

CHARTING FINANCIAL INCLUSION IN THE VISEGRAD COUNTRIES: A Comparative Cluster Analysis of Global Findex Data (2017–2021)

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KEYWORDS

financial inclusion, Visegrad Countries, Global Findex, digital financial services, cluster analysis

ABSTRACT

This study examines the improvement of financial inclusion in the Visegrad countries – Czech Republic, Hungary, Poland, and Slovakia – using World Bank Global Findex data for 2017 and 2021. We use hierarchical cluster analysis to identify patterns across key dimensions, including bank card ownership, savings, credit use, and digital service adoption. The findings indicate substantial progress from 2017 to 2021. While respondents in 2017 primarily relied on basic banking services, by 2021, near-universal bank card access was achieved alongside marked increases in digital transactions and remittance activity. Comparative analysis shows that Slovakia and the Czech Republic lead in financial integration, whereas Poland and Hungary lag. Socio-demographic factors, such as age, income, and employment, significantly influence financial inclusion, with younger, economically active groups more likely to embrace digital financial tools. These results offer critical insights for policymakers aiming to enhance inclusive financial growth in Central and Eastern Europe.

INTRODUCTION

Financial inclusion has been recognized as a catalyst supporting seven out of the United Nations' 17 Sustainable Development Goals. It stands as a crucial factor in international development, capable of enhancing individuals' and households' well-being, stimulating entrepreneurial activities, and fostering economic growth and employment (Abel et al., 2018). Daily bank card usage or the receipt of salary notifications via SMS at the beginning of the month seem commonplace in developed countries. However, in 2021, 24% of the global population lacked even a basic bank account, with higher rates in developing nations (Demirgüç-Kunt et al., 2022).

This paper examines the improvement of financial inclusion in the Visegrad countries – namely, the Czech Republic, Hungary, Poland, and Slovakia – by analysing

individual-level data from the World Bank Global Findex Database for 2017 and 2021. Using hierarchical cluster analysis, we classify respondents according to their engagement with key financial services, including bank card ownership, savings behaviour, credit usage, and the adoption of digital financial channels such as online payments and remittance services.

Our study aims to provide a comparative overview of how financial inclusion patterns have shifted in these countries, highlighting the dynamic interplay between traditional and digital financial practices. In particular, we explore how socio-demographic factors such as age, income, and employment status contribute to distinct clusters of financial behaviour. A growing body of research analyses financial inclusion in African, Asian, or South American countries (Fungáčová-Weill, 2015; Kim et al., 2018, Neaime-Gaysset, 2018, Thai-Ha Le et al., 2019, Khan et al., 2022). However, two-thirds of the high-quality literature analysing the financial inclusion/exclusion of developed countries focuses on the USA and the UK, and only one-fourth on the rest of Europe (Fernández-Olit et al., 2020). Quite a few writings explore the financial inclusion of the CEE region (Botrić-Broz, 2017; Burton, 2017 with a special focus on credit inclusion; Corrado-Corrado, 2015), but specifically, the Visegrad countries have not yet been analysed, suggesting that our research could significantly contribute to the literature.

Our investigation reveals that while basic financial services have become nearly universal, significant heterogeneity remains in the uptake of advanced services. This explorative study presents a detailed analysis of the clusters identified in 2017 and 2021, emphasizing both convergences and divergences in financial behaviour across the region.

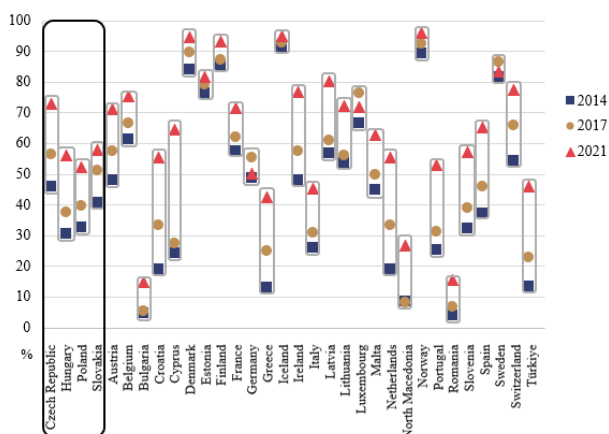
FINANCIAL INCLUSION: DEFINITIONS AND THE EUROPEAN LANDSCAPE

Financial inclusion refers to the accessibility and affordability of a broad range of financial products and services, enabling individuals and businesses to participate fully in the economy. According to the World Bank, it encompasses services such as transaction accounts, savings, credit, insurance, and digital payments – provided responsibly and sustainably. Scholars like Dev (2006) and Sarma (2008) have

defined financial inclusion as a process that removes barriers for disadvantaged groups, ensuring that formal financial institutions cater to the needs of all segments of society. Financial inclusion is closely linked to economic empowerment, poverty reduction, and improved living standards.

Technological advancement and long-standing institutional frameworks shape the financial inclusion landscape in Europe. Eurostat data consistently indicate high levels of bank account ownership and access to formal financial services across the European Union. However, despite these high rates, disparities persist, particularly in the uptake of digital financial services (Figure 1). It is worth highlighting the difference between electronic (e-banking) and online banking. The former is a broader category that includes all electronic channels used to access banking services, essentially anything that is not a face-to-face or paper-based transaction. In contrast, online banking specifically refers to banking transactions conducted over the Internet.

Figure 1: Percentage of participants in electronic banking in European Countries (2014, 2017, 2021)



Based on our later calculation, Central and Eastern European countries, including the Visegrad group, exhibit notable differences in adopting online banking, mobile payments, and remittance services. While nations such as the Czech Republic and Slovakia have advanced rapidly in digital integration, Hungary and Poland show slower progress, especially in areas beyond basic banking.

The European approach to financial inclusion emphasizes targeted policies supporting digital literacy and financial education. As banks and fintech firms broaden their services, data security and consumer protection concerns have become prominent. Researchers increasingly view financial inclusion as a multi-dimensional concept shaped not only by financial infrastructure but also by socioeconomic factors such as income, education, and employment. It is also closely linked to income poverty: Varga (2024) notes that Hungary had the highest poverty rate in 2014 and 2017,

followed by Poland and Slovakia, while Czech households were the least affected.

This paper situates its analysis within this broader European context, drawing on the Global Findex indicators to measure how effectively the Visegrad countries have integrated traditional and digital financial services. By comparing the clusters emerging from the 2017 and 2021 data, we provide a nuanced perspective on the progress and remaining challenges.

DATA AND METHODOLOGY

In the empirical analysis of this study, we use microdata extracted from the World Bank Global Findex Database for the years 2017 and 2021. The dataset covers the populations of the four Visegrad countries – Czech Republic, Hungary, Poland, and Slovakia – with each country's sample consisting of approximately 900 to 1,000 respondents after data cleaning. The Findex survey gathers detailed information on various dimensions of financial inclusion, including possession of bank and credit cards, savings behaviour, borrowing from formal institutions, online bill payments, online shopping, remittance activities, and mobile payment usage.

For our analysis, we focus on four key financial services dimensions: (1) bank card ownership, (2) savings at financial institutions, (3) borrowing and credit card usage, and (4) utilization of digital financial services, including online transactions and remittances. Descriptive statistics of each country's sample reveal that while basic services such as bank card ownership approached nearly 100% by 2021, substantial variation persists in digital service adoption and credit use across countries. For example, preliminary analyses indicate that 2017 digital transactions and remittance activities were relatively low, particularly in Hungary and Poland. In contrast, by 2021, these indicators showed a marked increase in all four countries.

Our study utilizes cluster analysis to group individuals from the four Visegrad countries, aiming to unveil their similarities and differences. Due to the presence of binary variables, we use hierarchical clustering in our analysis. Initially, we employed the Ward method with the squared Euclidean distance measure. Subsequently, we explored groups using the Size difference method. To assess the degree of independence between these approaches, we cross-tabulated the two classifications and examined Cramer's V and Phi-square values. The clusters derived from the Ward method exhibited a higher uniformity concerning the number of elements they encompassed. We ensured an equitable distribution, preventing clusters from having either an excessive or insufficient number of elements. A cluster's minimum number of elements accounted for approximately 10%, while the maximum reached 36%. Additionally, a one-way analysis of variance (ANOVA) was conducted on the formed clusters to ascertain statistically significant differences in the overall group averages based on our variables.

Finally, we ran a post hoc Tukey test to identify significant differences among the clusters concerning our variables. We considered disparities in at least 80% of the variables crucial for establishing distinct clusters. We extensively scrutinized individual perspectives across demographic and cluster-forming variables in characterizing these clusters.

Descriptive statistics on socio-demographic factors – such as age, gender, education level, income quintiles, and workforce status – are also incorporated to contextualize the cluster profiles. Appendix 1 and 2 show the descriptives of the demographic, as well as the main financial inclusion variables.

FINDINGS

a) Clusters of 2017

In 2017, the cluster analysis revealed marked heterogeneity in financial behaviour across the Visegrad countries. Five clusters emerged for Hungary and the Czech Republic and four for Poland and Slovakia, each with roughly equal subsamples. These clusters were classified along the strongest financial inclusion variables, as illustrated using a Venn diagram in Figure 2.

We can identify three primary levels of financial inclusion:

1. No inclusion

We found only one Hungarian cluster (HU_1, including 12% of the sample), where participants do not use banking services or own a mobile phone.

There are other 3 clusters (CZ_1, PL_1, HU_1) where individuals only have a mobile phone and no bank services.

2. Moderate inclusion

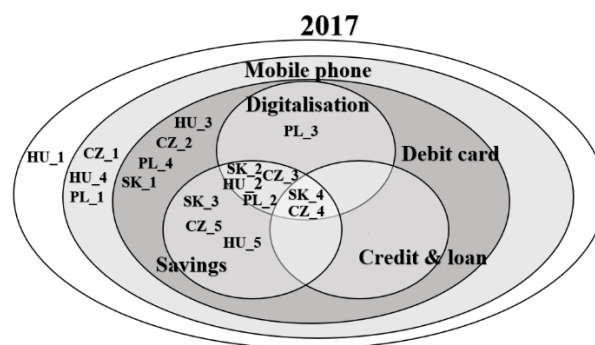
We defined the clusters with moderate inclusion, where the individuals use only one banking service, such as a bank card or bank card + savings. In all four countries, there is one bank card (CZ_2, HU_3, PL_4, SK_1), one bank card + savings (CZ_5, HU_5, SK_3), and one bank card + digitalization (PL_3) cluster.

3. High inclusion

Highly inclusive are those clusters where individuals use combined banking services, e.g., savings and digitalization, or even loans and credit cards.

In Hungary and Poland, the maximum combination is two; however, in the Czech Republic and Slovakia, clusters (CZ_4, SK_4) use all types of financial services.

Figure 2: Grouping of clusters along the main financial inclusion characteristics – 2017



In Appendix 3, we show the distribution of clusters alongside the financial inclusion variables.

Socio-demographic analysis of these clusters revealed:

1. No inclusion

HU_1 (nothing): Individuals in this cluster are mostly elderly (with an average age of 71), not active in the workforce, primarily male, falling within the lowest three income quintiles, and typically having a maximum education level of primary school.

CZ_1, PL_1, HU_4 (only mobile): This group comprises individuals around 60 years old, inactive in the workforce, and mainly possessing secondary education.

2. Moderate inclusion

CZ_2, HU_3, PL_4, SK_1 (only bank card): Aged between 45 and 55, generally with secondary education, this group spans various income categories and is almost equally split between active and inactive in the workforce. The Slovak cluster here tends to be older, with a median age of 60.

CZ_5, HU_5, SK_3 (card + save): This group comprises elderly individuals around 60 years old, falling into higher income categories.

3PL (card + digital services): a very young cluster with an average and median age of 38 and 35, respectively. Primarily comprised of financially well-off, actively working women with at least secondary education.

3. High inclusion

CZ_3, HU_2, PL_2, SK_2 (card + save + digital services): relatively young cluster (average age: 43 years, median: 42 years) with the highest workforce participation (78%). More than 34% belong to the top 20% from an income perspective.

CZ_4, SK_4 (card + save + digital services + credit/loan): around 40-year-old men and women, highly involved in the workforce. The Czech cluster predominantly uses credit cards (88%), while borrowing is notable in the Slovak cluster.

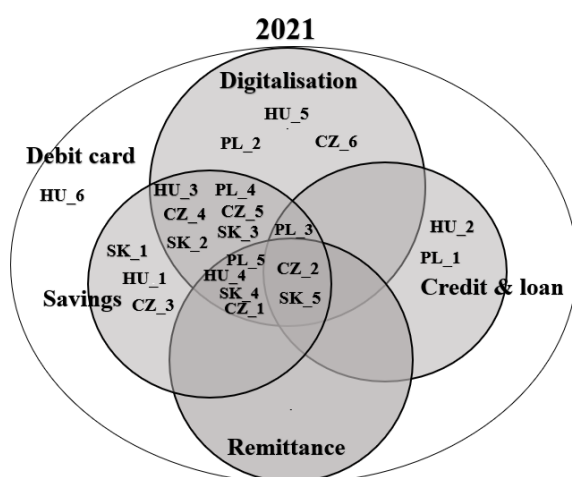
Overall, the 2017 clusters highlighted a transitional phase in financial inclusion: while basic banking services were broadly available, adopting digital financial tools was still in its early stages. The clustering outcomes underscored persistent disparities across countries, with the Czech Republic and Slovakia showing more advanced integration into the formal financial system than Hungary and Poland.

b) Clusters of 2021

By 2021, the landscape of financial inclusion in the Visegrad countries had significantly transformed. Near-universal bank card ownership became a defining feature across all nations. The no-inclusion clusters are entirely erased from the samples. The cluster analysis for 2021 identified a higher number of groups – reflecting increased heterogeneity – compared to 2017.

In addition to the previous 2017 clustering criteria, we added ‘remittances’¹ separately as a significant grouping factor.

3. Figure: Grouping of clusters – 2021



In 2021, Hungary's lag behind the other Visegrad countries became even more pronounced. In Appendix 3, we included the distribution of 2021 clusters too.

61% of respondents use only one service. Hence, their level of financial inclusion falls behind that of the other countries. Here, three clusters emerged where digitalized services are not typical, with 42% not utilizing digital banking services. In the other three countries, those clusters not using digital banking services are much less represented (in Slovakia, this is only 16%, in the Czech Republic, 22%, and in Poland, 23%).

The Czech respondents are the second most active in savings; 89% of all respondents have savings at financial institutions (in Slovakia, this is 100%; however, in Poland and Hungary, it is only around 60%).

Credit and loans are not highly penetrated in the three Visegrad countries (14% in Czechia, 9% in Hungary, and 15% in Slovakia). However, Poland is the most active in this sense, with 45% of respondents.

We found clusters encompassing all financial services users only in the Czech Republic and Slovakia.

In summary, regarding financial inclusion, Hungary lags behind the other Visegrad countries, followed by Poland, while the development of the Czech Republic and Slovakia stands out compared to the others.

c) Main Differences Between the Two Years' Clustering

Comparing the percentage of the individuals belong to the cluster(s) with the given characteristic from 2017 and 2021 reveals several key developments (Figure 4).

First, the near-universal adoption of bank cards by 2021 created a baseline from which additional services were layered. In 2017, significant segments of the population either lacked a bank card or used only minimal services; by 2021, the focus shifted to the extent and diversity of service usage.

Second, digital financial services experienced substantial growth (CZ: 48%→78%; HU: 29%→58%; PL: 49%→78%; SK: 45%→83%). Whereas in 2017, digital banking was confined to a few clusters – mainly in the Czech Republic and Slovakia – by 2021, digital engagement became widespread across all countries. This shift is most evident in the emergence of clusters defined by high digital transaction volumes and increased remittance activity.

Third, the complexity of clusters increased over time. The 2021 analysis produced more nuanced clusters, reflecting a diversification in financial behaviour. In particular, clusters that combined multiple financial services – savings, credit, and digital transactions – became more prominent. This indicates that individuals are not merely adopting digital services as an alternative to traditional banking but are integrating them into a more comprehensive financial strategy. Moreover, while socio-demographic factors such as age, income, and education continued to influence cluster membership, their roles evolved. Younger, higher-income respondents became even more concentrated in advanced digital integration and multi-service usage clusters.

Finally, the comparative analysis underscores that while all four Visegrad countries made progress in financial inclusion between 2017 and 2021, the pace and scope of this progress varied. The Czech Republic and Slovakia emerged as leaders in the digital transformation of financial services, whereas Hungary and Poland exhibited a more gradual shift. These differences suggest that local institutional factors, regulatory

¹ Remittances = the traditional electronic payment method where the bank is entrusted with sending the specified amount. The Global Findex questionnaire distinguishes another type of

money transfer, “sending money to friends/relatives”, which is the mobile phone-based money transfer service in our research that is not included in the ‘remittances’ variable.

environments, and levels of digital literacy likely played significant roles in shaping the observed outcomes.

Figure 4: Changes in the characteristics of the clusters – 2017 & 2021



CONCLUSIONS AND LIMITATIONS

This study provides a comprehensive examination of financial inclusion in the Visegrad countries by comparing data from 2017 and 2021. Our analysis, based on hierarchical cluster methods applied to the World Bank Global Findex Database, reveals a substantial transformation in the financial landscape over the four years. In 2017, the financial ecosystem was

characterized by heterogeneous clusters –some marked by limited service usage and others by emerging engagement with digital products. By 2021, near-universal bank card ownership established a new baseline, while significant growth in digital financial services, including online payments and remittance activities, was observed.

The cluster analysis demonstrated that the Czech Republic and Slovakia are at the forefront of digital integration, with large segments of their populations engaging comprehensively with a wide range of financial services. In contrast, Hungary and Poland showed slower adoption of advanced financial tools, highlighting persistent gaps in digital inclusion. Socio-demographic factors continue to shape financial behaviour, with younger, higher-income, and better-educated individuals more likely to integrate multiple financial services into their daily routines.

Our results in the Visegrad countries have significant relevance in light of Huang et al. (2021) research. Their study analysed 27 EU nations and found that financial inclusion has a substantial influence on economic performance in the new and lower-income EU members, such as the V4. Our findings suggest that while overall access to basic financial services has improved, targeted strategies are necessary to foster digital financial inclusion – especially in countries where progress has been slower. It is important to remember that the economies of Central and Eastern European countries are generally more volatile and vulnerable than the more developed economies of Western Europe. As Németh et al. (2025) has shown, people react more sensitively to changing economic situations.

In summary, this explorative paper contributes to understanding regional financial inclusion dynamics and highlights the transformative impact of digital technologies in reshaping financial behaviours. Future research should explore the role of local institutional factors and regulatory frameworks in further advancing financial inclusion in Central and Eastern Europe. Additionally, validating the socio-demographic composition of our sample against large-scale administrative datasets, such as those used by Kovács et al. (2015), may enhance robustness in future research.

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ANNA GARAMSZEGI is a recent graduate, having attained her Master's degree in Economics with a specialization in Corporate Finance from CUB in June 2023. With her diploma thesis on financial inclusion in the Visegrad countries, supervised by Dr. Vaskövi, she won first place in the Banking and Fintech section of the Corvinus University Scientific Student Conference. This thesis served as the foundation of this scientific paper.

APPENDIX 1: Descriptive statistics of the demographic variables 2017 & 2021

		2017				2021			
		Czech Republic	Hungary	Poland	Slovakia	Czech Republic	Hungary	Poland	Slovakia
Age	Average	48	54	45	49	50	52	48	47
	Median	48	55	45	50	48	52	45	45
Gender	Male	43,9%	40,6%	40,5%	43,1%	46,1%	43,8%	47,7%	48,0%
	Female	56,1%	59,4%	59,5%	56,9%	53,9%	56,2%	52,3%	52,0%
Education level	Primary or less	11,3%	23,3%	7,3%	10,3%	3,2%	5,7%	0,6%	1,9%
	Secondary	77,9%	61,5%	65,0%	74,2%	60,2%	48,8%	41,9%	49,8%
	Tertiary or more	10,7%	15,2%	27,7%	15,5%	36,6%	45,5%	57,3%	48,3%
Within-economy household income quintile	Poorest 20%	15,5%	15,7%	15,5%	14,8%	14,9%	13,1%	14,4%	11,8%
	Second 20%	20,3%	18,7%	17,9%	19,0%	19,3%	16,6%	17,6%	17,6%
	Middle 20%	21,2%	21,0%	18,1%	22,3%	23,3%	20,9%	18,2%	20,4%
	Fourth 20%	20,1%	22,7%	22,7%	20,6%	18,9%	23,5%	23,1%	23,5%
	Richest 20%	22,9%	21,9%	25,8%	23,3%	23,5%	25,8%	26,7%	26,6%
Workforce status	Out of workforce	40,6%	49,8%	32,3%	27,9%	28,2%	34,5%	28,2%	26,0%
	In workforce	59,4%	50,2%	67,7%	72,1%	71,8%	65,5%	71,8%	74,0%

APPENDIX 2: Descriptive statistics of main financial inclusion variables 2017 & 2021

		Czech Republic	Hungary	Poland	Slovakia
Has a debit card	2017	77,5%	67,2%	82,7%	77,6%
	2021	95,7%	93,6%	92,6%	96,1%
Has a credit card	2017	24,3%	12,6%	18,1%	21,1%
	2021	33,0%	25,0%	31,4%	35,8%
Made bill payments online using the Internet	2017	59,0%	26,7%	54,9%	51,9%
	2021	82,7%	66,4%	78,9%	80,0%
Bought something online using the Internet	2017	53,1%	24,0%	48,8%	37,3%
	2021	82,1%	65,4%	75,9%	76,2%
Saved in past 12 months: using an account at a financial institution	2017	48,7%	25,8%	38,9%	51,6%
	2021	71,5%	46,9%	45,6%	68,1%
Borrowed in past 12 months from a financial institution	2017	14,5%	6,4%	23,3%	18,0%
	2021	13,2%	9,4%	21,6%	16,3%
Sent domestic remittances in past 12 months	2017	16,2%	7,6%	16,6%	17,2%
	2021	37,7%	28,9%	30,0%	37,9%
Received domestic remittances in past 12 months	2017	15,0%	5,8%	17,5%	14,8%
	2021	30,0%	17,3%	17,3%	28,7%

APPENDIX 3: Distribution of country clusters 2017 & 2021

2017	Cluster code	Distribution	Main feature
Czech Republic	CZ_1	19%	M
	CZ_2	20%	B
	CZ_5	13%	S
	CZ_3	27%	S, D
	CZ_4	21%	S, D, C
Hungary	HU_1	12%	-
	HU_4	15%	M
	HU_3	36%	B
	HU_5	8%	S
	HU_2	29%	S, D
Poland	PL_1	16%	M
	PL_4	35%	B
	PL_3	13%	D
	PL_2	36%	S, D
Slovakia	SK_1	24%	B
	SK_3	32%	S
	SK_2	24%	S, D
	SK_4	20%	S, D, C

M - Mobile phone

B - Bank card

S - Saving

C - Credit & loan

D - Digitalisation

R - Remittances

2021	Cluster code	Distribution	Main feature
Czech Republic	CZ_3	22%	S
	CZ_6	11%	D
	CZ_4	26%	S, D
	CZ_5	11%	S, D
	CZ_1	16%	S, D, R
	CZ_2	14%	S, D, C, R
Hungary	HU_6	12%	B
	HU_1	21%	S
	HU_2	9%	C
	HU_5	19%	D
	HU_3	16%	S, D
	HU_4	23%	S, D, R
Poland	PL_1	23%	C
	PL_2	16%	D
	PL_4	12%	S, D
	PL_5	27%	S, D, R
	PL_3	22%	S, D, C
Slovakia	SK_1	16%	S
	SK_2	21%	S, D
	SK_3	21%	S, D
	SK_4	27%	S, D, R
	SK_5	15%	S, D, C, R