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Defeating the Dark Sides of FinTech: A Regression-Based Analysis of Digitalization's Role in Fostering Consumers' Financial Inclusion in Central and Eastern Europe

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Abstract: Financial technologies metamorphose economies with customer-focused innovation. In this way, financial inclusion is fostered and economic growth is increased. However, risks, trust issues, and ethical concerns stem from the faster advancement of digital technologies and expanding financial innovation. Thus, this paper aims to understand the risks and barriers associated with FinTech and consumer adoption, focussing on the impact of digitalization on financial products/services' acceptance. The research investigates the impact of digitalization on financial services and the recognition of the role played in the global economy by FinTech. For this reason, the regression analysis was used to explore the influence and correlation of various variables on FinTech in Central and Eastern European (CEE) countries, such as Internet usage, online shopping, paying bills via the Internet, and making and receiving digital payments. The results show differences between three clusters of CEEs in terms of FinTech adoption. While several past studies have explored the advantages of FinTech, few studies have investigated the risks associated with its adoption, trust, and barriers to its usage in different country contexts. The present paper fills the gap by analysing the data on Internet usage, online shopping, paying bills via Internet, and sending or receiving digital payments in CEE countries. The study recommends that FinTech companies share information online not only to present their offerings to users, but also to promote financial education through clear and straightforward communication about the features of their services. This approach can indirectly benefit society by contributing to financial development, inclusion, social stability, and, consequently, sustainable development.

Keywords: innovation; FinTech; financial inclusion; digitalization; Central and Eastern European countries

1. Introduction

Digital technologies have transformed the economy, society, and consumer behavior (Grigorescu et al. 2021a; Kamdjoug et al. 2021; Liu et al. 2023; Lulaj et al. 2024). The rise of technological advancement led to the disruption of traditional value chains that eventually reshaped the market (Murinde et al. 2022). Financial technologies (FinTech) have changed the financial ecosystem and impacted business operations (Grigorescu et al. 2021b; Moghavvemi et al. 2021; Bu et al. 2022a, 2022b; Elia et al. 2022; Apostu et al. 2023; Arena et al. 2023; Panait et al. 2023; Ghosh 2024). Thus, FinTech enables remote delivery of

financial services and includes digital money, mobile payment, cryptocurrencies, blockchain technology, crowdfunding, and peer-to-peer (P2P) lending (Manta 2018, 2020; Bollaert et al. 2021). The intensification of technical and financial innovation and an increase in the level of financial education have contributed to the increase in the degree of financial inclusion and the reduction in the gaps between women and men and young and old in accessing financial services (Ene and Panait 2017; Malik et al. 2021; Raimi et al. 2021; Imam et al. 2022; Nguyen 2022; Wani and Khanday 2024).

Although FinTech innovation offers advantages, it also includes potential shortcomings such as privacy, fraud, data protection, and security issues (Chan et al. 2022). Individuals, organizations, and society can face serious barriers and risks while adopting FinTech (Schwienbacher 2019; Lee and Shin 2018). For example, financial stability, customer protection, financial development, and inclusion can be important objectives for financial regulation (Iacovoiu and Stancu 2017; Janjua et al. 2024). There can be new sources of barriers that can stem from digitalization, such as cyber risks emerging from the growing rate of technological development and implementation of digital systems in finance, cybersecurity threats, and data protection. Furthermore, all the risks and limitations that might emerge in FinTech are still not known (Vasile et al. 2021).

Those issues prevent consumers from adopting financial technologies and affect their trust in digitalization (Chan et al. 2022). Consumers are concerned regarding their privacy as their data can be accessed and misused, and even if the data access is legal, they consider the law to be more strict, empowering consumers to know and restrict the use of their data (Chen and Duan 2022). FinTech can impact the risk of manipulation of consumer behavior based on the collected data about people's habits and lifestyles (Najaf et al. 2021). It can encourage overspending, overborrowing, and overconsuming. Another source of mistrust can be the replacement of traditionally regulated banks with FinTech institutions, leading to systemic risks of failure or cyberattack (Nguyen et al. 2022). In addition, adoption barriers, trust in new technologies, and ethical considerations need to be considered as well. Ethical dilemmas and environmental and social concerns are also associated with FinTech (Anshari et al. 2021).

Therefore, there can be risks and barriers to the digitalization of financial operations and the adoption of FinTech from both the consumer and business sides (Chan et al. 2022). Customer experience plays a key role in the adoption of FinTech. FinTech companies can offer customer-oriented financial services that enrich the customer experience, enhance trust in financial technologies, and provide customer satisfaction. While much past research has been dedicated to exploring FinTech advantages, few studies have investigated the risks associated with its adoption or the trust in and barriers to its usage in different country contexts (e.g., Chen et al. 2022; Ashta and Herrmann 2021; Murinde et al. 2022). Moreover, whereas FinTech improves financial inclusion, progress varies by countries and regions as determined by customer demand, regulations, financial systems, the technological environment, and the economic developmental level (Murinde et al. 2022).

Thus, the present study aimed to fill the gap by analyzing the data on Internet usage, online shopping, paying bills via the Internet, and sending or receiving digital payments in Central and Eastern European (CEE) countries. The purpose of this study is to determine whether or not FinTech impacts financial inclusion in CEE countries. The study aims to investigate which variables influence FinTech in CEE countries. Therefore, a main research question is framed as follows: Is there a role of digitalization in promoting financial inclusion through FinTech in CEE countries?

To answer the research question and achieve the research aims, we applied empirical research based on regression analysis.

The research contributes to understanding the interrelated issues of FinTech, digitalization, and financial inclusion in CEE countries. In addition, new financial services and products can be designed and offered to consumers in those countries based on the empirical study results. The paper extends the existing literature on FinTech by examining

the limits of the adoption of financial technologies, discussing financial inclusion in CEE countries, and exploring the impact of FinTech on CEE countries.

This paper is structured as follows. Following the introduction, a literature review is presented exploring the theoretical background of financial inclusion, digitalization, and financial technologies together with ethical considerations connected with their application in practice. Risks and barriers to adopting and using FinTech in CEE countries have also been studied in the literature. The Section 3 includes data and methodology explaining the research methods and data sources. Next, the empirical results are presented, followed by a discussion of findings. Finally, conclusions are provided together with research limitations and theoretical and managerial implications.

2. Literature Review

2.1. Digitalization and Financial Technology

The term *Digitalization* differs from *Digitization.* Digitization is oriented on the activities that aim to digitize processes—shifting tasks from analog or paper-based to digital (Murinde et al. 2022). Digitalization refers to technologies and changes in society and the economy offering new approaches to create value and develop new business models (Tilson et al. 2010). In this sense, digitalization is a broader term including customer-centered and problem-solving approaches, and is used in complex social and technological contexts (Legner et al. 2017; Murinde et al. 2022).

FinTech is related to digitalization, as financial services and products, such as payments, digital bank accounts, loans, debits and credits, can be accessed through financial technologies (Chen et al. 2022; Sangwan et al. 2020; Ranabahu 2022). FinTech means *Financial Technology* and is applied to innovative financial products and services that can enable consumers to manage their finances while promoting the financial ecosystem through meeting "the needs of economic agents" in an inclusive way (Murinde et al. 2022). FinTech is understood as the concept of producing financial innovation through technologies that alter the traditional financial sector and create novel nosiness models, approaches, processes, services, and products (Puschmann 2017).

Together with the growth of e-commerce and online shopping, financial institutions must adapt their services to customers' demands using digital payment methods, digital money, and mobile applications to complete their online purchases (Nejad 2022). Not only developed but also developing countries have benefited from FinTech, especially because of the development of mobile money and mobile financial applications (Siano et al. 2020; Tidjani 2021) to increase financial inclusion (Joia and Cordeiro 2021; Khan et al. 2021). Previous studies have emphasized that mobile money positively affects financial inclusion (Suri and Jack 2016; Suri 2017).

Furthermore, considering the innovation diffusion theory (Rogers et al. 1962), FinTech can be seen as a tool used to enable the access of large groups of underserved populations to finance and provide affordable financial services. An additional incentive for FinTech adoption includes a profitable banking sector, while FinTech can achieve efficiency in terms of financial service costs. Thus, FinTech has been on the rise due to unmet demand for financial services as it can deliver financial inclusion and support economic development (Voica 2017). Interrelations between FinTech, financial inclusion, and economic growth have been widely discussed (Nejad 2022). FinTech and financial inclusion positively affect the gross domestic product (GDP) per capita, and financial inclusion also triggers FinTech diffusion, hence increasing GDP per capita (Kanga et al. 2022).

However, the expansion of Fintech requires appropriate risk management strategies, which can enhance predictive accuracy, fraud detection, and regulatory compliance (Daiya 2024). Central banks face unique challenges in managing FinTech and cybersecurity risks, requiring an integrated risk management approach throughout financial organizations (Khan and Malaika 2021). Key strategies include establishing dedicated risk management units, ongoing training, clear reporting lines, and assessing cyber resilience (Khan and Malaika 2021). Policymakers and industry stakeholders must adopt proactive measures

and develop a robust regulatory framework to navigate the complexities of FinTech responsibly, ensuring consumer protection while fostering innovation (Qiang 2024). Artificial intelligence can be used in FinTech risk management for data analytics, as well as for identifying, measuring, and mitigating risks. Cybersecurity strategies will further promote the FinTech industry.

2.2. Financial Inclusion: Opportunities and Challenges

The technical progress generated by digitalization, but also by the intense financial innovation, has led to the emergence of new financial services and products that have increased consumer involvement and improved their access to different segments of the financial market (Chan et al. 2022). However, they have generated new challenges for different stakeholders, such as financial supervision and financial institutions (Chen et al. 2022; Murinde et al. 2022; Ashta and Herrmann 2021). Public authorities need to keep up with technical and financial innovation and better regulate new market operations given the risks that can affect a country's financial stability, which can lead to financial abuse by consumers (Malik and Yadav 2022). In addition, the digitalization of financial operations generates new risks such as the risk of cyber-attacks, but it also brings new opportunities to reduce the risk of money laundering and terrorist financing (Dobrowolski and Sułkowski 2019; Janjua and Khan 2020).

Increasing the accessibility of financial products and services for both individuals and entrepreneurs should be a concern for financial institutions not only as a business opportunity, but also as a corporate social responsibility (Palazzo 2019; Siano and Palazzo 2019). For example, entrepreneurs in rural areas could be among the beneficiaries of new financial technologies that will allow them access to banking and non-banking products and services without having to travel to urban areas. Microfinance can also be a solution to support small businesses, and FinTech can facilitate its expansion (Nguyen et al. 2022). The impact on local communities would be considerable because the development of local entrepreneurs has training effects at the regional level, which contributes to the sustainable development and financial resilience of rural areas (Yue et al. 2019).

Utilizing data from banks from 115 countries over a 16-year period, Murinde et al. (2022) concluded that banks are engaging in developing FinTech platforms as technologies are forming opportunities for financial institutions. The research conducted by Chen et al. (2022) demonstrated that banks' reactions to FinTech are rather slow.

The generalization of cashless transactions is generated by the expansion of the use of new financial technologies, thanks to the measures imposed by public authorities (payment of salaries of state employees, pensions or allowances only on cards, and payments of a certain value should be made only by bank transfer), and increasing the degree of financial education (Nathan et al. 2022). An essential element is the attitude of consumers and small entrepreneurs toward cash transactions considering the traditions, culture, and religion (Loo 2019; Srivastava et al. 2019; Rubino et al. 2020; Liaqat et al. 2022).

Restrictions on physical distance have intensified online commerce as well as digital payments and receipts, with the coronavirus (COVID-19) crisis playing a key role in promoting FinTech globally (Nathan et al. 2022). Therefore, despite the negative effects that this event has had on the world economy, the opportunities generated in the financial market are remarkable (Nejad 2022). It must be highlighted that the specialists draw attention not only to opportunities generated by the COVID-19 crisis for the FinTech industry, but also to risks, saying that "the COVID-19 crisis is the first major test of the FinTech sector's resilience during a crisis" (Sahay et al. 2020, p. 4).

In addition, previous research shows that a basket-based stablecoin can increase financial inclusion, decrease the risk of currency fluctuation, and be resilient to currency shocks caused by pandemics or other crises (Giudici et al. 2022). While offering advantages for cross-border payments and financial inclusion (Kondova and Bolliger 2024), stablecoins address the issue of high volatility of traditional cryptocurrencies, making them more suitable for daily transactions (Cao et al. 2024). Giudici et al. (2022) found that a basket-

based stablecoin is less volatile compared to all individual currencies and maintains its value in times of instability.

2.3. FinTech: The Use of Digitization in Financial Operations

According to the research conducted by Joia and Cordeiro (2021), FinTech can serve people without traditional bank accounts, it can reach customers throughout remote geographical locations, and it can be cheaper due to the competition. For this reason, several authors highlight that governments should create suitable mobile and Internet infrastructure, facilitate financial education and digital skill development, increase awareness and trust among consumers, and develop an appropriate legal framework for financial technologies (Joia and Cordeiro 2021; Zhou et al. 2021).

Despite the existence of numerous studies that consider that digitalization has positive effects on the phenomenon of financial inclusion, Victor et al. (2018, p. 503) raised an interesting issue, highlighting that "digital financial services are not the solution but sometimes even the reason for exclusion". In fact, financial innovation and digitalization are so intense that they are able to create a new category of consumers: the "new unbanked". The "new unbanked" are people who previously used traditional financial products and services, but for some reason, with regard to their acceptance of new technologies or their ability to learn new things, they did not access the new applications of Internet banking or mobile banking (Ooi and Tan 2016). The closure of banking offices and the promotion of new digital financial technologies generate financial exclusion, especially for the elderly, which has come to the attention of public authorities given the process of increasing the share of the elderly population, especially in developed countries (Cham et al. 2022). This issue is gaining dramatic momentum, as the new financially excluded people are, in fact, excluded from the digital economy that is about to become widespread (Cham et al. 2022).

FinTech companies make funds available for customers; however, they do not offer illiquid loans through these funds without a special license (Navaretti et al. 2017). In this regard, they act as agencies connecting lenders and borrowers while relocating the credit risk to investors (Navaretti et al. 2017).

Starting from the previous studies, there is a need to better understand all the facets of FinTech's development, as it is clear that this phenomenon is able to generate a complex scenario in which lights and shadows are living side by side.

For this reason, the hypotheses of this study are:

H1: *FinTech is positively correlated to financial inclusion in CEE countries.*

H2: *Digitalization is positively correlated to financial inclusion in CEE countries.*

H3.1: *Internet usage influences FinTech acceptance in CEE countries.*

H3.2: *Making online shopping influences FinTech in CEE countries.*

H3.3: *Paying bills via the Internet influences FinTech in CEE countries.*

H3.4: *Accessing a bank account online influences FinTech in CEE countries.*

H3.5: *Paying utility bills using a mobile phone influences FinTech in CEE countries.*

H3.6: *Making or receiving digital payments influences FinTech in CEE countries.*

H3.7: *Total bank assets in 2020/GDP influence FinTech in CEE countries.*

H3.8: *Account ownership influences FinTech in CEE countries.*

H3.9: *Debit card ownership influences FinTech in CEE countries.*

3. Methodology

3.1. Data Collection

To describe the situation of FinTech in CEE countries, this study considered several variables, which reflect the use of digitization to perform financial operations. Thus, we considered nine variables from 23 countries. For 2020, the data source is Eurostat and RBI (Raiffeisen Bank International)/Raiffeisen Research. The selected countries in the sample are Slovenia, Croatia, Bosnia and Herzegovina, Serbia, Montenegro, Albania, Macedonia, Bulgaria, Romania, Austria, Belarus, Croatia, Czech Republic, Estonia, Hungary, Kosovo, Latvia, Lithuania, Poland, Russia, Slovakia, Turkey, and Ukraine. The variables considered are Internet usage, making online shopping, paying bills via the Internet, accessing a bank account online, paying utility bills using a mobile phone, making or receiving digital payments, total bank assets in 2020/GDP, account ownership, and debit card ownership. All of these selected variables were selected before by other scholars and researchers who focused on the analysis of digital acceptance. A detailed description of the variables is presented in Table 1.

Table 1. Description of variables.

Variables	Description	Unit of Measure	Source Data	Authors
Internet usage (IU)	The share of persons aged > 15 years who used the Internet during the past year	%	Eurostat	Elgin (2013) Goss and Phillips (2002) Nayak et al. (2010)
Making online shopping (MOS)	The share of persons aged > 15 years who used the Internet to buy something online during the past year	%	RBI/Raiffeisen Research	Shih (2004) Liebermann and Stashevsky (2009) Kuswanto et al. (2020)
Paying bills via the Internet (PBI)	The share of persons aged > 15 years who used the Internet to pay bills during the past year	%	RBI/Raiffeisen Research	Mattila et al. (2003) Mantel (2001) DeYoung et al. (2007)
Accessing a bank account online (ABAO)	The share of persons aged > 15 years who used a mobile phone or the Internet to access an account (% age 15+)	%	RBI/Raiffeisen Research	Söderqvist et al. (2008) Riquelme and Rios (2010) Livingstone and Helsper (2007)
Paying utility bills using a mobile phone (PUBM)	The share of persons aged > 15 years who paid utility bills using a mobile phone	%	RBI/Raiffeisen Research	Krolikowski (2014) Tchouassi (2012) Alam and Shahriar (2012)
Making or receiving digital payments (MDP)	The share of persons aged > 15 years who made or received digital payments during the past year	%	RBI/Raiffeisen Research	Shree et al. (2021) Pandey (2022) Antonijević et al. (2021)
Total bank assets 2020/GDP (TBA)	Total bank assets reported to GDP	%	RBI/Raiffeisen Research	Abreu and Mendes (2001) Sari (2020) Hermes and Lensink (2004)
Account ownership (AO)	The share of persons aged > 15 years owning an account	%	RBI/Raiffeisen Research	Wale and Makina (2017) Nandru et al. (2016)
Debit card ownership (DCO)	The share of persons aged > 15 years owning a debit card	%	RBI/Raiffeisen Research	Stix (2004) Lee et al. (2007) Jin and DeVaney (2005)

Source: authors.

3.2. Settings and Sample: FinTech in Central and Eastern European Countries

The CEE geographical area was selected to make a comparison between nations, with distinct economic, social, and cultural perspectives regarding FinTech adoption and digital accessibility. Several studies have highlighted the need to analyze this geographical location.

Thus, using data collected between 1995 and 2015 and panel econometric techniques, Huang et al. (2021) made a comparison regarding the financial inclusion of old and new EU member countries. Although the researchers demonstrated that the impact of financial inclusion on economic output varies among EU countries, notable differences were detected, and the impact was higher in the low-income and new EU member countries than in the old EU countries (Huang et al. 2021). The new members of the EU are countries with lower levels of development, which is why labor migration to Western European countries has been favored by people's desire to earn more and have a better quality of life (Comes et al. 2018; Bunduchi et al. 2019). This not only generated significant financial flows to countries of origin, but also favored the process of financial inclusion (Jushi et al. 2021). The families left in the country have not only received important sums for a period, but their financial behavior has improved considerably. They have accessed not only financial products such as banking cards, but they have also made considerable savings through bank deposits (Vasile et al. 2021).

Similar studies have examined other countries in Central and/or Southeastern Europe, demonstrating the positive impact of remittances on the financial inclusion of local consumers. The study by Kokorović Jukan et al. (2020) was conducted for Albania, Bosnia and Herzegovina, Macedonia, Serbia, Croatia, Kosovo, and Montenegro. Using the Probit regression model and data of the Global FIndex for 2011, researchers demonstrated the positive impact of remittances on savings among youths from selected countries.

Considering the low level of financial inclusion of consumers in Central and Eastern European countries, the study by Mnohoghitnei et al. (2021) proposed a solution for this possibility of issuing Central Bank Digital Currencies (CBDCs), and the research focused on the impact of issuing CBDCs on financial stability and financial inclusion. The CBDCs are considered to be a solution for low financial inclusion because they allow unbanked or underbanked people to have access to traditional financial services without opening a formal bank account.

In addition, Laidroo et al. (2021) focused on the FinTech's business model in five rapidly emerging hotspots in CEE, namely, Estonia, Latvia, Lithuania, Poland, and Russia, which are considered regional leaders. The results obtained from an online survey were analyzed using descriptive statistics and cluster analysis. The major differences among the countries analyzed were observed, with the business models of FinTech companies being strongly influenced by the market maturity.

3.3. Data Analysis

The study is based on regression analysis, and was realized using Eviews 12, SPSS, and Tableau. Regression analysis is one of the most used methods of statistical analysis, with the main objective being to describe the relationship of a response with explanatory variables (Liang and Zeger 1993). With regard to the form of dependent variable distribution, there are multiple types of regression analysis (Alexopoulos 2010). In the case of continuous and approximately normal distribution, the linear regression model is used (Rosner 2015), assessing the impact of multiple variables in the same model (Draper and Smith 1998). Thus, it predicts the value of the dependent variable based on values of the independent variables, describing how the dependent variables depend on the independent variables (Alexopoulos 2010).

In this context, this study proposed the following three models, considering the following dependent variables: paying bills via the Internet (1), paying utility bills using a mobile phone (2), and making or receiving digital payments (3). The equations for the three models can be written as:

$$\text{PBI} = \beta_0 + \beta_1 * \text{IU} + \beta_2 * \text{MOS} + \beta_3 * \text{ABAO} + \beta_4 * \text{MDP} + \beta_5 * \text{TBA} + \beta_6 * \text{DCO} + \beta_7 * \text{AO} + \varepsilon \tag{1}$$

$$\text{PUBM} = \beta_0 + \beta_1 * \text{IU} + \beta_2 * \text{MOS} + \beta_3 * \text{ABAO} + \beta_4 * \text{MDP} + \beta_5 * \text{TBA} + \beta_6 * \text{DCO} + \beta_7 * \text{AO} + \varepsilon \tag{2}$$

$$\text{MDP} = \beta_0 + \beta_1 * \text{IU} + \beta_2 * \text{MOS} + \beta_3 * \text{PBI} + \beta_4 * \text{ABAO} + \beta_5 * \text{PUBM} + \beta_6 * \text{TBA} + \beta_7 * \text{DCO} + \beta_8 * \text{AO} + \varepsilon \tag{3}$$

where β_i are parameters to be estimated and ε is the error term.

Thus, we are highlighting which variables in the analysis are influencing paying bills via the Internet, paying utility bills using a mobile phone, and making or receiving digital payments. To group countries according to FinTech, this study used cluster analysis (Ketchen and Shook 1996). Hierarchical cluster analysis implies collection methods seeking to construct a hierarchically arranged sequence of partitions for some given object set, resulting in a hierarchy based on proximity measures defined for every pair of objects (Köhn and Hubert 2015). Hierarchical cluster analysis aims to establish a hierarchy of clusters (Murtagh 2014), attempting to group subjects with similar features into clusters (Zhang et al. 2017).

Moreover, to create clusters, the dissimilarities or distances between objects when forming the clusters were used (Zolfaghari et al. 2019). The most common distance is the squared Euclidean distance (Zhang et al. 2017), which is necessary to select the clustering algorithm to determine the specifying cluster membership (Zolfaghari et al. 2019). Finally, to estimate the distance between two clusters, this study used the Ward's method (Ward 1963), that is, the pair of clusters to merge based on the optimal value of an objective function.

3.4. Empirical Results

To analyze which variables influence FinTech in CEE countries, the study describes the summary statistics of the variables (Table 2). As can be observed, the average for the Internet usage is 82.59%; for online shopping, 43.59%; for paying bills via the Internet, 47.67%; and for making or receiving digital payments, 80.33%.

Table 2. Summary statistics.

Variables	Mean	Standard Deviation	Min.	Max.
IU	82.59	7.51	64.60	97.00
MOS	43.75	18.11	17.00	88.00
PBI	47.67	24.17	12.00	94.50
ABAO	45.03	21.75	13.50	92.00
PUBM	8.80	4.94	2.50	19.50
MDP	80.33	15.14	40.50	99.00
TBA	97.57	33.65	43.00	183.40
AO	85.63	11.09	57.00	99.00
DCO	75.70	17.32	37.00	97.00

Source: authors.

To proceed to correlation and regression analysis, the authors started creating the Boxplot, identifying that the variables were approximately normally distributed (Figure 1). The distributions were symmetric; thus, the linear regression analysis could be applied.

To detect whether the variables were correlated, Pearson correlation was used, according to which the variables were positively correlated (Table 3), but multicollinearity was not detected (Table A1, Appendix A). The multicollinearity was also tested using VIF, highlighting no problems.

In this context, three regression analyses were conducted, considering the following as dependent variables: paying bills via the Internet (Model I), paying utility bills using a mobile phone (Model II), and making or receiving digital payments (Model III). The results are presented in Table 3.
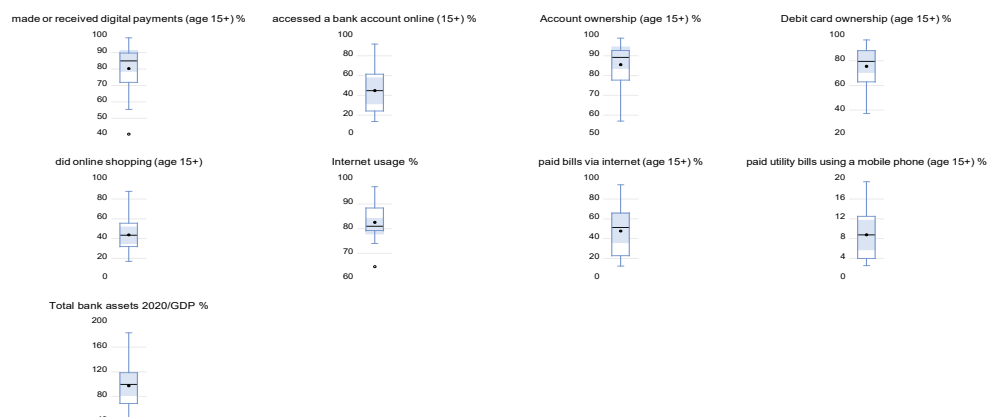
Figure 1. Boxplot. Source: authors.

Table 3. Results of the regression analysis.

	Model I		Model II		Model III	
Dependent Variable	**PBI**		**PUBM**		**MDP**	
	Coefficient	**Prob.**	**Coefficient**	**Prob.**	**Coefficient**	**Prob.**
Explanatory Variables						
IU	0.1932	0.4814	−0.1788	0.9863	−0.1766	0.0664
MOS	−0.0153	0.9387	−0.0145	0.1089	−0.0026	0.9709
PBI					0.0340	0.7542
ABAO	0.9380	0.0006	0.1394	0.0105	0.0700	0.5637
PUBM					−0.0807	0.6101
MDP	0.1621	0.8504	−0.2716	0.4734		
TBA	0.0173	0.7384	0.0263	0.7618	0.0018	0.9218
DCO	0.0214	0.9312	0.1483	0.8973	0.14247	0.0929
AO	0.0289	0.9757	0.2210	0.3482	1.0205	0.0000
Intercept	−28.6601	0.3483	7.0282	0.3509	−7.3891	0.5052

Source: authors.

According to Table 3 paying bills via the Internet is significantly influenced by accessing a bank account online, the other variables being insignificant. In case of paying utility bills using a mobile phone, it is influenced by online shopping and accessing a bank account online. Making or receiving digital payments is significantly influenced by Internet usage, owning a debit card, and owning an account. Cluster analysis was used to group the countries in CEE according to the FinTech status, with three different clusters highlighted (Figure 2).

As can be observed from Figure 2, Cluster 1 includes Croatia, Bosnia, Serbia, Albania, Bulgaria, Romania, Belarus, Czech Republic, Estonia, Hungary, Kosovo, Latvia, Lithuania, Slovakia, and Ukraine. Cluster 2 includes Austria, Poland, and Turkey. Cluster 3 contains Russia only. Therefore, the majority of countries are homogenous, being situated in Cluster 1. This cluster represents the lower level in terms of FinTech. Austria, Poland, and Turkey are more developed in terms of FinTech, and Russia registers the highest values.
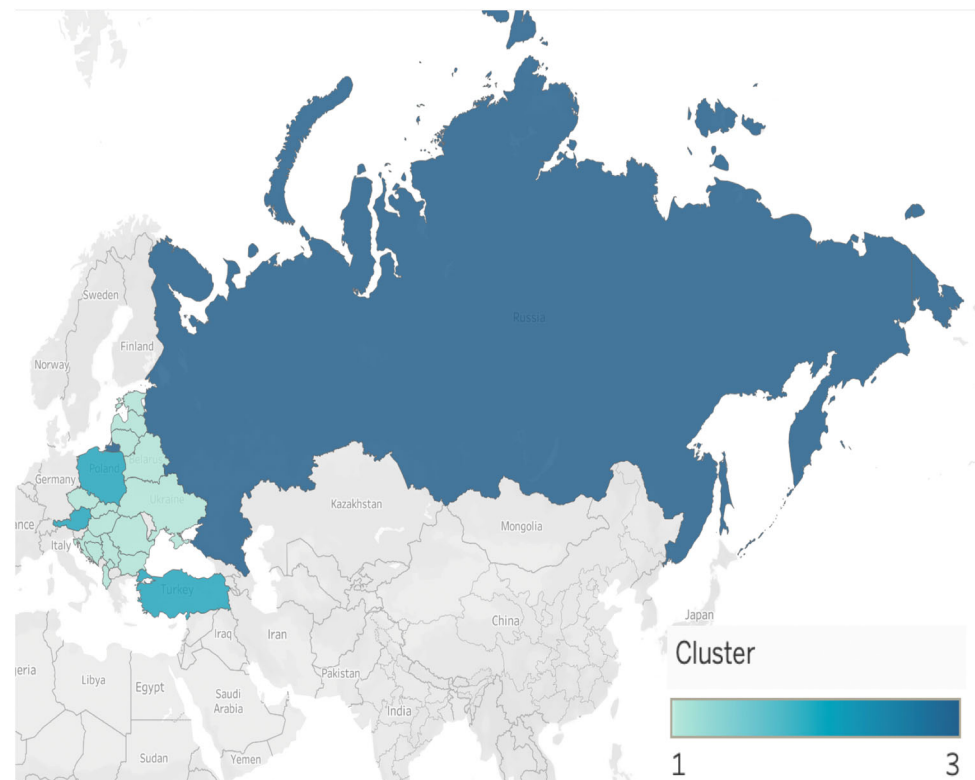
Figure 2. Clusters of countries in Central and Eastern Europe according to FinTech status. Source: authors.

4. Discussion

Starting from the analysis of previous studies, Central and Eastern Europe have not been of interest to researchers in terms of analyzing the level of financial inclusion and FinTech expansion. They focused their studies on developed countries (USA, EU) or emerging countries such as BRICS or ASEAN countries (Allinger 2018; Zaborovskaya et al. 2021). The CEE countries were partially selected only when the studies aimed at analyzing the situation of financial inclusion in the European Union. This is because most countries in Central and Eastern Europe are former communist countries characterized by a low level of financial education, which is reflected in the circumscribed use of financial products and services by their populations. Furthermore, banks operating in these countries are mostly foreign-owned, but this has not prevented them from engaging in unethical behavior that has tried to take advantage of the low level of financial education of the population to maximize profits (Panait et al. 2021). In addition, financial scandals in which the credit institutions were involved (the best known being the Swiss franc crisis) generated limited trust of customers toward bank institutions (Panait et al. 2021; Zeldea 2021).

As indicated by our findings, taking into account H1 and H2, most CEE countries (belonging to Cluster 1) have a similar level of financial inclusion, which can be explained by (i) the historical conditions that have shaped a certain pattern of economic development, (ii) the propensity for entrepreneurship and the level of financial education (most are former communist countries), (iii) the status of member countries or candidates for the EU (which generates a certain similarity of the legislative and institutional system on the financial market), (iv) the presence of foreign investors from Western Europe (Germany, France, Italy, Spain), (v) the attitude toward loans, and (vi) the lack of trust in financial institutions (Zeldea 2021).

The leaders of the region are Poland, Austria, and Turkey (Cluster 2). Consumers in these countries stand out in terms of access to digital financial products and services. The achieved results seem to reflect Abramova et al.'s (2020) findings, which focused on the FinTech market in Hungary, Poland, Slovakia, Romania, and Ukraine. The results of their

study demonstrated the leader position of Poland as well. In addition, the potential in the FinTech branch in Visegrád Group countries Poland, Czech Republic, Slovakia, and Hungary was analyzed by Sadłakowski and Sobieraj (2017). In line with our analysis and considering our hypotheses 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, and 3.9, the scholars concluded that the greatest potential for development is recorded by Poland due to the openness of the Polish peoples to the adoption of new technologies available on the financial market.

Focusing, instead, on the cases of Austria and Turkey, the high degree of financial inclusion that these countries attained can be explained by (i) the level of economic development; (ii) the urbanization; (iii) the stability of the banking system; and (iv) the level of financial education, Internet, and mobile usage (Klapper and Singh 2015; Sarigul 2020; Stakić et al. 2021).

Finally, considering the level of financial inclusion in Russia, this study highlights that, despite the territorial incongruities in the distribution of financial products/services across this country, the progress in promoting this trend in the area is real, and it is mostly concentrated in the western part of the country (Zaborovskaya et al. 2021).

5. Conclusions: Theoretical and Managerial Implications

The problems related to financial education and financial inclusion in CEE are complex and require significant effort and coordination among policy makers, financial product/service providers, the academic society, and customers, including both individuals and FinTech firms. The leading role of governments in promoting digitalization and financial inclusion should undoubtedly be positively evaluated. Several studies have demonstrated that CEE countries are on the right path: These geographical areas are gradually shifting from financial exclusiveness toward financial inclusiveness, also thanks to the Internet usage (Vasile et al. 2021). However, a closer look at FinTech adoption, as provided by this study, confirms that significant challenges still remain. Territorial discrepancies in the distribution of new financial products/services persist across CEE. The majority of the population seems to have problems with digitalization issues and new financial products/services providers. As a result, financial inclusion remains a significant issue. Moving toward understanding a more explicit role of financial inclusion in the modernization process is required.

In addition, social media pressure is escalating, often involving e-word of mouth among users, and is able to affect consumer behaviors in several sectors, including banking and insurance offers. Considering the significance of digitalization and the future trends related to social media empowerment, users should strengthen the use of these e-channels to profile financial products/services according to their specific needs. In so doing, users can succeed in democratizing access to credit, which is often hampered by policies and standards of institutions governing the market.

In contrast, it is fundamental that FinTech pay attention to user demands expressed through online touchpoints, putting into practice online organized listening activities. The scope is creating targeted social media content for different types of stakeholders (Confetto and Siano 2018), as well as reassuring and guiding them in first approaching the digital technologies and then the financial world. For this reason, it is relevant that in this process, FinTech safeguards the privacy of the users' personal and financial data, implementing technological security systems and leveraging positive reputation and trust. Another issue that can be suggested to FinTech is the disclosure of information and users' experiences related to these peculiar products/services, because they were recently released and are still, to some extent, unknown to the general public.

We, thus, suggest that FinTech should share information on the Internet aiming not only to propose their offer to users, but also to foster financial education thanks to clear and simple communication about the characteristics of the services. This, indirectly, could also generate advantages for society, such as financial development, inclusion, social stability, and consequential sustainable development (Zhang-Zhang et al. 2020; Gigauri et al. 2023). This strategy could lead to attracting more users that will become more aware about their

capabilities of purchasing financial services and understanding their features and potential risks. Moreover, increasing financial literacy empowers individuals/consumers to increase their own benefits, helping FinTech in reducing financial inequalities according to the Sustainable Development Goals (SDG 10). This means that social media communication is a good way for FinTechs to create "shared value" between companies and consumers, taking advantage of the discussion on social responsibility and sustainability to trigger inclusive and participatory processes of engagement. This aim can be also attained by reducing bureaucracy, implementing many different digital communication channels, guaranteeing privacy, decreasing barriers to engagement with the online content, and creating products/services that truly respond to users' needs.

This study successfully added to the existing literature on FinTech by examining the risks of the adoption of financial technologies, discussing financial inclusion in CEE countries, and exploring the impact of FinTech on CEE countries. Moreover, the paper offers managers and scholars several insights about Internet usage in CEE countries, analyzing different issues such as online shopping, paying bills via the Internet, and sending or receiving digital payments. In fact, this is one of few papers to study the adoption of FinTech while focusing on the role played by digitalization in helping consumers to accept this innovative kind of financial service/product. Nevertheless, several limitations inhibit the generalization of the empirical results of this study. First, the results clearly reflect the features of a specific geographical area, characterized by peculiar economic and social issues. Therefore, our findings cannot be generalized to any other different context.

Moreover, the research suggests that there is a relationship among the selected variables (i.e., Internet usage, did online shopping, paid bills via the Internet, accessed a bank account online, paid utility bills using a mobile phone, made or received digital payments, total bank assets in 2020/GDP, account ownership, and debit card ownership) related to digitalization and FinTech acceptance. Because these variables were analyzed during a specific time, there could be some peculiarities, which may have changed if the analysis were performed over a diverse period of time. The study tried to overcome this limit by considering various data and perspectives. Nonetheless, the paper suggests developing further studies to better explore the items and their existing relations by implementing other methods, which can reflect users' points of view about FinTech. The use of other approaches can allow for the triangulation of results.

Author Contributions: Conceptualization, M.C.P., S.A.A. and I.G.; methodology, S.A.A.; software, S.A.A.; validation, M.C.P., S.A.A. and I.G.; formal analysis, M.C.P., S.A.A. and I.G.; investigation, M.C.P., S.A.A., I.G., M.G.C. and M.P.; resources, M.C.P., S.A.A., I.G., M.G.C. and M.P.; data curation, M.C.P., S.A.A., I.G., M.G.C. and M.P.; writing—original draft preparation, M.C.P., S.A.A., I.G., M.G.C. and M.P.; writing—review and editing, M.C.P., S.A.A., I.G., M.G.C. and M.P.; visualization, M.C.P., S.A.A., I.G., M.G.C. and M.P.; supervision, M.C.P., S.A.A., I.G., M.G.C. and M.P., project administration, M.C.P. All authors have read and agreed to the published version of the manuscript.

Data Availability Statement: Data is contained within the article.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Correlation.

Variables	IU	MOS	PBI	ABAO	PBUM	MDP	TBA	AO	DCO
IU	1	0.43	0.43	0.41	0.43	0.11	0.21	0.18	0.32
MOS	0.43	1	0.87	0.89	0.59	0.75	0.44	0.72	0.77
PBI	0.43	0.87	1	0.97	0.67	0.85	0.31	0.83	0.84

Variables	IU	MOS	PBI	ABAO	PBUM	MDP	TBA	AO	DCO
ABA	0.41	0.89	0.97	1	0.64	0.85	0.29	0.82	0.83
PBUM	0.11	0.59	0.67	0.64	1	0.62	0.36	0.60	0.65
MDP	0.16	0.75	0.85	0.85	0.67	1	0.31	0.99	0.92
TBA	0.21	0.44	0.31	0.29	0.36	0.28	1	0.27	0.35
AO	0.18	0.72	0.83	0.82	0.60	0.99	0.27	1	0.90
DCO	0.32	0.77	0.84	0.83	0.65	0.92	0.35	0.90	1

Source: authors.

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