with the rapid development of electronic commerce in the last decade. At the same time, in the conditions of war in the context of migration processes, the issue has become especially relevant since many entrepreneurs are forced to work in the conditions of an unstable market, which is connected with military actions, and turn to digital marketing. Given the fact that migration has ambiguous effects on macro and micro indicators of business activity, financial, social and cultural development, it is interesting to study the impact of the migration crisis caused by the 2022 war on the development of the e-commerce market in Ukraine. Because in Europe about a quarter (25.5%) of e-commerce happens across borders [6], and this has been rising steadily every year, it's interesting to analyze this phenomenon in Ukraine.

2. Literature review

The article [7] presents an overview of research findings on the determinants and consequences of personal networks in the migration aspect. The paper [8] provides a review of the literature on the development impact of migration and remittances on origin countries and on destination countries. The researchers [9] proposed a systematic review of the state of the literature on international migration

scenarios and forecasts and evaluated their development in a comparative manner. The authors of the study proposed a typology of migration scenarios (Fig. 2), however, without considering the 2022 war, which caused an unprecedented surge in migration and completely changed all development scenarios after 24.02.2022.

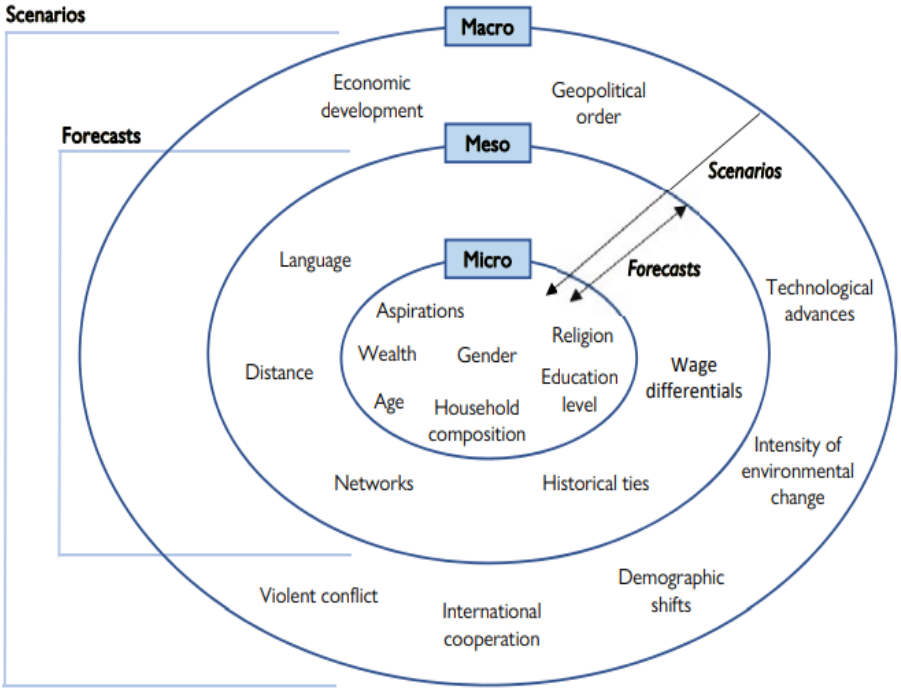

Figure 2: Selected migration drivers in scenarios and forecasts at the micro, meso and macro levels [9]

In article [10], the authors, based on the Push-Pull-Mooring (PPM) theory, investigate the impact of the Internet on the prosperity of e-commerce in rural areas of China. Villagers establishing their own companies and returning to places of residence outside large cities contribute to the economic development of rural areas. Therefore, centralized political support of entrepreneurs through various mechanisms should play a significant role in this. The research paper [11] gives an overview of how migration policies in Asian countries (Afghanistan, Bangladesh, Cambodia, India, Indonesia, Japan, Malaysia, Pakistan, Singapore et.) impact on the business/economic climate.

The article [12] analyzes the drop in e-commerce volumes in the aggressor country after it launched a full-scale war against Ukraine. Authors in [13] showed that labor immigration to Poland from Ukraine for many years, the crisis on the Polish-Belarusian border and the influx of refugees from Ukraine due to Russia's military aggression in February 2022 changed the status of Poland from a typical emigration country to typical immigration country very quickly. In article [14] an attempt was made to forecast the level of healthcare expenditures in Ukraine for 2023-2024, considering the scale of migration and the fall in GDP level. The authors proposed 3 scenarios for the development of the economy of Ukraine in 2023-2024, considering changes in the age structure of the population, migration and the volume of healthcare expenditures using the six-step cohort method.

In the study [15] the authors determined the state and prospects for business development and its marketing component during the war in Ukraine. Analysis of the study shows that the share of business representatives who entirely or partially ceased their activities during the first three months of the war decreased from 75.3% in March to 49.0% in May (compared to February 24, 2022), which indicates gradual resumption of business in Ukraine. A study of marketing activities in Ukraine shows that the most positive changes regarding gradual renewal are observed in digital marketing. In addition, the study proposes general approaches to adapting marketing and e-commerce during the war to preserve, restore and further develop business in Ukraine. The results of scientific research [16] note that despite the brutal war, mass emigration of clients to other countries, and rising unemployment, a business can adopt, survive, and develop through e-commerce. During the study, the authors proved that, as a result of hostilities, the behavior of customers is unpredictable. In the paper [17] it is proposed to consider digitalization and e-commerce as one of the country's economic security components. Digitalization

affects the economic security of the country by 22%. The results of the calculations confirmed the hypothesis that digitalization made it possible to maintain the reliable functioning of the banking system in the conditions of active hostilities on the territory of Ukraine and maintain a minimum standard of living for the population. As a result of the study, the author proved that e-commerce and e-government have a long-term impact on financial markets and financial institutions.

Experts from E-commerce Europe and EuroCommerce [18] noted that 2022 will be an exceptional year. As consumers have learned to shop online for cheap prices, some additional demand might go to e-commerce, but certainly, prices will be comparably higher across the board and therefore e-commerce will not capture and convert all demands. The war in Ukraine has undoubtedly had an impact on European e-commerce, particularly in the countries nearest to the conflict. The war in Ukraine has undoubtedly had an impact on European e-commerce, particularly in the countries nearest to the conflict. The need to study and study the consequences of war is actualized. In research [19] the possibilities of forming a balanced, effective, and mutually beneficial migration policy in the Mediterranean region are explored. As stated in studies [20; 21; 22; 23; 24], despite the "nostalgia trade" effect, when trade focuses in goods distinctive to the migrants' home country and trade in tourism services, the effects of trade caused by migration are not yet sufficiently understood, especially through e-commerce. The current research aims to find a missing link between e-commerce development, and labor migration, and to analyze the impact of migration processes on e-commerce progress.

3. Methodology

The current development of e-commerce in Ukraine is very dynamic since the war started. After a near-total shutdown of online sales in the first weeks of the war, retailers gradually adjusted logistics, relocated warehouses and adjusted to changes in demand. However, a lot of Ukrainians went abroad or change their location internally in Ukraine, which have a negative influence on market growth. In such conditions, despite individual spikes in consumer demand and an increase in the average check, a full recovery of the sector began only in the summer, so there is a decline in the e-commerce market. We can talk about trade in pre-war volumes only in terms of individual positions. The practical task of the present research is to model the influence of migration on the e-commerce market and forecast the potential future dynamic using the economic-mathematical model, constructed using R-Studio Software, and artificial neural network, constructed in Deductor Studio. The data about the e-commerce market was collected by an EVO Group [25] and Statista [26] for a period from 2010 to 2021 (Fig. 3) and as influenced factors were selected the following variables: net migration (from the State Statistics Service of Ukraine [27] for a period from 2010 to 2021 (Fig 4) and from the United Nations [28] for 2022), level of internet penetration and mobile penetration (from World Bank Open Data [29]).

So, in the first stage, we construct econometric (regression) model with the following general view:

$$E\text{-}commerce = Constant + b_1 * Exchange\ rate + b_2 * Net\ migration + b_3 * Mobile + b_4 * Internet. \quad (1)$$

The exchange rate was selected as a factor, which has a significant influence on e-commerce and retail in general as shows the dynamic of the economic situation in the country and the dynamic of consumers' income. Mobile and Internet penetration are one of the more significant factors, which demonstrate the trend of growing penetration of digitalization, which is one of the key drivers of e-commerce development. Migration growth leads to a large drop in the potential consumer base of the e-commerce market, so, as a result, the volume of e-commerce will significantly change. Considering the potential changes in the Ukrainian migration level, there are 3 different scenarios, which are presented in Table 1. The blackouts and Russian attacks increase the possibility of a pessimistic scenario.

4. Modelling the influence of migration on e-commerce and information-technical support of e-commerce development

The technical characteristics of the constructed linear regression model are presented in Table 2. Such a model is characterized by high quality (R-square is 83%, the model is adequate, and all factors are significant with 95% of probability. Considering the significant growth of immigration from

Ukraine in a case of a full-scale Russian invasion (more than 5 million Ukrainians go abroad), based on the constructed econometric model we estimate the forecast for 2022, which implies a drop in the e-commerce market volume to 3,2 bln USD (by 26% 2021).

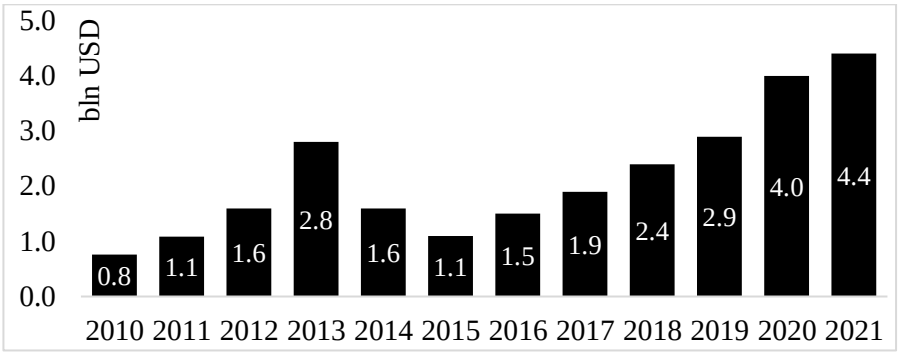

Figure 3: E-commerce market in Ukraine, bln USD [25, 26]

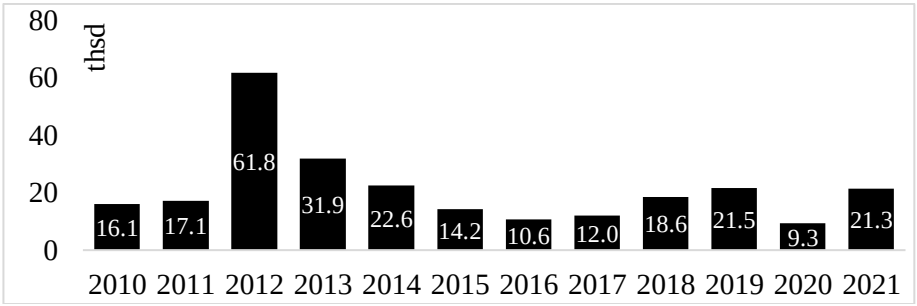

Figure 4: Population migration between Ukraine and other counties in population thsd. [27]

Table 1

The three alternative scenarios considering changes in the migration level and population size used in modeling and forecasting

Assumption	Pessimistic	Realistic	Optimistic
Migration	Grows ~10-12% – potential losses	Grows ~5% – potential losses	Shortened ~72% return
Population size	Decreases in accordance with the demographic forecast and migration processes (6.657 million refugees (UN) + occupied territories = ~19% of the population [30])		
	In 2022-2023 – the risk of losing another 10-12% of the population [30].	Return of 67% of the population at the earliest opportunity in 2023 [30]	Return of 89% of those who went abroad in case of victory in 2023-2024 (Kyivstar)

Table 2

The technical characteristics of a constructed econometric model for e-commerce in Ukraine

Variable	Coefficient	Stand. Error	t-statistics	p-value
Constant	10.0167	3.87	2.59	0.035928
Exchange Rate	-0.2122	0.07	-2.94	0.021688
Net Migration	-0.0235	0.01	-2.23	0.057243
Mobile phone penetration	-0.1327	0.04	-3.47	0.010388
Internet penetration	24.6982	5.60	4.41	0.003127
Multiple R-square	82.8%		Adjusted R-square	72.9%
F-Statistics	0.405638		p-value	0.003127

In the next stage, we constructed a neural network model with two hidden layers, considering e-commerce as an output variable and other factors as an input. The activation function was chosen to be sigmoidal with a slope of 1.0. In the process of neural network learning, 1.2 was selected as the ascending step and 0.5 was selected as the descending step. The neural network had the better performance in the period since 2015 after a political and economic crisis (the average error is less than

2%). After analysis of the forecast by the constructed neural network, we can make conclusions about its more optimistic view in comparison with the econometric model, as the prediction is that in 2022 the general level of the e-commerce market in Ukraine will accumulate 3,59 bln USD (-18% 2021).

It is relevant to consider such deviation as a range for the future dynamic of the e-commerce market for 2022. For 2023-2024, there are two different scenarios – slow recovering in case of continuing war and slowly coming back home (growth rate at average 10-15%) and optimistic option in case of victory of Ukraine (+15-20%), as more than 70% of Ukrainians plan to come back in Ukraine, when it will be safe [30]. Considering the influence of Ukrainian migration on EU e-commerce, we propose to concentrate attention on the Poland market as Poland is characterized by the largest share of Ukrainian migrants [28]. So, based on the forecasts of Statista [20], the total amount of Poland's e-commerce market will grow up to 17,14 bln USD (+13% vs 2021). In addition, it is appropriate to consider a system of relevant software that can be used to support the business processes of companies in the e-commerce market under the influence of migration processes. The modern world proposes a lot of programming tools and software for effective e-commerce development.

Table 3

The comparison of different software for visual analysis and support of e-commerce development [31]

Software	Advantages	Disadvantages
Power BI	• There is a desktop and mobile version • Interface that everyone understands • There is a free version • Combining data from multiple sources • Built-in visualization libraries • You can customize the display for any gadgets • Built-in query processing subsystem, data visualization and modelling system • Integration with Microsoft products	• Not enough tools to clean and process data • Importing and processing large amounts of data takes a long time
Tableau	• Working with different data sources and mixing them • Flexibility, speed, simplicity and ease of learning and use • High interactivity, a wide range of visualizations • Mobile platform support • Availability of an active user forum and a library with learning resources • Easy integration with Big Data platforms • Multiple users can work on a report at once	• Low level of data protection • Data must be pre-prepared • Data export takes a long time • Free version provided that all solutions are stored on a shared server with open access, but there is a paid version
Qlik	• A single analytics algorithm • Possibility of fast, interactive visualization • Ability to share • Processing in RAM, not in the DBMS • Data in the form of an associative model (automatic formation of links) • Integration of different data sources • Quick analysis of large datasets • Supports enterprise security policy • Convenient to create any filters • Flexibility, processing speed	• Filtering can combine data even if you don't want to • Difficulties may arise without a technical base • Difficult to use as a tool for the entire company • Difficult to send reports • High price

There are numerous techniques for modeling and forecasting consumer demand, price optimization, customer behavior analysis, etc. [31]. Obviously, before choosing technical tools it is needed to define the practical tasks and think about the relevant model. For example, for the task of monitoring the key business indicators, it is relevant to use different software for the development of dashboards and for visual analytics. Microsoft Power BI and Tableau are the most popular and the most useful tools for these goals. For solving the tasks of customer segmentation considering current and possible changes in their behavior due to war and migration (internal or external), it is recommended to implement clustering methods using such software as Deductor Studio, Weka, Loginom, IBM SPSS Modeler, or such programming languages as Python or R for a most professional and deeper level of data analysis and modeling.

Table 4
The comparison of different software for modeling and support of e-commerce development [32]

Software	Advantages	Disadvantages
Loginom	• A wide range of modelling methods and Data Mining algorithms • Has a set of relevant data preparation tools for working with data before the modelling • Nice visualization • Convenient work • Mobile device support • Maximum flexibility • Lots of math libraries • Ready business processes • Wide data mining techniques	• Non-trivial logic requires coding • Limited analysis functionality • No models are not available (for example Kohonen SOM) • Complexity of support
IBM SPSS Modeler	• It's an open solution • Run most of the data mining models and techniques • Simple deployment of modelling • Intuitive, quick, and easy to use • Produces models and rules which are easy to interpret • Wide range and combination of models and algorithms • Working with a CRISP-DM framework	• Graphs could be better • Already present integrations to other IBM products are poor • Some advanced statistical functions cannot be done in the menu • It's an expensive tool
Weka	• Open source, free, extensible, can be integrated into other packages • Relatively easy to use • Easy to compare the results of the different algorithms implemented • A wide range of clustering and classification models • Build KDD phases or run an individual experiment	• Lack of proper and adequate documentation • Systems are updated constantly • Accepts data in the ARFF format
Deductor Studio	• Wide range of available Data Mining methods for modeling and data analysis • Availability of Kohonen SOM • Relevant visualization tools for each used method • Convenient work • Free academic version	• Limited functionality in the free version • No actual updates of the software (company switch on development and support of Loginom Studio)

Table 5
The comparison of different programming languages for modeling and support of e-commerce development [33]

Software	Advantages	Disadvantages
R	• Great for statistical analysis • Work inside of environments like RStudio that include a data editor, debugging support, and a window to hold graphics as well • The best tool for data visualization. It includes quite a few packages that correspond with this • R language provides large community support with 1000 developers and data scientists spread across the world	• R has a steep learning curve, so the language studying is more complicated than Python • Deriving proper solutions with R can be considered as ineffective in terms of speed vs other programming languages if the code is written poorly. To overcome this drawback, it is mandatory to include libraries to achieve proper output
Python	• It is used broadly • Coincides with the way programmers think more than R does, and therefore it translates over to other languages more easily • It's nice to clean data with a full-service language like Python • Python is evolving with time • Python moves more quickly than R • Python has gained wide popularity as the syntax is crystal clear to understand	• It is slower in comparison with other programming languages as it is an interpreted language • Requires rigorous testing as the errors show up in runtime • It still has lower performance on mobile computing platforms as there are few apps created with Python as a core language

All the mentioned software also can be used for solving forecasting tasks and estimating the level of influence of various factors on e-commerce development. The comparison of different software is presented in Table 3, Table 4, and Table 5. Information and analytical support help to maintain business performance and quickly react to all market challenges with the goal of providing better services for consumers. It is very important to focus scientific attention on comprehensive data-driven solutions and gradually implement them in business processes on macro and micro levels of economic systems.

5. Conclusions

The proposed economic and mathematical model and neural network show the highest efficiency for the prediction of e-commerce development. The deviations in the e-commerce volume forecast for 2022 between different models are around 8-10%, which indicates different scenarios for the future development of the e-commerce market in Ukraine and in the main countries of the EU. Considering the highest level of migration level, there is a strong influence of the immigration process on e-commerce development, and according to the forecast, there will be decreasing in e-commerce volume in Ukraine by 18-26% in 2022 vs 2021. Some part of the Ukrainian e-commerce demand was switched to Poland Market with a significant number of Ukrainians, who go to Poland after the full-scaled start of the Russian-Ukrainian war, and, as a result, there will be additional growth in the Poland market, which will accumulate more than 17 bln USD in 2022 with a growth rate of around 13% vs 2021. So, the proposed models prove the significant influence of migration on the level of the e-commerce market and on its future dynamic.The presented review of software for informational and analytical support of e-commerce contains the pros and cons of three groups of tools: platforms for dashboard development and Visual Mining, where Microsoft Power BI and Tableau are the most popular and the most useful for business tasks, as generates the opportunity to implement effective visual analytics with real-time updating. The second group is software for Data Mining tasks (forecasting, clustering, classification, etc.) and contains the WEKA, as well as Loginom and IBM SPSS Modeler, which make it possible to realize projects through CRISP-DM methodology and framework. The third group contains programming languages R and Python, two of the most important languages for Data Science.

The article presents a comparison of the advantages and disadvantages of these programming languages, but, in general, both help to realize deep dive into data and find hidden insights from them. Implementation of analytical support and mathematical modeling to business processes make it possible to improve performance and quickly react to all market challenges with the goal of providing better services for consumers. It is quite important to focus attention on data-driven solutions and gradually implement them in business processes on macro and micro levels of economic systems.

So, the findings and conclusions of the presented research will be interesting for the national government and for Ukrainian and International companies in the e-commerce market, who feel the impact of migration on business development. As the area of future research, we focus on overcoming the limitations of current research and modeling the influence of migration on other countries of the EU and comparison of its impact.

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