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UNRAVELING THE PROFITABILITY PUZZLE: A COMPREHENSIVE ANALYSIS OF BANKS' IT ADOPTION IN SOUTHEAST AND CENTRAL EUROPE[5]

The purpose of this research paper is to investigate the impact of commercial bank branches (CBBs), automated teller machines (ATMs), the number of debit cards (NDCs), and the number of credit cards (NCCs) on Banks Profitability (BP) in terms of Return on Assets (ROA) and Return on Equity (ROE). The sample used for this research covers the years 2017-2022, respectively 108 yearly observations with a particular emphasis on the eighteen Southeast and Central European countries (SCE). The current research employed panel data, with the econometric strategy that combines ordinary least squares (OLS) and generalized methods of moments (GMM) to examine the premise. The findings indicate that NDCs and ATMs have a negative statistical influence on BP, whereas CBBs and NCCs have positive influences, based on the static approach. Additionally, results obtained from the dynamic GMM approach indicate that ATMs, CBBs, and NCCs positively impact BP, whereas NDCs have the opposite effect. From the perspective of originality and scientific contribution, the research is considered unique in the inclusion of variables and countries in the analysis.
Keywords: Bank profitability; financial services; entrepreneurial orientation; panel data.
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1. Introduction

Global economic progress is significantly aided by the presence of commercial banks. A robust and efficient banking system can meaningfully affect economic activity by expediting

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the transfer of capital, streamlining the flow of goods and services, and speeding up payment activities (Salih, Alsalhia, Abou-Moghli, 2024). The banking sector is undergoing numerous changes due to the advancement of information technology, global competition, as well as the improvement of the quality of services. From the bank's perspective, implementing qualitative initiatives like Six Sigma, Lean, and Lean Six Sigma has produced positive outcomes, including increased profit, and qualitative and efficient services (Avdullahi, Fejza, 2015). One of the most significant challenges faced by the banking system in the past decade was the Covid-19 pandemic, which directly impacted liquidity shortages, the deterioration of loan quality, and increased pressure for compliance with regulations established by supervisory authorities (Huang et al., 2023). However, commercial banks nowadays, do not have the luxury of easily expanding their market share. They face formidable competition from other commercial banks. According to Ercegovac, Klinac and Zdrilić (2020), the banking industry is encountering heightened competition also from non-banking entities. Therefore, their focus on providing quality services, enhancing efficiency, and leveraging multiple distribution channels helps them to maintain competitiveness, improve performance, and gain an edge in the market. According to Magallón González, Figueroa and de la Torre-Torres (2023), several elements contribute to BP, but they can be broadly split up into two groups: internal and external influences. A bank's profitability is heavily influenced by a variety of critical internal factors, including internal processes, risk mitigation, financial resilience, loan performance, managerial decisions, operational efficiency, risk management, capital adequacy, and funding costs. The bank's profitability is hammered by an array of external factors. Some of these factors are heavy market competition, technological advancements, and macroeconomic factors.

Bank branches and ATMs serve as distribution channels of the banking sector, serving as essential means of delivering financial services to customers. While physical branches offer traditional in-person transactions, personalized services, and financial advice, ATMs offer self-service options that enable basic transactions at various locations, enhancing accessibility beyond regular banking hours. In the study conducted by Aslam et al. (2019), it is emphasized that the usage of ATMs by customers, in terms of reliability and practicality, is associated with factors such as ease of use, security level, privacy protection, availability outside regular hours, and various other dimensions. As a result of these findings, the management structures within the banking industry should improve and expand the ATM network to further enhance service quality. Within the larger payment infrastructure, debit and credit cards function as transaction facilitators and are classified as financial products and payment instruments. With the help of these cards, customers may access money, make purchases, and conduct financial transactions. They can do so by easily completing transactions using already-established distribution channels including ATMs, online payment gateways, and point-of-sale terminals. Bank's profits increased from credit cards, but they also faced higher risks (Sinkey, Nash, 1993). Alfonse and Florence (2012) investigated the impact of credit cards on Kenyan banks' performance using a descriptive approach. The study revealed that the utilization of credit cards increased bank revenues. Numerous financial ratios and BP indicators that assess how well a bank is generating profits relative to its assets, capital, and other financial metrics can be used to determine BP. Numerous financial ratios and performance indicators that assess how well a bank is producing earnings relative to its assets, capital, and other financial metrics can be used to

determine banks' profitability. However, from our review of the literature, we have not found any research paper that investigates the impact of bank branches, ATMs, NDCs, and NCCs on BP in terms of ROA and ROE. Thus, with this article, we aim to fill this gap in the literature.

Therefore, to address this gap, the current study accurately examines multiple variables that enlighten BP by examining a sample of 17 countries from 2017 to 2022. More particularly, the study on the topic brings several significant thoughts. Firstly, it contributed to the expansion and improvement in analyzing the variables influencing BP through static and dynamic approaches. Secondly, the study deals with several determinants that have been addressed insufficiently, perhaps not at all, by different researchers, which adds value in terms of scientific contribution and bringing innovations in this particular field. Thirdly, the paper experimentally clarifies how channels of distribution, especially the number of ATMs, the NCBBs, NCCs, and the NDCs influence BP in Southeast and Central Europe (SCE). Fourth, the study can be utilized as an inspiration for future research on this topic, while additionally exploring other determinants categorized as the products of modern banking. Finally, this study offers observable information that certain authorities may leverage as guidelines to identify the significance and relevance of these determinants concerning BP. The remaining parts of the article are designed, including the literature review section, the methodological approach, the discussion of the results, and the conclusions.

2. Literature Review

The academic literature examines the banking industry from several angles. According to Magallón González, Figueroa, and de la Torre-Torres (2023) it is delving into its history, performance, and relationship. According to Murinde, Rizopoulos, and Zachariadis (2022), the banking system has played a decisive part in the economic lives of many developed civilizations, serving as a symbol of sociological and cultural advancement and financial strength. In addition, Tmava, Avdullahi, and Sadikaj (2018) stress that the transfer of money from left-over to shortage economic units is made possible by banks acting as financial intermediaries. A nation's economy suffers when there is a lack of competition among banks (Fejza-Ademi, Avdullahi, Tmava, Durguti, 2022), leading to higher costs for financial goods and services (Cetorelli, Strahan, 2006). Emerging technologies are making the banking industry more competitive, which means that institutions need to work even harder to maximize performance to stay ahead of the competition (Murinde, Rizopoulos, Zacha, 2022). The influence of the FinTech development on the forthcoming of banking: opportunities and risks. Through the integration of technologies like blockchain, Artificial Intelligence (AI), Robotic Process Automation (RPA), and the Internet of Things (IoT), the financial sector is experiencing a digital transformation that is resulting in improved customer experiences, streamlined banking processes, and significant changes to industry operations (Vijayashree, 2022).

Silber (1983) asserts that traditionally the banking industry is heavily regulated, which limits and constrains innovation (Ashiru, Balogun, Paseda, 2023). This results in the banking industry having set informal restrictions. These restrictions limit the banks' capability to test

out new concepts and can also make financial institutions less efficient (Ashiru, Balogun, Paseda, 2023). Therefore, the constrained-induced financial innovation theory that was developed by Silber (1983) advocates for accepting financial innovation. The COVID-19 pandemic for a very short period forced the digitization of the operations of many businesses (Kim, 2020), including the banking sector. Entrepreneurial orientation is considered a critical component of improving the performance of organizations that helps firms identify and successfully navigate new investment possibilities and areas, resulting in desired outcomes and ongoing progress (Salih, Alsalhia, Abou-Moghli, 2024). Having an entrepreneurial mindset has a big impact on how well banks work, especially when it comes to choosing distribution channels like ATMs, POS terminals, bank branches, and other technology-driven channels that reflect the banking industry's commitment to innovation. To ensure a dynamic and customer-centric approach that complies with changing market demands, technological advancements, and client preferences, banks can effectively evaluate and optimize the deployment of these channels by embracing an entrepreneurial mindset.

This will ultimately lead to increased operational efficiency and improved overall performance. Due to reduced costs as a result of the proliferation of technology, banks encourage customers to use electronic channels including ATMs, POS terminals, mobile banking, and online banking (Ketkar, Ravi, Banwet, 2012). In their study, Le and Ngo (2020), looked into the influences that affect BP in 23 different countries between 2002 and 2016. The outcomes show that BP can be increased by increasing the number of bank cards issued, ATMs, and point of sale (POS) terminals (Le, Ngo, 2020).

According to Ming-Pey (2022) with the emergence of technology devices like Internet banking, mobile banking, and e-money, electronic payment has developed into a higher level of payment services. In addition, Yang, Li, Ma, and Chen (2018) point out that with the use of electronic banking, ROE and ROA are going to increase. As stated by Hernando and Nieto (2007), Spanish banks have experienced the profitability of Internet banking only after three years of adoption. Researchers (Durguti, Arifi, Gashi, Spahiu, 2023; Le, Ngo, 2020; Valverde, Humphrey, 2009) have examined ATMs and Bank branches aspects. Le and Ngo (2020) conducted a cross-country analysis in industrialized and unindustrialized economies to look at the effects of credit cards, ATMs, POS, non-performing loans, capital-to-assets, market concentration, GDP growth, and inflation on BP. The study's results display that ATMs, and credit cards all have a favourable impact on bank performance. For a period of six years (from 2013 to 2019), Awan and Parveen (2023) used data from twelve chosen commercial banks as a sample of study to examine the effects of financial innovations on the financial performance of commercial banks in Pakistan, using three profit indicators: ROA, ROE, and earning per share (EPS). The results show that the quantity of ATMs, mobile banking, and online banking are the most efficient ways to influence banking services.

3. Research Methodology

3.1. Research questions, data and sample

For our research purpose, our study addresses the following research questions:

RQ1: *Does the presence of more bank branches enhance customer retention and acquisition, thereby increasing profitability?*

RQ2: *Is there an important interplay between ATM availability and BP?*

RQ3: *How does the issuance of debit cards relate to the overall BP?*

RQ4: *How does the issuance of credit cards relate to the overall BP?*

This research relies on the selection variety of variables attempts to discover the interaction that exists within financial innovations on the bank profitability (BP) for the SCE (Albania, Bulgaria, Bosnia & Herzegovina, Czech Republic, Croatia, Estonia, Germany, Hungary, Kosovo, Lithuania, Latvia, Montenegro, North Macedonia, Poland, Romania, Slovenia, Slovakia and Serbia). Therefore, the research sample focuses exclusively on these economies and covers the 6 years. The justification for the inclusion of these 6 years is to capture developments that may have new financial technologies that are outlined as innovations in the context of the SCE. Another additional incentive for exploring these countries was if they have adapted the advancements imposed by information technology, as a result of confronting worldwide competition. Hence, the current research covers the period 2017-2022 employing panel data within the official format released by the IMF. However, it's worth emphasizing that the restriction at this particular period is caused by some of the countries included in the research failing to provide data for earlier periods.

The dependent variables, which are ROA and ROE are expressed in percentages, meanwhile, the independent variables everyone is expressed in natural logarithms (ln). Throughout recent times, numerous research studies utilized various controlling variables to examine their influence on BP. The conceptual framework of the quantitative approach as well selection of a set of variables with substantial modifications were fostered by the authors Arifi (2023), Ashiru, Balogun, and Paseda (2023), and Durguti, Spahiu, and Gashi (2023). Table 1, in detail, displays the applicable variables and the source wherein they were obtained. By investigating the research questions, we can understand how these variables influence bank profitability, helping to inform strategic decisions aimed at enhancing BP.

Table 1. Description of variables

Explanation	Denominations	Acronyms	Data sources
Dependent variable	Return on assets	ROA	IMF
	Return on equity	ROE	IMF
Independent variable	Automated teller machines	lnATMs	IMF
	Commercial bank branches	lnCBBs	IMF
	Number of credit cards	lnNCCs	IMF
	Number of debit cards	lnNDCs	IMF

Source: Author's compilation.

3.2. Model specification

This section of the research discusses the main justifications behind employing econometric approaches to explore the interaction between bank profitability (BP) and modern financial services offered by banking businesses in SCE countries. After an extensive review of theoretical and empirical evidence, specifically using panel data, it is determined that any

approaches have limitations. Nevertheless, when dealing with dynamic panel data, there is widespread consensus on using the dynamic approach. The strength of this opinion is particularly evident when the time series (individual panel data) are equal to or lesser than the number of countries ($T \leq N$) involved in the research (Hoechle, 2007). In the following, we are going to explain the justification behind the approaches used, which will be the main focus of the examination of the results. Considering, the dynamics of panel data minimizes the acceptance of the static OLS approach, especially since in such instances could potentially lead to inaccurate and unreliable results due to the causal connection discovered between the predicted variable and lagged panel data (Hasanovic, Latic, 2017). The simplified form of the OLS approach is:

$$Y_{it} = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n + \varepsilon_{it} \quad (1)$$

Y_{it} denotes our dependent variables ROA and ROE, whereas X_1, X_2, …, Xn presents a set of our independent variables as presented in Table 1, with associated coefficients β_1, β_2, βn, along with an intercept term α_0 and an error term ε_{it}. Consequently, having in mind that the OLS approach may not produce robust results, this mathematical equation the authors Arellano and Bond (1991) incorporated certain modifications (in setting the difference and instruments) necessary to explore the nature of the dynamic data, which is known as GMM. This modification addresses endogeneity issues, which might lead to biased and heterogeneous results under certain conditions even though we observe individual countries. Even after successfully implementing these modifications, multiple researchers claimed that this approach should still be boosted by placing additional instruments to be incorporated into the model. To accomplish the recommendation on the framing of additional instruments, the authors Arellano and Bover (1995) also Bllunden and Bond (1998) offered an important modification compared to the previous approach, setting the conditions for the utilization of differences as well as the use of additional instruments within the approach. Thus, this significant modification has resulted in a combination of the static approach (OLS), the inclusion of restrictions on the effective use of the difference, and the increasing number of instruments with panel data. Finally, this version is known as the two-stage GMM approach. The quality that distinguishes this approach from other methods is that it overcomes concerns with endogeneity and autocorrelation, as well as eliminates errors within the model (Ullah et al. 2018).

Mathematically, this equation proposed in the first difference can be expressed:

$$\Delta Y_{it} = \Delta \sum_{j=1}^{r} \varphi_j Y_i, t - j + X_{i,t}\beta_1 + w_{it}\beta_2 + \pi_i + \varepsilon_{i,t} \quad (2)$$

Y_{it-j} represents the lagged value of the dependent variable Y for entity i at time $t - j$, $t - j$ denotes a subscript separator, indicating that Y is indexed by both entity i and time $t - j$. The model aims to analyze how changes in the dependent variable (ΔYit) are influenced by lagged values of the dependent variable, as well as other independent variables. In addition, by changing the parameters of the second equation in our authentic example, the approach for both models will be as follows:

$$\begin{aligned} \Delta ROA_{i,t} = \varphi + \Delta\mu\left(ROA_{i,t}\right)_{-1} + \beta_1\left(ATMs_{i,t}\right) + \beta_2\left(\ln CBBs_{i,t}\right) + \beta_3\left(\ln NCCs_{i,t}\right) \\ + \beta_4\left(\ln NDC_{i,t}\right) + \pi_i + \varepsilon_{it} \end{aligned} \quad (3)$$

$$\Delta ROE_{i,t} = \varphi + \Delta\mu(ROE_{i,t})_{-1} + \beta_1(ATMs_{i,t}) + \beta_2(lnCBBs_{i,t}) + \beta_3(lnNCCs_{i,t}) + \beta_4(lnNDC_{i,t}) + \pi_i + \varepsilon_{it} \quad (4)$$

Where: ROA as well ROE – denote the dependent variables, β_1 to β_4 – associated coefficients to other independent variables in the analysis, i – denotes the specific effects in the background of the analysis, t – denotes the time covered by the analysis 2017-2022, π_i- denotes the unobserved effects and specific issues, and ε_{it}- represents potential errors in the mathematical simulation. In both formulas $\Delta\mu(ROA_{i,t})_{-1}$ and $\Delta\mu(ROE_{i,t})_{-1}$ the "-1" subscript indicates that the variable being referred to is from the previous period and represents the change in the mean of ROA and ROE between the previous two time periods. This allows the model to capture temporal dynamics and dependencies in the data when analyzing the relationship between ROA and ROE and other variables.

4. Finding's Discussion

4.1. Descriptive statistics

The current section offers an extensive examination of the results obtained through the panel data, studying each variable thoroughly. As demonstrated by the data in Table 2, the mean value of the ROA is 1.29. This proves that each country analyzed over the specified period had a positive return. The smallest score recorded was 0.07, while the highest score was 2.76. Upon analyzing the second metric, it is observed that the ROE has a mean value of 10.61. Unfortunately, there is a discrepancy with the ROA, where the smallest score is -0.41 and the highest score is 24.92. The results obtained from this research give us stable indications that SCE countries during the observation period have a stable profitability rate. Simultaneously, integrating ATMs into the operations of commercial banks has led to a mean value of 4.13 (or 66.31 ATMs per 100,000 inhabitants). Croatia achieved the highest score of 5.05 (equivalent to 156.20 ATMs per 100,000 inhabitants) in 2019. Whereas, Lithuania achieved the smallest score of 3.38 (equivalent to 29.56 ATMs per 100,000 inhabitants) in 2022. According to Lietuvos Bankas (2022), due to the easing of COVID-19 restrictions, the outbreak of war in Ukraine, and higher wages and social benefits, the demand for cash in Lithuania was notably higher during the first half of 2022 compared to the same period in 2021. Therefore, the Bank of Lithuania, the Association of Lithuanian Banks, and the country's main credit institutions signed a Memorandum of Understanding to ensure access to cash in Lithuania and installed 100 ATMs in the regions in 2022 (Lietuvos bankas, 2022).

Table 2. Description of variables

Variables	Obs	Mean	SD	Min	Max	Skewness	Kurtosis
ROA	108	1.289	0.515	0.071	2.760	0.223	3.458
ROE	108	10.611	4.503	-0.410	24.921	0.268	3.518
lnATMs	108	4.134	0.344	3.386	5.051	0.087	3.616
lnCBBs	108	3.025	0.516	1.777	4.369	-0.257	3.093
lnNCCs	108	5.237	0.674	3.703	6.752	0.179	3.327
lnNDCs	108	7.034	0.508	5.954	9.477	1.952	11.817

Source: Author's calculations.

In terms of providing service coverage, lnCBBs has a mean score of 3.03 (equivalent to 23.38 branches per 100,000 inhabitants). The lowest coverage value achieved is 1.78 (or 5.91 branches per 100,000 inhabitants), reached in Latvia in 2022. This is mostly due to an 80% decline in the number of bank branches in Latvia over the last decade, with only roughly 70 sites currently providing face-to-face customer assistance (Bērtiņa, 2024). However, this situation is expected to change since the President of the Bank of Latvia, Mārtiņš Kazāks, stated: "*Financial services must be equally available in both physical and digital formats that customers should be able to choose their preferred medium, but it cannot be limited to digital channels*" (Bērtiņa, 2024). The most significant coverage value reached is 4.37 (or 79.04 branches per 100,000 inhabitants), achieved in 2022 in Bulgaria. According to Parusheva (2018), this can be attributed to Bulgaria's well-developed physical banking infrastructure.

The overall use of lnNCCs has a mean score of 5.24, the smallest score reached is 3.70 in 2017 in Albania. This can be attributed to the fact that Albania joined the credit card system rather late and is currently facing issues such as a market flooded with sophisticated credit card systems, misinformed customers, and banks that lack application approval models (Galo, 2016). Whereas the highest score of 6.75 was reached in 2022 in Slovenia. This can be mainly due to the very early development of the system for information exchange by the Association of Banks of Slovenia for commercial banks and savings bank members, which facilitated credit card payment services (EBRD, 2014). The final variable considered in the analysis is lnNDC, having a mean score of 7.03 with a standard deviation of 0.51. The lowest score reached is 5.95 achieved in 2017 by Albania. The low usability of debit cards and credit cards in Albania turns out to be a result of the high level of shadow economy (Dybka et al., 2019). In addition, the highest score achieved is 9.45 achieved in 2022 by Lithuania. This is mainly due to the majority of the people opting to pay by card rather than in cash, especially for minor payments up to €5 (Lietuvos bankas, 2022). Within the setting of the data variability analysis, it can be observed that only lnCBBs have a negative coefficient of skewness, meaning that the data are skewed left, while the rest of the variables have positive signs. Kurtosis, on the other hand, reflects that all variables have positive signs, which means a significant correlation in data distribution. Generally, in an extensive manner, Table 2 offers the entire descriptive information for the observed period.

4.2. Correlation analysis

The research attempted to ensure if the data has any cause for concern regarding multicollinearity within dependent variables (ROA & ROE) and independent ones, correlation analysis, and vector inflation factor (VIF) were performed. The discoveries of the tests mentioned are shown in Tables 3 and 4.

Table 3. Correlation matric for ROA

	ROA	lnATMs	lnCBBs	lnNCCs	lnNDCs	VIF	1/VIF
ROA	1.000						
lnATMs	-0.270	1.000				2.49	0.402
lnCBBs	-0.035	0.413	1.000			1.61	0.620
lnNCCs	-0.149	0.586	-0.071	1.000		2.50	0.399
lnNDCs	-0.106	-0.094	-0.194	0.069	1.000	1.41	0.707
VIF mean						**2.00**	

Source: Author's calculations.

The findings of Table 3 exhibit evidence that ROA has a weak negative association with every factor incorporated into the model, and at the same time, this slight association provides evidence that the data doesn't have any dilemma with multicollinearity. Gujarati (2004) has established statistically that if any coefficient inside the association analysis has a value equal to or higher than ($\beta \geq 0.75$), then it is believed that the statistics hold deficiencies with multicollinearity. Furthermore, recent studies on the issue of multicollinearity within the regression analysis, underline that if the value of the correlation coefficient is higher with even variables, then it is suggested that the possibility of multicollinearity is possible. In this context, if the absolute value of the correlation coefficient is close to 0.8, collinearity may exist (Young, 2017). The authors Belinda and Peat (2014) reached the same argument regarding multicollinearity, noting that the issue with multicollinearity is evident if the coefficients within the correlation analysis exceed the individual value of 0.8. However, in cases such as when we are dealing with panel data and the performance of regression analysis, we use it more widely and the most accurate results are provided through vector inflation analysis (VIF). More specifically, to verify this phenomenon even more, we performed the VIF analysis, and the mean value for ROA is 2.00. Wooldridge (2012) stated that in cases where the VIF result is lower than 10, it can be considered an acceptable result since every coefficient inside the model will be consistent. In an extensive analysis, the author Shrestha (2020) emphasizes that the lowest VIF tolerance provides higher assurance that the data do not have multicollinearity problems. Furthermore, more specifically the challenging value of VIF when it is between 5 and 10. What is observed in our analysis is the highest individual value is 2.49, which provides stable evidence regarding this matter.

Table 4. Correlation matric for ROE

	ROE	lnATMs	lnCBBs	lnNCCs	lnNDCs	VIF	1/VIF
ROE	1.000						
lnATMs	-0.384	1.000				2.24	0.445
lnCBBs	-0.172	0.412	1.000			1.49	0.671
lnNCCs	-0.192	0.586	-0.070	1.000		1.88	0.533
lnNDCs	0.113	-0.094	-0.194	0.069	1.000	1.05	0.953
VIF mean						**1.66**	

Source: Author's calculations.

Additionally, as we examine the data in Table 4, we can observe that we have a positive association between ROE and lnNDCs, whereas there is an adverse association with the other factors. Considered as a whole, regarding multicollinearity even due to the second metric ROE, we do not observe any factors that have a coefficient higher than ($\beta > 0.75$), therefore

we can assume that the data don't have cause for concern with this issue. This interpretation is further strengthened by the outcome of the VIF examination, exhibiting a mean value of 1.66.

Based on the results presented in Tables 3 and 4, a slight negative correlation is observed, excluding NBCs, with ROE showing a slight positive interrelation. This phenomenon of slight negative interrelation can be elaborated through several arguments. First, the expansion of bank branches and the number of ATMs by financial institutions directly influence the increase in their operational costs. Therefore, the increase in operating costs may negatively affect both ROA and ROE since these institutions are obliged to utilize more inputs to support the expansion of their networks. Second, the continuing improvement in competition in the supply of financial services manifests itself in increased competitiveness, making it harder for banks to maintain their net interest margin. Lastly, the financial technology development and investments compelled by banks to be in step with the highly dynamic market involve investments in new infrastructures and other digital services which may be shown in their profit level.

4.3. Unit root test

Intending to increase the soundness and consistency of the examination, the investigation devoted the Levin-Lin-Chu test to evaluate the stationarity of panel data. This step is crucial since panel data is susceptible to stationarity issues, and these can result in unpredictable conclusions. The accuracy of this test relies on the premise (null hypothesis) that if the data being analyzed are not stationary, then they possess a unit root. Results offered in Table 5 validate that all the variables incorporated in the model exhibit stationarity at level.

Table 5. unit roots

	ROA	ROE	lnATMs	lnCCBs	lnNCCs	lnNDCs
At level						
Statistic	-13.612	-13.035	-4.447	-6.865	-30.862	-12.978
ρ – value	0.000	0.000	0.000	0.000	0.000	0.000

Source: Author's calculations.

The results obtained here demonstrate that there is no combination among integration orders, however, there exists a long-standing relationship within the lnATMs, lnCBBs, lnNCCs, and lnNDCs, as well as bank profitability (BP). To reinforce this justification, we performed the Pedroni and Westerlund integration test, wherein the result was tested at the 1% confidence level. The results of these measurements for ROA were $\rho = 0.000$, correspondingly $\rho = 0.006$, whereas for ROE were $\rho = 0.000$, correspondingly $\rho = 0.005$ (see Table 6 in the diagnostic testing subsection). Therefore, taking into account these data, our research rejects the null hypothesis and validates the alternative hypothesis. The conceptualization of this discovery validates that the applied data are correctly integrated (Pedroni, 1999).

4.4. Findings and Interpretation

Our study adapted the OLS and two-step GMM economic modelling paradigm to underline the short-term impact caused by variables called modern financial services (financial innovations) on bank profitability (BP). The primary emphasis of the research will be on the dynamic panel approach because ROA and ROE are affected by their historical values coming from prior periods. For this reason, shedding light on the results will be in the spirit of the model adapted by authors Blundell and Bond's (1998) two-step GMM system presented in Table 6. Therefore, initially, various diagnostic procedures of OLS and GMM will be addressed and explained. Based on the outcomes of the model according to the static approach (OLS), it can be observed that the F-test across the two metrics has a coefficient smaller than 10 ($F \leq 10$), which signifies that all the coefficients are determined adequately. Furthermore, the probability value under both instances is $\rho = 0.000$. From the standpoint of the explainability of the independent variables to the dependent one, it can be observed that 20.6 per cent explain the return on assets (ROA), and 19.9 per cent explain the return on equity (ROE). In contrast, the remaining percentage is described by those variables that are not encompassed in the model. To determine if the data have any worries with heteroscedasticity, we employed Breusch-Pagan, and in both metrics, it seems that the ρ - value is insignificant ($\rho = 0.488$), and this conveys solid indications that the data does not suffer from heteroskedasticity problems.

Regarding the tests performed using the dynamic two-step GMM approach, the Sargan test was initially executed, which is utilized to verify if the instruments have been widely recognized and to identify the restrictions of their over-identification. By analyzing the values ($\rho = 0.317$ for ROA; and $\rho = 0.312$ for ROE) it was determined that the instruments are placed perfectly in the entire research scenario, due to their value ($\rho \geq 0.10$). Additionally, for determining whether the data possess any concerns regarding serial autocorrelation, AR1, and AR2 were performed, whereby examining their results it is observed that AR1 is significant ($\rho = 0.057$, respectively $\rho = 0.056$), whereas the results of AR2 has the insignificant value ($\rho = 0.103$, respectively $\rho = 0.113$), thereby offering robust insight that the data doesn't have difficulties with serial autocorrelation (Arellano and Bond, 1991). Most importantly, are the results of the Wald test chi (2) = 122.67, respectively 1,024.31 that both of these metrics turned out to be with $\rho = 0.000$, which at first indicates that the model is perfectly defined, considering the first difference and the instruments.

Similarly, as was previously emphasized, the core focus of the finding discussion will concentrate on the two-step GMM approach, which is designed to adapt to the dynamic characteristics of the panel data. Considering the findings in Table 6, it has been discovered that lnATMs, lnCBBs, lnNCCs, and lnNDCs have an important positive influence on BP, except in the case of the lnNDCs variable which was discovered to have an important negative influence on the ROA. The improvement of customer services through the deployment of ATMs, which leads to improved accessibility and availability, exhibits a significant statistical influence on the bank's profitability, with a confidence level of 1 per cent.

Table 6. Empirical results

	OLS approach				***Two-stage GMM approach***			
	ROA		ROE		ROA		ROE	
	β	ρ ≥ [z]	β	ρ ≥ [z]	β	ρ ≥ [z]	β	ρ ≥ [z]
lnATMs	-0.922	0.000	-7.466	0.000	0.003	0.020	0.017	0.055
lnCBBs	0.219	0.052	0.738	0.452	0.068	0.069	0.095	0.000
lnNCCs	0.297	0.006	1.215	0.194	0.001	0.002	0.021	0.000
lnBDCs	-0.241	0.025	-0.228	0.006	-0.002	0.002	0.002	0.024
cons	4.577	0.000	34.485	0.000	0.646	0.000	-0.541	0.794
Diagnostic test								
F-test	6.680	0.000	6.420	0.000	"-"	"-"	"-"	"-"
R-squared	0.206	"-"	0.199	"-"	"-"	"-"	"-"	"-"
Wald chi2(5)	"-"	"-"	"-"	"-"	122.67	0.000	1024.31	0.000
Breusch-Pagan	0.481	0.488	0.481	0.488	"-"	"-"	"-"	"-"
Pedroni test	"-"	"-"	"-"	"-"	6.473	0.000	6.473	0.000
Westerlund test	"-"	"-"	"-"	"-"	1.516	0.006	1.515	0.005
Sargan J test	"-"	"-"	"-"	"-"	14.845	0.317	14.922	0.312
$AR_{(1)}$	"-"	"-"	"-"	"-"	-1.896	0.057	-1.907	0.056
$AR_{(2)}$	"-"	"-"	"-"	"-"	-2.906	0.103	-2.903	0.113

Source: Author's calculations.

Following the ceteris paribus theory, a 1 per cent increase in the improvement and deployment of ATMs for customers is estimated to have a beneficial impression on BP. For instance, this may result in a 0.3 per cent increase in ROA and a 1.7 per cent increase in ROE. The conclusion is derived through the coefficients and ρ -values. More precisely, for ROA, the constant is β=0.003 with a ρ -value of ρ = 0.020, meanwhile, for ROE, the constant is β = 0.017 with a ρ -value of ρ = 0.055. The findings of our research align with those of Arifi (2023), who employed a similar econometric approach to examine the influence of ATMs and NBBs on BP in the instance of Kosovo also North Macedonia, the author concluded that the deployment of ATMs and the extension of the NBBs possess a positive influence on BP. Durguti et al. (2023) studied the implications of ATM deployment and broadband expansion across Southeast European Countries on bank profitability. The results of the research present sufficient proof that both of these variables have a positive influence on BP. Our results are in line with Garškaitė-Milvydienė and Tvaronavičiˇ (2024), indicating that having more ATMs improves a bank's financial performance as they are considered an asset, increasing its worth. Therefore, the fundamental need for financial innovations is the setup of widespread broadband infrastructure, the setting up of an appropriate number of ATMs, as well the issuing of credit/debit cards to clients. The rise in numbers or expansion of branches creates facilities in the performance of financial services on the one hand, however, on the other hand, it also creates additional revenue (through various commissions) for financial institutions. Consequently, in our actual scenario, lnCBBs across both metrics (ROA with ρ = 0.069 and ROE with ρ = 0.000) contributed to significant statistical influence at the 1 per cent confidence level. This indicates that a 1 per cent growth in lnCBBs will cause a rise of 6.8 per cent in ROA, respectively 9.5 per cent in ROE. Indeed, it is important to highlight the fact that several countries that have been included in the analysis in recent years started to close their physical offices and replace them with 24/7 online services. Lastly, the research paper performed by Arifi (2023) explicitly addressed the expansion of commercial bank

branches in Kosovo and North Macedonia, where a significant positive association was discovered, nevertheless, it was noted that in recent years the banks trying to reduce their expenses have started decreasing the number of bank branches.

The following variable, which is a connecting component of financial innovations, is the number of credit cards delivered by the bank (lnNCCs) that are used by clients, based on the value of the constant ($\beta = 0.001$ with $\rho = 0.002$ for ROA, and $\beta = 0.002$ with $\rho = 0.0024$ for ROE) reveal the statistically significant positive influence on bank profitability. These discoveries allow us to understand that a 1 per cent increase in the number of credit cards issued by banks will influence the increase in bank profitability (0.1 per cent in ROA, and 0.2 per cent in ROE). The conclusions of our research align with the same vein of the research performed by the authors Le and Ngo (2020) who discovered that the NCCs issued, ATMs, and the number of points of sales positively influence bank profitability. Moreover, the authors draw attention to the need for further expansion of these distribution channels. Saroy, Jain, Awasthy, and Chandra Dhal (2023) also evaluated the utilization of credit cards issued by banks through the DEA approach from the perspective of cost reduction and more effective customer service. Indeed, even though any cost reduction for financial institutions leads to an improvement in the level of profitability.

Lastly, concerning the lnNDC variable, divergent findings within ROA and ROE have been discovered, where ROA has resulted in significant adverse influence at a significance level of 1 per cent, whereas ROE exhibited significant positive influence. Our findings enable us to understand that a 1 per cent increase in lnNDC is expected to have a negative influence on ROA by 0.2 per cent ($\beta = -0.002$, with $\rho = 0.002$). Our results are in line with Garškaitė-Milvydienė and Tvaronavičі (2024) indicating that debit cards and digital payments harm Italian banks' ROA ratios. Whereas a 1 per cent increase in lnNDC would positively influence ROE by 0.2 per cent. The discoveries of the research fit perfectly with the spirit of the authors Doran, Bădîrcea, and Manta (2022) since they strongly assert that the implementation of financial innovation, especially during and after the COVID-19, had a substantial influence on bank profitability. The authors reached this conclusion by examining 10 Central and Eastern European Countries over the period 2010-2021 via three regression models. Meanwhile, our results for ROA correspond with the results obtained by Akhisar, Batu Tunay, and Tunay (2015) who analyzed 23 advanced and developing countries to examine the influence of financial innovations on bank profitability. The results of their research contend that financial innovations can be beneficial for the banking industry since they have a positive influence, instead, some electronic services, including the number of debit cards, possess a negative influence, and their effects rely on the level of development of the monetary system of the countries involved in the analysis.

5. Conclusions and Recommendations

This article examines how the number of bank products (NCCs and NDCs) and distribution channels (the number of ATMs and NCBBs) affect BP in terms of ROA and ROE in Southeast and Central Europe (SCE). We have used dynamic panel data obtained from the IMF database for our study as secondary data, focusing on eighteen Southeast and Central

European (SCE) nations and covering the years 2017-2022. Using an econometric approach that combines generalized methods of moments (GMM) and ordinary least squares (OLS), we investigated how bank products (NDCs and NCCs) and distribution channels (ATMs and CBBs) affected Banking Performance (BP) as measured by Return on Equity (ROE) and Return on Assets (ROA). The results show a statistically negative impact observed on the number of debit cards (NDC) and Automated Teller Machines (ATM) on BP. These results may be a consequence of the high operational and maintenance costs of ATMs, as well as the low charges of Debit Cards, which may increase operating expenses and suggest a possible detrimental impact on business profitability. Income from interest charges usually comes from interest on revolving balances, as cardholders who carry over an outstanding balance from one month to the next are assessed interest on the balance (Franklin, Lupini, 2023). The number of Commercial Bank (CBB) branches enhances client interaction by allowing employees to discover consumer needs and cross-sell products and services. Furthermore, the findings suggest that ATMs, CBBs, and NCCs have a favourable impact on BP, while NDCs have the opposite effect. Commercial bank management should act entrepreneurially, aiming to improve performance by successfully identifying pain points, opportunities, and new areas of improvement and investment. The article seeks to stimulate a qualitative discussion regarding policy modifications and regulatory structure reviews that could impact BP.

We recommend policymakers consider ways to reduce the expenses of operating and maintaining ATMs in light of their detrimental effects on BP. This could entail supporting shared ATM networks or providing incentives for institutions to implement affordable technology. We recommend encouraging sustainable banking practices, that can establish minimum fees or looking at alternative fee structures. Given the beneficial effects of the number of credit cards (NCCs) on BP, bank authorities can try to encourage the credit card industry to expand by launching campaigns. A climate conducive to successful banking would be achieved by striking a balance between protecting customers and permitting fair costs.

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