Digital payments as an indicator of financial inclusion in Euro Area countries

Tamara Petrikova[1], Kristina Kocisova[2]

[1] *Technical University of Kosice, Faculty of Economics, Department of Banking and Investments, Slovakia, ORCID: 0000-0002-3094-1114, Tamara.Petrikova@tuke.sk;*

[2] *Technical University of Kosice, Faculty of Economics, Department of Banking and Investments, Slovakia, ORCID: 0000-0003-0784-441X, Kristina.Kocisova@tuke.sk (corresponding author).*

Abstract: *The process of digitisation in the financial sector is developing through the systematic introduction of computer systems, the establishment of Internet connectivity and the use and ownership of various information and communication devices. Information and communication technologies can increase the desired degree of financial inclusion in a country by increasing the availability of various financial services. This study examines the individual attributes that can affect financial inclusion in the Euro Area countries in 2021. Our analysis applies a probit model to data from the World Bank Global Findex database, focusing on digital payments as a proxy for financial inclusion. The main finding highlights that higher income, higher education, female gender, and younger age groups are associated with an increased propensity to engage in digital payments. Notably, our expectation of a non-linear relationship between age and digital payments is confirmed, as evidenced by the application of the Robin Hood algorithm. Specifically, we observe a positive correlation between age and digital payment usage. However, this trend reverses beyond a specific breakpoint, approximately around the age of 40, leading to a subsequent decline in digital payment activity. Furthermore, our research shows that individuals who utilised alternative payment methods alongside cash before the COVID-19 pandemic are likelier to engage in higher digital payments. Additionally, a tendency for higher adoption of digital payments coincides with countries that achieved a higher Digital Access Index (DAI), an indicator assessing the degree of digitalisation in a country. Furthermore, it is associated with countries among the Euro Area's founding members.*

Keywords: *Financial inclusion, made and received digital payments, individual characteristics, Internet, mobile ownership, U-shaped relationship.*

JEL Classification: *G21, O16, P34.*

APA Style Citation: Petrikova, T., & Kocisova, K. (2024). Digital payments as an indicator of financial inclusion in Euro Area countries. *E&M Economics and Management, 27*(2), 162–182. https://doi.org/10.15240/tul/001/2024-5-004

Early Access Publication Date: *January 23, 2024.*

Introduction

In early 2020, with the onset of COVID-19, the global population was attracted and forced to use advanced digital technologies. It catalysed a rapid adoption of technology across various sectors. Kabakova and Plaksenkov (2018) assert that technological advancements rank among the foremost factors contributing to enhanced financial inclusion in numerous countries. Moreover, the pandemic, as noted by Demirgüç-Kunt et al. (2022), profoundly influenced the utilisation and nature of various banking services, fostering concerted efforts towards global financial inclusion. They highlight that the crisis accelerated the surge in online purchases of banking products, which,

in many cases, led to a notable shift away from in-branch transactions towards exclusive online interactions.Consequently, more individuals are now opting for and executing transactions via the Internet, mobile applications or ATMs. This digital revolution, spurred by the pandemic, has revolutionised access to financial services while simultaneously lowering the costs associated with digital transactions for individuals and businesses. As digital payments become more common and the costs continue to decline, many private enterprises have switched to electronically making payments to employees, suppliers, or for tax obligations. Furthermore, this shift has positively impacted governance, as social programs now channel transfers directly to their beneficiaries, reducing leakage and minimising delays in the process. The transition to digital payments has made financial operations more efficient and increased transparency, as funds flow directly from national budgets to individuals, reducing corruption opportunities.

Demirgüç-Kunt et al. (2022) state that the prevalence of digital payments has exhibited significant growth in developing economies, with the share of adults engaged in making or receiving digital payments rising from 35% in 2014 to 57% in 2021. In high-income countries, the share is nearly 95%, while on a global scale, approximately 64% of adults participate in digital payment transactions. According to the definition, digital payments include using a mobile money account, a debit or credit card, a mobile phone or the Internet to make a payment from an account, send money to relatives (or friends) or pay bills. Access to digital payments leads to the financial inclusion of non-financial companies and individuals while boosting resilience and growth on the micro and macro levels. Financial inclusion represents using formal financial services, contributing to the prerequisite of financial development. Information and communication technologies (ICT) have helped the banking sector and countries to become digital, especially with the gradual introduction of mobile phones, the Internet, and various digital services. Adopting diverse ICT platforms engenders a heightened interest in utilising financial accounts for digital payments. It extends to a broader spectrum of financial services, including savings or borrowing through various types of loans. There are still many opportunities to increase the use of financial accounts for digital payments, increasing financial inclusion. For instance, one way to progress involves employing financial accounts to facilitate digital payments for essential utilities such as water and electricity or fully transitioning merchant payments into digital formats. Additionally, digitalising wage disbursements and government payments directly into financial accounts can encourage individuals to save while reducing the time and costs of receiving such payments.

Studying digital payments as an indicator of financial inclusion is important for several reasons. 1) Digital payments serve as a tangible gouge of financial inclusion, offering insights into how individuals can access and utilise formal financial services. By examining digital payment behaviour, researchers and policymakers can assess the inclusiveness of financial systems. 2) Digital payments are emblematic of financial services' accessibility and convenience. A high prevalence of digital payments suggests that financial services are readily available and user-friendly, making them more accessible to a broader population segment. 3) The ability to make digital payments is closely linked to individuals' capacity to engage in economic activities. People who can transact digitally are better positioned to participate in the formal economy, receive wages electronically, make purchases, and access credit, all of which are vital for economic growth and development. 4) Digital payments can enhance financial resilience. Individuals who use digital payment often have the resources to manage more effectively with financial shocks, as they can access their funds and conduct transitions remotely, reducing the risk of financial exclusion during crises. 5) Digital payments can lower transaction costs for both individuals and businesses. It can lead to more efficient financial transactions, facilitating economic growth and reducing the financial burden on users. 6) Digital payments are more transparent and secure than traditional cash transactions. It can reduce the risk of fraud, corruption, and theft, ultimately contributing to financial stability and security. 7) Analysing digital payment data provides policymakers with valuable insights into financial behaviour. This data can inform the development of targeted policies aimed at enhancing financial inclusion, improving the efficiency of the financial system, and fostering economic development. 8) Understanding digital payment adoption can help

identify gaps in access to digital infrastructure and financial services, highlighting areas where interventions are needed to bridge the digital divide and ensure that all population segments can benefit from digital financial services. Studying digital payments as an indicator of financial inclusion allows for a comprehensive assessment of financial inclusion in a given region or country. It sheds light on the extent to which financial services are accessible, affordable, and user-friendly, ultimately contributing to economic development, reducing poverty, and improving the financial well-being of individuals and communities.

The evolution of digital payments poses several key questions. Firstly, which individual characteristics influence the use of digital payments in Euro Area countries? Secondly, has there been a change in the use of digital payment after the coronavirus pandemic? Thirdly, is the level of digitalisation in the country crucial for increasing financial inclusion expressed through digital payments? To address these questions comprehensively, our study aims to examine the impact of individual characteristics on financial inclusion in the Euro Area countries in 2021. Methodologically, we employ a probit model as our research framework. The dependent variable under consideration is the indicator of financial inclusion, specifically from the perspective of digital payments. Our primary control variables include age, gender, education level, and household income quintile. To address our second research question regarding changes in financial behaviour after COVID-19, we include an additional control variable designed to capture shifts in financial behaviour caused by the pandemic. In our final model, we introduce two supplementary variables: the duration of Euro Area membership and the Digital Access Index (DAI), which help us to answer the third research question. The micro-level data is taken from the Findex Global Questionnaire survey administered by the World Bank for 2021. The International Telecommunication Union publishes the data about DAI.

The remainder of this article is structured as follows. Section 1 provides an overview of the existing literature on financial inclusion. Section 2 describes the data and methodology employed in this study. Section 3 analyses digital payments in the Euro Area countries and presents our key findings. Finally, Section 4 draws conclusions from the study's findings.

1. Theoretical background

In this section, we offer a comprehensive review of the existing literature related to financial inclusion. We present the key findings from other scholars who have examined financial inclusion using different indicators across various countries and periods.

Financial inclusion, as defined by the World Bank (2022a), encompasses the provision of accessible and cost-effective financial products and services adapted to the needs of both individuals and businesses. These services include a spectrum ranging from transactions and payments to savings, credit, and insurance, all delivered responsibly and appropriately. Ozili (2021) characterises financial inclusion as ensuring that individuals, especially those facing financial difficulties, access fundamental financial services within the formal financial sector. Erlando et al. (2020) emphasise that formal financial inclusion starts with establishing a deposit account at a bank or other financial service provider, extending to the making and receiving payments, secure money storage or savings management. Moreover, financial inclusion also includes credit availability from formal financial institutions and insurance products designed to mitigate financial risks. In recent years, we have seen an increased interest in financial inclusion at political and academic levels. Scholars such as Ozili (2021) and Demirgüç-Kunt et al. (2018) emphasise its pivotal role in achieving the goals of sustainable development in the country. Lenka and Barik (2018) identify financial inclusion as a driving force behind the construction of inclusive societies and economies, while Demirgüç-Kunt et al. (2022) argue that it serves as a critical factor in poverty reduction, mitigating income inequality, and fostering inclusive economic growth. Additionally, Nagpal et al. (2020) state that enhanced financial inclusion contributes to the stability of the financial system in the country and the effectiveness of its monetary policies. However, it is essential to recognise that access to financial services is more readily available to individuals in developed nations. In contrast, individuals in developing countries often face significant barriers. Erlando et al. (2020) characterise financial inclusion as a process characterised by advances in the quantity, quality, and efficiency of financial services, each of which plays a role in simplifying lives, enhancing opportunities, and strengthening

economies on an individual level. Furthermore, Chinoda and Mashamba (2021) underscore the importance of easy access to and the utilisation of affordable financial services and products customised to diverse business and individual needs, which include transactions, payments, savings, or loans. However, they suggest that geographical location, local context, and environmental factors significantly impact the implementation of financial inclusion.

The opposite of financial inclusion is financial exclusion. One of the initial efforts to define financial exclusion can be found in the study of Leyshon and Thrift (1995), who characterise it as preventing disadvantaged individuals from accessing essential financial services. Sinclair (2001) further explains financial exclusion as the inability to access necessary financial services. Claessens (2006) highlights that financial exclusion is linked to social exclusion, meaning that access to financial services depends on factors such as education, employment status, income level, and other individual attributes. Sinclair (2013) also highlights the limited access to conventional banking services for individuals with limited incomes, particularly those residing in economically disadvantaged areas. In such cases, reliance on cash transitions becomes the norm due to the absence of direct access to formal financial services. These problems individuals face create inefficiencies that hamper economic growth and deepen poverty, primarily due to unequal access to financial resources. Many authors emphasise the imperative for governments, central banks, and regulators to understand the determinants of financial inclusion and the underlying reasons for financial exclusion. Such understanding enables the formulation of effective policy and regulatory measures to address these issues comprehensively.

Demirgüç-Kunt et al. (2022) highlight fundamental financial inclusion indicators, including financial account or mobile money account ownership, savings, borrowing, and digital payments. Key among these indicators is account ownership, as defined by the World Bank (2022b), which refers to the ownership of an individual or jointly owned account at a regulated institution, such as a bank, credit union, microfinance institution, post office, or mobile money service provider. Aurazo and Vega (2021) regard access to financial and mobile accounts as a fundamental indicator of financial inclusion, which should be universally available to every adult in the country. Such account ownership empowers individuals to utilise financial services, fostering their personal development and, at the same time, contributing to the development of their nations. Owners of accounts can send or receive money and, with access to other financial services, can withstand financial shocks more effectively compared to those without such access. From a global perspective, account ownership has shown substantial growth over the past decade. According to Demirgüç-Kunt et al. (2022), between 2011 and 2021, global account ownership increased from 51% to 76%. Notably, in European countries like Denmark, Iceland, Germany, Austria, the United Kingdom, the Netherlands, Sweden, and Ireland, reaching 100% account ownership has become commonplace. It underscores the fundamental nature of this financial inclusion indicator. The second key indicator of financial inclusion is borrowing, which includes adults who have obtained loans within the last 12 months, including through credit card usage. According to the World Bank (2022b), in 2021, 53% of adults worldwide reported having borrowed any money, with formal borrowing predominating over-borrowing from family, friends, or other sources. High-income economies like Canada (81%), USA (66%), Japan (61%) and European countries such as Iceland (73%) or Switzerland (61%) exhibit higher rates of borrowing through formal means. Savings are another indicator of financial inclusion. Individuals save for several reasons, including future expenses, education or business investments, and retirement planning. Globally, 49% of adults saved or set aside money within the last 12 months in 2021. According to the World Bank (2022b), 25% of adults in developing countries employed an account for savings, with an even larger share, 39%, using accounts for cash management.

The final indicator of financial inclusion is digital payments. Digital payments include using a mobile money account, a debit or credit card, a mobile phone and the Internet to make transactions from an account, send money to relatives or friends, or settle bills. According to Allen et al. (2016) and Demirgüç-Kunt et al. (2015), digital payments are key in advancing financial inclusion by making payment transactions easier, more accessible, and more secure. Tsatsou (2020) argues that the digital technologies facilitating access to financial

services significantly impact individuals' quality of life and social inclusion. Moreover, making and receiving digital payments through various digital technological means, as noted by Martins et al. (2014), contributes to the broader adoption of banking and financial services, particularly in emerging markets. Alter and Yontcheva (2015) state that adopting basic digital financial payment methods results in a more convenient financial ecosystem, benefiting financial institutions and individuals. According to the World Bank (2022b), the use of digital payments has reached a relatively high level globally, particularly in high-income economies where digital payments have become an integral part of daily life. As of 2021, worldwide statistics indicate that digital payments are made by 82% of the population and received by 70%, with an overall digital payment rate of 64%. However, as reported by Nandru et al. (2021), it is important to note that over 4 billion people still lack Internet access, with 90% residing in developing countries. It underlines the significance of addressing the digital divide to ensure consistent access to digital services and promote digital financial inclusion. It is often observed, as highlighted by Nuzzo and Piermattei (2020) and Aurazo and Vega (2021), that simple ownership of a bank account does not guarantee its active use, as many individuals tend to withdraw funds from their accounts and rely exclusively on cash transactions. The transition from cash to digital payments substantially benefits both payers and recipients. It enhances payment efficiency by expediting transactions and reducing associated costs. Additionally, it strengthens payment security, thereby diminishing digital payment-related crime. Furthermore, it enhances payment transparency, reducing the risk of information leakage between the payers and recipients in digital transactions.

Numerous studies have looked at financial inclusion, often drawing upon respondent-level data from the World Bank's Global Findex database, which provides a comprehensive array of fundamental financial inclusion or exclusion indicators. This database offers valuable insights into how people use information and communication technologies to engage with various financial services. Microdata allows us to examine which individual characteristics significantly impact financial inclusion in a country. The determinants of financial inclusion represent a critical area of research, as they shed light on the factors influencing individuals' access to and utilisation of formal financial services. An extensive literature review reveals several key determinants of financial inclusion: income level, education, geographical location, gender, age, employment status, digital infrastructure, regulatory environment, social networks, cultural and social norms, credit history, government initiatives, and economic stability. One of the most significant determinants is income. Higher-income levels are often associated with greater access to and utilisation of financial services. Individuals with higher incomes typically find it easier to open and maintain bank accounts, access credit, and engage in various financial transactions. The second important indicator is education. People with higher levels of education tend to have better financial literacy, which enables them to navigate the complexities of formal financial systems more effectively. Financial education programs can also enhance financial inclusion by equipping individuals with the knowledge to make informed financial decisions. Geographical factors, including urban or rural residence, can significantly impact financial inclusion. Rural areas often have fewer physical bank branches and limited access to financial services, making it more challenging for residents to engage with formal financial institutions. Gender disparities persist in financial inclusion. Women, particularly in developing countries, are often less financially included than men. Cultural and social norms and legal and regulatory barriers can hinder women's access to financial services. Age is another determinant, as younger individuals may have different financial needs and preferences than older generations. Younger populations may be more inclined to adopt digital financial services, while older individuals may prefer traditional banking. Employment status and access to a regular income source are crucial determinants of financial inclusion. Formal employment often correlates with access to payroll accounts and the ability to save and transact digitally. The availability and quality of digital infrastructure, such as Internet access and mobile phone penetration, are instrumental in promoting financial inclusion. Digital channels provide convenient and cost-effective ways to access financial services, particularly in remote or underserved areas.

Nagpal et al. (2020) underscore the role of individual characteristics in determining

disparities between those categorised as "financially excluded" and those not. Motta and Farias (2018) and Lotto (2018) concur that key individual attributes such as gender, age, employment status, income, and education play a key role in determining financial exclusion. Fungáčová and Weill (2015) examined financial inclusion in China relative to other BRICS countries in 2014. In China and other BRICS countries, a high level of financial inclusion is mainly marked by extensive usage of formal bank accounts and savings. Their analysis revealed that more frequent use of formal bank accounts and credit correlates with higher income and educational attainment, especially among older men. Similarly, Susilowati and Leonnard (2019) employed these same three primary determinants of financial inclusion in their analysis of ASEAN countries in 2014. Zins and Weill (2016) conducted a study incorporating the same three determinants but with "account ownership" as the dependent variable, including account ownership in a formal institution and mobile money account ownership. Their main findings confirmed the influence of income and education levels on the likelihood of financial inclusion, especially among older men. Furthermore, these findings align with the notion that policies designed to foster financial inclusion should be customised to target specific demographic groups, such as women and young individuals, which is supported by studies by Demirgüç-Kunt and Klapper (2013) and Nagpal et al. (2020). As highlighted by Motta and Farias (2018) and Lotto (2018), age also emerges as a significant factor in financial inclusion, with older individuals showing a higher likelihood of owning a bank account, saving, and accessing credit through formal financial institutions. In summary, the determinants of financial inclusion are multifaceted and interconnected. Understanding these determinants is crucial for policymakers, financial institutions, and researchers seeking to design effective strategies and interventions to promote greater financial inclusion, reduce disparities, and enhance the economic well-being of individuals and communities.

The analysis of financial inclusion and its determinants has predominantly focused on regions such as China, Asia, and Africa, with relatively fewer studies exploring this issue in European countries. Given the continuous growth in financial inclusion, particularly in the context of escalating digitalisation, we consider the research gap in understanding the relationship between the level of financial inclusion as measured by the "digital payments" and the socio-demographic characteristics of the respondents, including age, gender, income, and education. Our research will focus on Euro Area countries and rely on data from the World Bank's Global Findex database drawn from a questionnaire survey conducted in 2021. Regarding research methodology, we employ a probit model to analyse determinants of financial inclusion, consistent with the approaches adopted in prior studies. However, our paper introduces a novel dimension by relying on linear modelling and incorporating a non-linear approach. Quadratic regression is standardised for assessing the potential U-shaped relationship. The novelty of this paper is the introduction of the Robin Hood algorithm to set the breakpoint between the lines. Simonsohn (2018) argues that this algorithm increases the statistical power in detecting U-shaped relationship. This two-lines test offers a straightforward examination of whether the independent variable effect on the dependent variable varies in sign between high and low values of the independent variable. By employing this U-shaped analysis, we aim to determine whether increasing age always positively affects financial inclusion indicators or whether this relationship becomes reversed once a breakpoint is reached. Our model incorporates two variables serving as proxies for digital payments, which include both made and received digital payments and the utilisation of a mobile phone or Internet for payments. Additionally, age, gender, education level, and household income quintile are integrated as control variables. Compared to prior research, our contribution lies in including a control variable designed to detect shifts in financial behaviour following the COVID-19 pandemic, incorporating the number of years of Euro Area membership, and integrating the Digital Access Index. These factors enrich our analysis and provide a more comprehensive understanding of the determinants of financial inclusion in the Euro Area context.

2. Research methodology

Our dataset originates from the World Bank's Global Findex database (World Bank, 2022b), which encompasses micro-level data gathered through a survey of 127,859 adults aged 15 and above across 123 countries conducted in 2021. The database has been periodically published

every three years since 2011. Currently, it contains data from the years 2011, 2014, 2017 and 2021. It is important to note that the database includes data for 2021 specifically, as the COVID-19 pandemic disrupted the regular cycle, and data for 2020 was not made available. The comprehensive database affords insights into various indicators and access to and utilisation of formal and informal financial services. Within this dataset, we gain insights into individuals' account ownership, usage of credit or debit cards, borrowing habits, saving behaviours, and engagement in digital payment transactions facilitated through mobile phones and the Internet. Fungáčová and Weill (2015) have noted that the Findex questionnaire within this global database offers extensive and detailed information on financial inclusion based on an extensive array of inquiries. Furthermore, the database includes essential individual characteristics, such as gender, age, income, education, and employment status, further enriching the dataset's analytical capabilities.

In the study, we aim to address three main research questions. First, which individual characteristics influence the use of digital payments in Euro Area countries? Second, has there been a change in the use of digital payment after the coronavirus pandemic? Third, is the level of digitalisation in the country crucial for increasing financial inclusion expressed through digital payments?

As the dependent variable, we use the indicator of financial inclusion from the perspective of digital payments. We consider two indicators related to digital payments. In Model 1, digital payments (labelled as "digital") are defined as payments made or received digitally. The indicator takes a value of 1 when the respondent answers "yes" to one of the two questions posed in the Global Findex Questionnaire. The first question, FIN31A, inquires: "In the past 12 months, have you personally, directly made payments for electricity, water, or trash collection through a bank account or another type of formal financial institution?". The second question, labelled FIN34A, asks: "In the past 12 months, has an employer paid your salary or wages directly into your account at a bank or another type of formal financial institution?". In Model 2, digital payments ("mobile_internet") are defined as digital payments realised via mobile phone or Internet. The indicator takes value 1 when the respondent answers "yes" to question FIN5: "In the past 12 months, did you ever use a mobile phone or the Internet to make payments, buy things, or send or receive money using this account?"

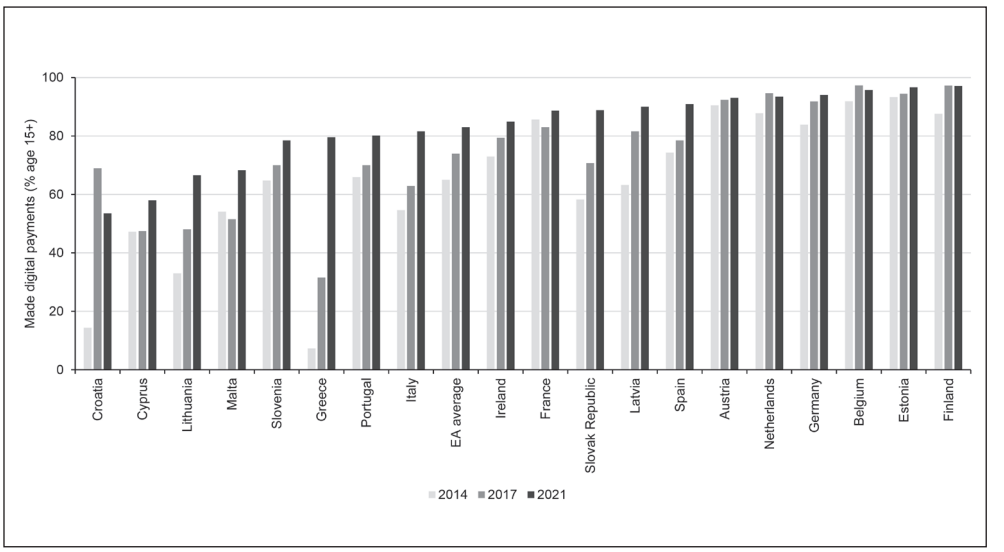


Fig. 1: **Made digital payment using a financial institution account in Euro Area countries for 2014, 2017 and 2021**

Source: own (based on World Bank, 2022b)

The first indicator of financial inclusion points to respondents who formally made payments for services. This percentage denotes individuals who have confirmed that they personally and regularly paid for water, electricity, or waste collection in the past year, paying directly from a financial institution account. An examination of this indicator at the national level reveals notable disparities within the Euro Area, as illustrated in Fig. 1, across the years 2014, 2017 and 2021. In 2021, residents of Euro Area countries demonstrated a heightened propensity to make digital payments for services using their financial accounts compared to 2014. This transformation is strongly reflected in the overall average for Euro Area countries, which has seen an increase of 18% in 2021 relative to 2014 (ascending from 65% to 83%). Exceptionally high levels of digital payment usage were observed in Finland and Estonia (97%), Belgium (96%) and Germany (94%). Notably, despite an initial low usage rate of this digital payment method in 2014 (7%), Greek respondents significantly increased their utilisation of digital options for bill payments to 82% in 2021. Similarly, a remarkable surge was observed between 2014 and 2021 in Croatia (increasing by 39%), Lithuania (increasing by 34%), Slovakia (increasing by 31%), as well as Latvia and Italy (both increasing by 27%).

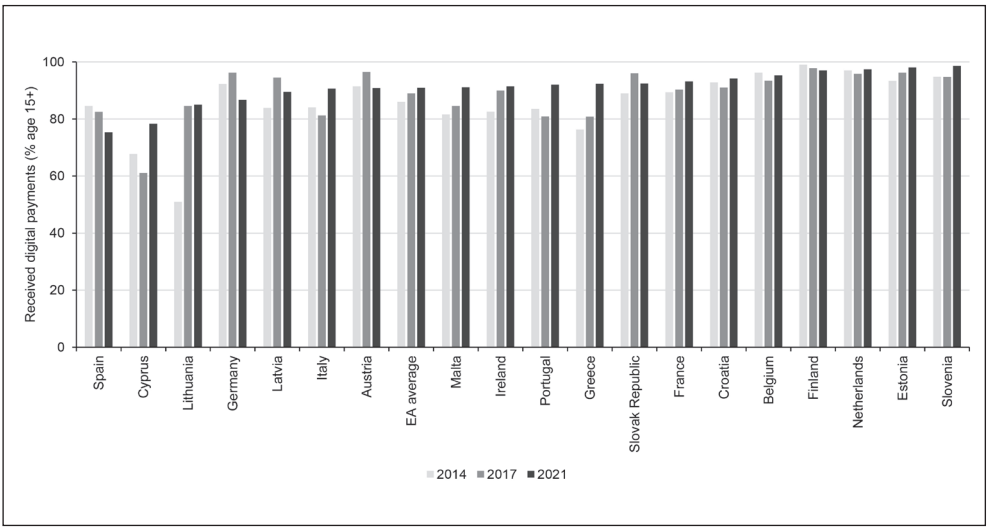


Fig. 2: **Received digital payments into a financial institution account for 2014, 2017 and 2021**

Source: own (based on World Bank, 2022b)

The second indicator, focusing on received digital payments, examines respondents who reported receiving income from their employers in the form of salaries or wages directly deposited into a financial institution account in the past year. Analysing Fig. 2, we observe relatively minor variations across Euro Area countries during the presented years. The average rate of received digital payments in Euro Area countries consistently hovered around 90% during the monitored period. Notably, in 2021, the lowest values were reported in Spain (75%), Cyprus (78%) and Lithuania (85%). The highest progress was recorded in Lithuania, where the value increased by 34% from 2014 to 2017.

The development of digitisation within the banking sector primarily revolves around the widespread adoption of mobile devices and Internet connectivity. Nowadays, nearly every individual owns a mobile phone. According to the World Bank (2022b), in 2021, a remarkable 86% of the global adult population owned a mobile phone. This trend is universal, with mobile phone ownership commonplace

in both developing economies, at 83%, and high-income economies, at 95%. Furthermore, in 2021, 63% of the world's population utilised the Internet, with the adoption rate differing between developing countries, at 57%, and high-income countries, at a higher 91%. In the Euro Area countries, mobile phones have become a widely used digital device, with ownership rates starting at 87% in Ireland and climbing even higher (Fig. 3). The overall mobile phone ownership rate across these nations averages an impressive 96%. Notably, countries like Austria, France, and Malta (100%) have the highest rates of mobile phone ownership. It begins at 85% in Cyprus, with the average Internet access rate at 91%. Residents of Nordic European countries, such as Estonia and Finland, demonstrate exceptional access

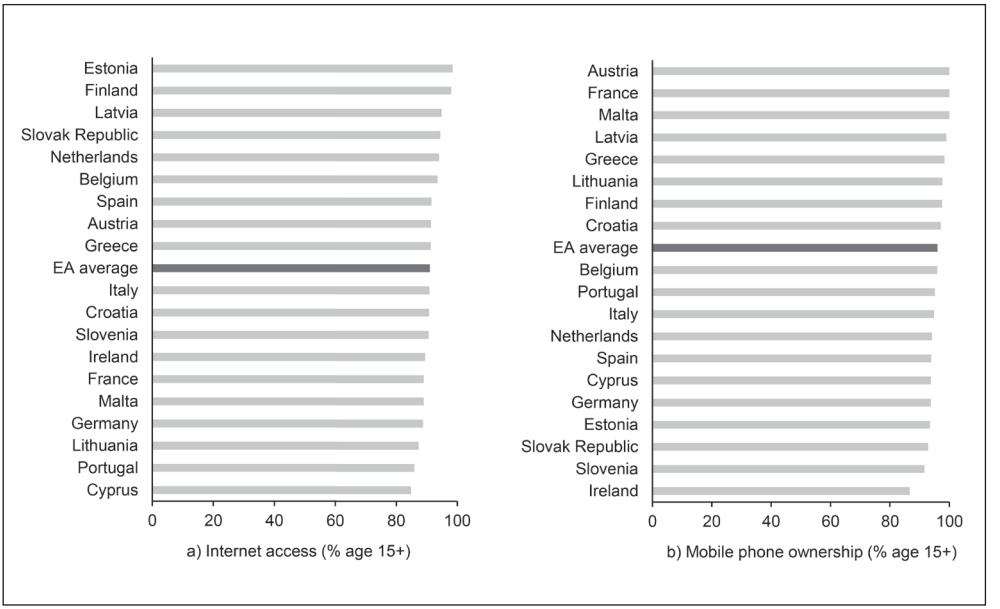


Fig. 3: Internet access and mobile phone ownership in Euro Area countries for 2021

Source: own (based on World Bank, 2022b)

to the Internet, with both nations achieving a full 100% Internet penetration rate.

The third key indicator related to digital payments sent and received (Fig. 4). This indicator represents the proportion of respondents holding an account at a financial institution who reported using a mobile phone or the Internet to make payments, purchase things, or send or receive money through their financial account. It is essential to note that data for this indicator is available for 2021 exclusively. Globally, 52% of adults with financial accounts have actively participated in digital payments via mobile phone or the Internet. Within this global figure, developing economies registered a rate of 47%, while their high-income counterparts exhibited a higher rate of 68% in 2021. The overall average for this indicator across the Euro Area countries reached 68%. However, again, it should be pointed out that the Nordic European countries, including Finland (91%), Estonia (86%), the Netherlands (80%) and Latvia (79%), stood out with the highest levels of digital payments among adults. In contrast, countries such as Croatia (46%), Portugal (54%), and France (55%) reported the lowest values for this indicator.

Our analysis uses micro-level data obtained from the World Bank's questionnaire survey and focuses on the responses of individuals in 2021. This research examines the impact of personal

Fig. 4: **Made and received digital payments via mobile phone or Internet in 2021**

Source: own (based on World Bank, 2022b)

characteristics (independent variables) on individuals' financial inclusion, as measured by the digital payments indicator (dependent variable), specifically in Euro Area countries. We employ probit regression analysis for this investigation. Regarding financial inclusion, as measured through the "digital" metric, our dataset includes 17,251 individuals who both received and sent digital payments formally, while 18,470 respondents are considered for digital payments made via mobile phone or the Internet (referred to as "mobile_internet"). The study focuses on the 19 Euro Area countries for 2021. Luxembourg is not included in our analysis due to the unavailability of data within the Global Findex database for this particular country. Comprehensive descriptive statistics and variable definitions can be found in Tab. 1.

We use the data on individuals' characteristics in the Global Findex database to examine how these different characteristics are associated with financial inclusion in Euro Area countries. We perform probit estimations to explain measures of financial inclusion and estimate the following equation:

$$FI_i = \alpha + \beta \cdot gender_i + \gamma \cdot age_i + \\ + \delta \cdot education_i + \kappa \cdot income_i + \varepsilon_i \quad (1)$$

where: *FI* – one of two financial inclusion indicators (Model 1: digital = made or received digital payment; Model 2: mobile_internet = use a mobile phone or Internet to make payment); *i* – the index for individuals. The explanatory variables belong to four groups of individual characteristics provided in the survey dataset: gender, age, education, and income. *Gender* is considered by introducing a dummy variable equal to one if the individual is a female. *Age* is defined as the number of respondents' years. *Education* is divided into two sub-groups according to the education level (primary or secondary; we omitted tertiary education as the model defined this variable as not relevant). *Income* is divided into four sub-groups according to the household income quintile (from first to fourth; we omitted the fifth income quintile as the model defined this variable as not relevant).

Within the first step to analyse the potential non-linear relationship between age and financial inclusion, we apply the Robin Hood algorithm.

Tab. 1: Descriptive statistics and definition of variables

Variable name	Label	Definition	Model	Observation	Mean	Std. dev.
Digital	Made or received digital payments	= 1 if FIN31A or FIN34A is 1 = 0 otherwise	Model 1	17,251	0.9159	0.2776
Mobile_internet	Use mobile or the Internet to make a payment	= 1 if FIN5 is 1 = 0 otherwise	Model 2	18,470	0.7197	0.4492
Gender	Gender of respondent	= 1 if female = 0 otherwise	Model 1	17,251	0.4869	0.4998
			Model 2	18,470	0.4835	0.4997
Age	Respondent age	age in a number of years	Model 1	17,251	49.7913	16.4746
			Model 2	18,470	49.6700	16.8436
Educ_primary	Respondent education level – primary	= 1 if a respondent has completed primary school or less = 0 otherwise	Model 1	17,251	0.0607	0.2388
			Model 2	18,470	0.0651	0.2468
Educ_secondary	Respondent education level – secondary	= 1 if a respondent has completed secondary school = 0 otherwise	Model 1	17,251	0.5450	0.4980
			Model 2	18,470	0.5502	0.4975
Educ_tertiary	Respondent education level – tertiary	= 1 if a respondent has completed tertiary education or more = 0 otherwise	Model 1	17,251	0.3944	0.4887
			Model 2	18,470	0.3847	0.4865
Income_q1	Within-economy household income quintile – first	= 1 if income is in the first income quintile = 0 otherwise	Model 1	17,251	0.1367	0.3435
			Model 2	18,470	0.1413	0.3483
Income_q2	Within-economy household income quintile – second	= 1 if income is in the second income quintile = 0 otherwise	Model 1	17,251	0.1665	0.3726
			Model 2	18,470	0.1664	0.3724
Income_q3	Within-economy household income quintile – third	= 1 if income is in the third income quintile = 0 otherwise	Model 1	17,251	0.1923	0.3941
			Model 2	18,470	0.1931	0.3947
Income_q4	Within-economy household income quintile – fourth	= 1 if income is in the fourth income quintile = 0 otherwise	Model 1	17,251	0.2327	0.4226
			Model 2	18,470	0.2308	0.4213
Income_q5	Within-economy household income quintile – fifth	= 1 if income is in the fifth income quintile = 0 otherwise	Model 1	17,251	0.2718	0.4449
			Model 2	18,470	0.2685	0.4432
Change	Change in payment method after the coronavirus pandemic	= 1 if the respondent used only cash to make payments before the coronavirus and now realises the payments also through the financial account or other payment methods = 0 otherwise	Model 1	17,251	0.0439	0.2048
			Model 2	18,470	0.0332	0.1791
Country EA	Euro Area membership	Number of years within the Euro Area	Model 1	17,251	18.5452	6.9187
			Model 2	18,470	18.6077	6.8809
DAI	Digital Access Index	The value of the Digital Access Index in 2021 in the country	Model 1	17,251	0.6814	0.0703
			Model 2	18,470	0.6820	0.0698

Source: own

We apply the methodology presented by Simonsohn (2018). He suggests testing the possibility of a U-shape by merely testing if the effect of *x* (age) on *y* (digital payments) changes sign for low versus high *x* values. Such a test involves computing two average slopes, which is done by estimating two regression lines, one for $x \le x_c$ and the other for $x \ge x_c$, where x_c is the breakpoint separating the two regions. One may increase statistical efficiency by simultaneously estimating both lines in a single regression, relying on what is often referred to as an interrupted regression. Specifically, interrupted regressions conform to the following general formulation:

$$y = a + bx_{low} + cx_{high} + d \times high + \mathrm{ZB}_{\mathbf{Z}} \quad (2)$$

where: $x_{low} = x - x_c$ if $x < x_c$ and 0 otherwise; $x_{high} = x - x_c$ if $x \ge x_c$ and 0 otherwise; and high = 1 if $x \ge x_c$ and 0 otherwise; Z – the (optional) matrix with covariates; B_Z – its vector of coefficients.

After verifying the presence of a U-shape, we estimate the following equation:

$$FI_i = \alpha + \beta \cdot gender_i + \gamma_1 \cdot age_i + \gamma_1 \cdot (age_i)^2 + \\ + \delta \cdot education_i + \kappa \cdot income_i + \varepsilon_i \quad (3)$$

To analyse the impact of the coronavirus pandemic, we also estimate the following equation:

$$FI_i = \alpha + \beta_1 \cdot gender_i + \gamma_1 \cdot age_i + \\ + \gamma_1 \cdot (age_i)^2 + \delta \cdot education_i + \\ + \kappa \cdot income_i + \lambda \cdot change_i + \varepsilon_i \quad (4)$$

The *change* is measured as the change in the use of the payment after the coronavirus pandemic. The variable took the value 1 when the respondent used only cash to make payments before the coronavirus pandemic, and nowadays, the respondent realises the payments through the financial account or other payment methods. The variable took value 0 when the respondent used only cash to make payments before the coronavirus pandemic; now, the respondent does not use the financial account to realise payments.

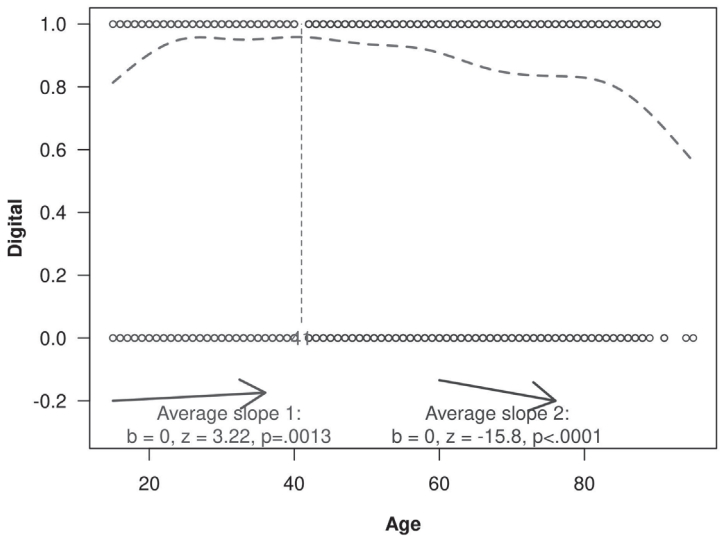
To verify the impact of digitalisation and the membership in Euro Area countries, we also estimate the following equation:

$$FI_i = \alpha + \beta_1 \cdot gender_i + \gamma_1 \cdot age_i + \\ + \gamma_1 \cdot (age_i)^2 + \delta \cdot education_i + \kappa \cdot income_i + \\ + \lambda \cdot change_i + \sigma \cdot countryEA_i + \\ + \varsigma \cdot countryDAI_i + \varepsilon_i \quad (5)$$

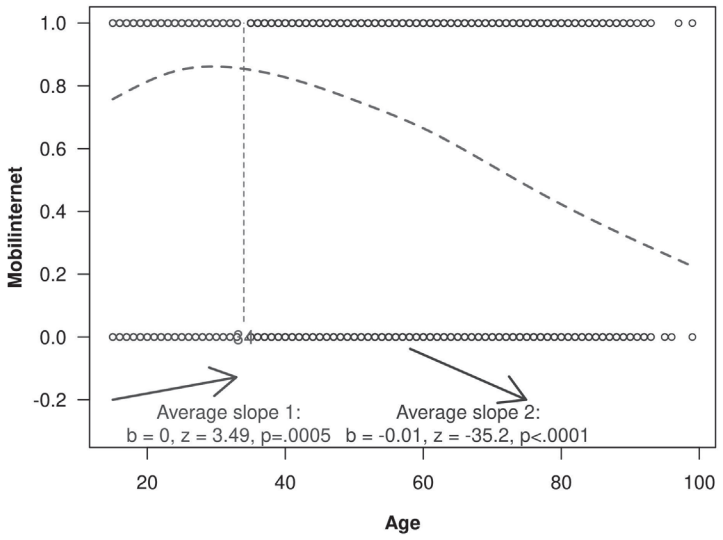
where: *countryEA* – the number of years of membership within the Euro Area; *DAI* – the level of digitalisation in the country measured by the Digital Access Index. These variables are on the country level.

3. Results and discussion

In the initial stage of our analysis, we employ the Robin Hood algorithm to investigate the potential presence of a U-shaped relationship between financial inclusion, as measured by digital payments, and the age of respondents. In this two-lines test, we focus solely on these two indicators. The test results are graphically presented in Fig. 5. As displayed, the analysis confirms the existence of an inverted U-shape between digital payments and age. It implies that digital payments tend to increase with age up to a specific breakpoint, after which the relationship shifts. In the case of the first indicator of digital payments (digital = made or received digital payment), the breakpoint is identified at 41. It signifies that up to 41, a positive association may exist between age and digital payments. However, beyond 41, we observe a negative correlation between these variables. Examining the age distribution, it is clear that over 65% of the data points fall on the side of the curve where, with increasing age, the usage of digital payments declines. Given the predominant distribution on this side, we can confidently assert the presence of a significant negative correlation, aligning with the theory of the generation effect. In the case of the second indicator of digital payments (mobileinternet = use a mobile phone or Internet to make payment), the breakpoint occurs at the age of 34. Once again, examining the age distribution reveals that over 78% of respondents are situated beyond this breakpoint, reconfirming the theory of the generation effect. The theory of the generation effect in the context of financial inclusion suggests that different generations may exhibit distinct financial behaviours and preferences, particularly concerning their adoption and use of digital financial services and technologies. The younger generation may be more comfortable and adept at using digital payment methods, mobile banking apps, and online financial services. This generation is often more digitally literate and open to using technology for financial transactions. In contrast, the older generation may face challenges in adapting to digital financial services due to lower digital literacy levels.



a) Made and received digital payments vs. age



b) Use a mobile phone or Internet to make a payment vs. age

Fig. 5: **Two-lines test**

Source: own

Based on the Robin Hood test results, we found it relevant to incorporate a quadratic term into the probit regression model. We applied the equations defined in the methodology section to analyse the impact of specified variables on digital payments in Euro Area countries. Initially, we estimated Equations (1–4) for Model 1 and subsequently for Model 2, as per the defined variables. In Model 1, the dependent variable indicates if the respondents in the past 12 months used an account at a bank or another type of formal financial institution to make a digital payment or receive payments directly into this type of account. This dependent variable was sourced from the Findex questionnaire and database, denoted by the question codes FIN31A and FIN34A. It takes value 1 when the respondent answered yes in both or one of the mentioned questions and 0 when the respondent answered no in both questions. The probit estimation results, employing digital payment as the dependent variable, are presented in Tab. 2.

We find that the use of digital payments is related to all independent variables in Equation (1) and Equation (2). It suggests that all individual characteristics are significantly associated with financial inclusion.

Women are more likely to use digital payments in all Equations (1–4), with their gender significantly increasing the probability of involvement in digital payment activities. It can be attributed to the key roles many women play within households, where they often initiate and manage financial transactions daily. Given that a substantial proportion of women own mobile phones and related devices, it enhances their accessibility to financial services. Digital payments allow women to make payments conveniently while balancing work and family responsibilities, particularly when they may not have the time to visit a physical bank branch. Consequently, digital payments can help women optimise their time management, freeing up time for more productive activities. Our analysis results align with the research by Zhongming et al. (2019), highlighting that financial technology serves as a tool for narrowing the gender gap in financial inclusion. While digital payments, whether through mobile phones, personal computers, the Internet, or cards, are not necessarily new, substantial technological investments have increased their adoption in recent years.

Notably, digital payments are a key instrument for reducing disparities between men and women, as the rate of adoption by women has increased more rapidly, particularly concerning payments initiated by women themselves.

The impact of age in Equation (1) is notably significant and carries a negative sign, signifying an inverse relationship between age and the use of digital payments. It suggests that younger generations primarily use digital payments, with a decreasing tendency among older individuals. In essence, older people use digital payments less frequently than the rest of the population. Our descriptive statistics further support this trend according to age. Specifically, we can find that the mean age of respondents who use digital payments is 47 years, whereas for those who do not, the mean age is notably higher at 57 years. Moreover, the mode value within the first group is lower (50 years) compared to the second group (65 years). As noted by Fungáčová and Weill (2015), this phenomenon can be attributed to what is commonly referred to as the "generation effect." Older individuals may exhibit unwillingness to adopt digital payment methods due to concerns about information technology usage, thereby favouring traditional payment methods like cash. It is in line with the findings of the European Central Bank (2022), which underscored differences in preferences for cash usage based on age. The study revealed that the highest proportion of individuals who preferred cash transactions belonged to the 55+ age group, indicating that older individuals were more inclined to be heavy cash users. According to Age UK (2021), many older people rely heavily on cash, with some completely dependent on it. Cutting off from cash and banking services is tantamount to social exclusion, so it is essential to maintain access to them for older demographics. Notably, those in the oldest age bracket (75+) have preferred using cash as their primary method for spending money and making payments across most of their financial needs. Cash offers them enhanced financial management capabilities and facilitates their daily budgeting. It is important to acknowledge that while age demonstrates a positive correlation with cash usage, it does not provide conclusive insights into whether this preference is only due to the natural inclination of the older population towards cash or if other factors, such as their average income or transaction sizes, play a role in driving these outcomes.

Tab. 2: Determinants of the usage of digital payments

	Equation (1)	Equation (2)	Equation (3)	Equation (4)
Intercept	2.4677***	1.7370***	1.7160***	−0.1359
	0.0620	0.1255	0.1269	0.2196
Gender	0.0507*	0.0525*	0.0585**	0.0202
	0.0288	0.0289	0.0291	0.0298
Age	−0.0137***	0.0173***	0.0171***	0.0187***
	0.0009	0.0048	0.0048	0.0049
Age2		−0.0003***	−0.0003***	−0.0003***
		0.0000	0.0000	0.0000
Educ_primary	−0.6465***	−0.6119***	−0.6180***	−0.6683***
	0.0528	0.0532	0.0538	0.0549
Educ_secondary	−0.2301***	−0.2231***	−0.2235***	−0.2672***
	0.0327	0.0328	0.0331	0.0339
Income_q1	−0.5380***	−0.5391***	−0.5475***	−0.5363***
	0.0465	0.0467	0.0471	0.0478
Income_q2	−0.3084***	−0.3108***	−0.3166***	−0.2861***
	0.0459	0.0461	0.0465	0.0473
Income_q3	−0.1484***	−0.1470***	−0.1554***	−0.1254***
	0.0460	0.0462	0.0466	0.0473
Income_q4	−0.1125**	−0.1110**	−0.1130**	−0.0915**
	0.0443	0.0445	0.0448	0.0454
Change			4.4600	4.9070
			33.3200	32.3000
Country EA				0.0184***
				0.0032
DAI				2.2990***
				0.3263
AIC	9,272.6000	9,231.6000	9,102.2000	8,754.2000
Pseudo *R2*	0.0709	0.0752	0.0884	0.1237
Loglikehood	−4,627.2800	−4,605.8000	−4,540.0800	−4,364.0900

Note: The dependent variable is made or received digital payments. We report the estimated marginal effects in the first line, and standard errors are in the second line. Asterisks denote significance at the ***99%, **95%, *90% levels.

Source: own

Hence, it is evident that national central banks are trying to enhance the financial literacy of older individuals, aiming to reduce barriers that prevent them from adopting digital payment methods. These initiatives aim to give seniors the knowledge and skills to work with digital payment platforms without fear. However, besides promoting financial literacy, it

is equally important to highlight the potential risks associated with using information technology in financial transactions. Such risks contain various cyber threats, including phishing, pharming, or other hacker attacks. In this regard, educating older individuals about the importance of protecting their personal and financial information when conducting online transactions is important. By raising awareness of these cybersecurity issues, individuals can become more vigilant and better equipped to protect themselves from potential digital threats, thus ensuring safer and more secure digital payments.

As indicated by dummy variables, the influence of education exhibits a negative correlation with the adoption of digital payments. Notably, primary and secondary education dummy variables display significant negative coefficients, with a larger impact observed for individuals with primary education. It suggests that respondents who have completed only primary education or possess lower educational qualifications tend to use digital payment methods less frequently than those with higher secondary education. We can see a negative coefficient in the case of secondary education, but the value of the coefficient is smaller than in the case of primary education. To provide a clearer perspective, in Equation (1) in Tab. 2, being primary educated decreases the probability of using digital payments by 64.65%, while secondary educated decreases the probability by 23%. Therefore, we can say that the use of digital payments increases with higher levels of education. This trend is consistently evident across all Equations (1–4) in the analysis.

The dummy variables representing different income quintiles exhibit statistical significance and negative coefficients, with larger coefficients corresponding to lower income quintiles. It indicates that respondents in lower income quintiles are less likely to use digital payment methods than those in higher income quintiles. As presented in Tab. 2, Equation (1), for the person who is in the first income quintile, the probability of using digital payments decreases by 53.8%, and if the person is in the second income quintile, it decreases the probability of using a digital payment by 30.84%. Furthermore, negative coefficients are also observed for the third and fourth income quintiles, but the value of the coefficient is smaller than in the case of the first and second income quintiles. For example, to be in the last income quintile decreases the probability of using digital payments by 11.25%. Therefore, we can say that the use of digital payments increases with income level.

This finding aligns with previous research conducted by Demirgüç-Kunt and Klapper (2013), Fungáčová and Weill (2015), and Zins and Weill (2016), who identified a positive correlation between income and financial inclusion. Additionally, the study by Nandru et al. (2021) showed that individuals with higher educational backgrounds and incomes may associate with specific brands. Furthermore, they exhibited a propensity for online shopping, making purchases without needing physical visits to shopping malls. These individuals also use mobile phones and the Internet to realise their daily payments and regular transactions online without needing in-person visits to bank branches. Moreover, a significant portion of this demographic used their financial accounts to receive wages and other payments from the government or other authorities, which enabled them to do most of their financial transactions cashless.

It is evident from the results that individuals with lower levels of education and those with lower incomes tend to use digital payments less frequently. Additionally, this trend is consistent across all Equations (1–4) in our analysis. Moreover, older individuals and men have a reduced slope for using digital payment methods.

In our analysis of Equation (2), we examine the potential non-linear relationship between age and the use of digital payments. This investigation aimed to uncover any U-shape or inverse U-shape between these two variables. Identifying such non-linear relationships could indicate that positive and negative relations between variables also exist. It allows us to identify an optimal breakpoint around which age can enhance or reduce the use of digital payments. As demonstrated in Equations (2–4), our findings show a non-linear relation between age and the use of digital payments. It means that the use of digital payments increases with age, but after a specific breakpoint, there is a change in the relationship. As the quadratic term is negative and statistically significant, we can suppose the inverse U-shape of the function aligns with Robin Hood's two-lines test.

In Equation (3), we looked at the variable describing the shift in digital payment usage following the outbreak of the COVID-19 pandemic.

As can be seen, a positive relationship between variables is observed, but this relationship could not be considered significant. This fact is evident from Equations (3–4). Therefore, we can suppose that the impact of the COVID-19 pandemic on financial inclusion was indirect. Due to the pandemic, people have started to change their thinking and behaviour. Before the pandemic, performing work in the workplace and physically shopping in stores could be standard behaviour. However, frequent lockdowns have shown that there are other possibilities. People have learned to work from home, use their banks' online services more frequently, and make purchases over the Internet. Thus, we see a change in people's thinking that has also led to a change in their buying behaviour. What was used only minimally before the pandemic has become a regular part of the lives of the majority of the population. Thus, we can say that the pandemic has indirectly changed people's attitudes towards the use of digital payments due to changes in their thinking.

In the final Equation (4), we examine the impact of membership in the Euro Area and the level of digitalisation within the economy, as measured by the Digital Access Index in selected countries. Remarkably, both estimated coefficients are significantly positive, indicating that respondents from the countries which belong to the Euro Area for longer periods tend to use digital payments at a higher level than others. Furthermore, in countries with higher levels of digitalisation, respondents display a greater propensity for digital payment usage compared to countries with lower values of DAI.

To validate our findings, we also conducted tests using Model 2. In this model, the dependent variable indicates if the respondents have used mobile phones or the Internet within the past 12 months to make payments, purchase things, or send or receive money via their bank or financial institution account. Tab. 1 presents the dependent variable derived from the questionnaire and the Findex database, carrying the question code FIN5. The dependent variable took a value of 1 when the respondent realised payment using a mobile phone or the Internet, while 0 denotes a situation where the payment was not realised through these means. The outcomes of the probit estimations are presented in Tab. 3, in which we use digital payment realised by mobile phone or Internet as the dependent variable.

Tab. 3: Determinants of the usage of mobile phone or Internet to make payments – Part 1

	Equation (1)	Equation (2)	Equation (3)	Equation (3) without	Equation (4)	Equation (4) without
Intercept	2.0898***	1.4800***	1.4570***	2.0483***	0.5836***	1.2865***
	0.0428	0.0894	0.0904	0.0431	0.1579	0.1304
Gender	0.0568***	0.0579***	0.0634***	0.0624***	0.0574***	0.0564***
	0.0207	0.0207	0.0209	0.0209	0.0210	0.0210
Age	−0.0218***	0.0047	0.0042	−0.0214***	0.0052	−0.0220***
	0.0006	0.0035	0.0035	0.0006	0.0035	0.0006
Age2		−0.0003***	−0.0003***		−0.0003***	
		0.0000	0.0000		0.0000	
Educ_primary	−0.8202***	−0.7812***	−0.7877***	−0.8244***	−0.7878***	−0.8273***
	0.0425	0.0428	0.0433	0.0430	0.0434	0.0431
Educ_secondary	−0.3758***	−0.3685***	−0.3708***	−0.3780***	−0.3810***	−0.3881***
	0.0227	0.0228	0.0230	0.0230	0.0231	0.0230
Income_q1	−0.3570***	−0.3556***	−0.3598***	−0.3613***	−0.3617***	−0.3622***
	0.0344	0.0344	0.0347	0.0347	0.0348	0.0348

Tab. 3: Determinants of the usage of mobile phone or Internet to make payments – Part 2

	Equation (1)	Equation (2)	Equation (3)	Equation (3) without	Equation (4)	Equation (4) without
Income_q2	−0.2270***	−0.2299***	−0.2370***	−0.2346***	−0.2387***	−0.2354***
	0.0327	0.0327	0.0330	0.0330	0.0331	0.0330
Income_q3	−0.1545***	−0.1547***	−0.1637***	−0.1639***	−0.1626***	−0.1624***
	0.0314	0.0315	0.0318	0.0317	0.0318	0.0318
Income_q4	−0.0673**	−0.0660**	−0.0725**	−0.0738**	−0.0703**	−0.0714**
	0.0301	0.0302	0.0305	0.0304	0.0305	0.0304
Change			5.0150	5.0071	5.1055	5.0894
			22.8900	22.8047	22.7990	22.7261
Country EA					−0.0036	−0.0026
					0.0024	0.0024
DAI					1.3833***	1.2393***
					0.2336	0.2328
AIC	19,748.0000	19,690.0000	19,344.0000	19,397.0000	19,294.0000	
Pseudo *R2*	0.0998	0.1025	0.1184	0.1159	0.1208	0.1180
Loglikehood	−9,864.8400	−9,835.0900	−9,660.9900	−9,688.3000	−9,634.2000	−9,664.8000

Note: The dependent variable is using a mobile phone or Internet to make payments. We report the estimated marginal effects in the first line, and standard errors are in the second line. Asterisks denote significance at the ***99%, **95% levels.

Source: own

As displayed in Tab. 3, Model 2 brings consistent outcomes with Model 1. The only notable difference arises in the case of the variable "age," where a significant non-linear relation was not confirmed. Since the non-linear relationship was insignificant, we tested Equations (3–4) without incorporating the quadratic age term. The results from all estimations consistently pointed to the inverse relationship between age and financial inclusion measured using digital payments through mobile phones or the Internet. It indicates that such digital payment methods are predominantly embraced by a younger generation, with utilisation diminishing among older age groups, aligning with the theory of the generation effect.

Our analysis observed that using financial services through digital payments, direct financial access, the Internet, or mobile devices is widespread in Euro Area countries. By analysing the causes of financial exclusion, the regulatory authorities can find factors contributing to lower digital payment adoption rates in specific countries. This understanding can guide efforts to remove barriers, ultimately promoting a higher uptake of financial services. Furthermore, it plays a key role in fostering economic development within the country. This issue is connected to the broader challenge of enhancing financial literacy. Regulatory bodies must not only seek to increase the adoption of digital services but also ensure that their use is conducive to the well-being of individual users. Achieving this balance is essential to prevent excessive household indebtedness, which could jeopardise the financial stability of the households.

Through our analyses, we have identified the key characteristics that negatively impact the usage of digital payments. The most significant factor is age, with older individuals using digital payment methods, including innovative tools, to a lesser extent. This phenomenon could be attributed to various factors, including psychological barriers, financial costs, or other personal preferences that lead them to abstain

from those financial services. Consequently, the European Central Bank must adapt to conditions surrounding digital payments. As part of its overall strategy to enhance financial literacy, the central bank must tailor its efforts to specific demographics to encourage the optimal use of these services. This approach ensures that individuals can enjoy the benefits of digital payments while safeguarding against potential issues from both the clients' and the banks' perspectives.

Using the Digital Access Index (DAI) enables us to assess the nation's degree of digitalisation. Based on this knowledge, regulatory bodies and policymakers can allocate increased resources to infrastructure development, technological advancement, and innovation within the country. This strategic allocation of resources can improve accessibility to a wide range of services, get people interested in using financial services and ultimately raise residents' overall standard of living in such countries.

Therefore, the outcomes of the performed analyses can serve as recommendations for policymakers, guiding their effort to foster the expansion of financial inclusion, reduce barriers to financial exclusion, and support the increase of financial literacy. Notably, this aligns with one of the ECB's priority focus areas.

Conclusions

The landscape of financial services has undergone rapid transformation in recent decades, driven by the digitalisation of services, modernisation and technological advancements, and evolving customer preferences in accessing financial services. Antonijević et al. (2021) state that the financial sector remains highly sensitive to ongoing changes. Consequently, there is a pressing need to adapt quickly and promptly to client's requirements. Bank clients need faster, more efficient, and more convenient ways of delivering services and transactions. As mobile phones, smartwatches, and other internet-connected devices have become indispensable in most people's daily lives, new digital services have supplemented traditional transactions.

In this paper, our primary focus is examining the degree of financial inclusion in Euro Area countries based on the Global Findex database. Fungáčová and Weill (2015) highlight that financial inclusion is crucial because it helps foster economic growth. Increasing access to financial services opens up new avenues for education and entrepreneurial efforts, contributing to overall economic development.

In our study, we have employed digital payment indicators to express financial inclusion in Euro Area countries for 2021. We conducted two distinct analyses to explore the impact of individual characteristics on the level of financial inclusion through digital payments. In the first analysis, we focused on the influence of various factors on the use of digital payments made and received through financial accounts. Our finding revealed that men, older residents, less educated people, and people from poorer countries are associated with lower use of digital payments. We also observed a positive association between the COVID-19 pandemic and increased usage of digital payments among residents in the Euro Area countries. However, this effect could be considered an indirect impact due to changes in consumers' thinking and buying behaviour during and after the pandemic. Additionally, individuals from countries with longer-standing Euro Area membership exhibited a higher propensity for utilising digital payments. Furthermore, countries with higher DAI scores, indicating a higher level of digitisation, have seen an increase in digital payments. In the second analysis, which included mobile phones and Internet-based digital payments, our results remained consistent, except for the age variable. This analysis confirmed that the younger population tends to use digital payments via mobile phones and the Internet, with usage rates declining with age. The results of our analysis are in line with the theory of the generation effect. In line with this theory, it is necessary to underline the importance of recognising that different generations have different financial behaviours and preferences, particularly regarding digital financial inclusion. Policymakers, financial institutions, and FinTech companies should consider these generational dynamics when designing strategies to promote financial inclusion and ensure that individuals of all ages have access to and can benefit from digital financial services.

The bank service providers must enhance the accessibility of their services. They must invest financial resources to increase their customers' ability to use digital payments, which can reduce costs on the side of banks and the side of banks' customers. Besides increasing the range of online services, it is also important to increase resistance

to cyber risks, which are connected to the use of information technologies.

Our findings hold important policy implications for Euro Area authorities. Specifically, there is a pressing need to increase financial literacy, particularly among the older demographic. In a rapidly digitising world, the rising demand for digital payment methods exposes this group to greater vulnerability due to their limited information technology experience. Consequently, responsible authorities should prioritise efforts to enhance financial and practical IT skills among the elderly. By doing so, this demographic can make informed decisions that mitigate the adverse effects of the risks they face daily.

Acknowledgments: *Supported by grant No. 1/0444/23, "Network Analysis and Modelling of Interrelationships on International Financial Markets" of the "MINEDU of Slovak Republic."*

References

Age U. K. (2021). *Short-changed: How the decline of cash is affecting older people*. Age UK.

Allen, F., Demirguc-Kunt, A., Klapper, L., & Martinez Peria, M. S. (2016). The foundations of financial inclusion: Understanding ownership and use of formal accounts. *Journal of Financial Intermediation*, *27*, 1–30. https://doi.org/10.1016/j.jfi.2015.12.003

Alter, A., & Yontcheva, B. (2015). Financial inclusion and development in the CEMAC. *IMF Working Papers*, *15*(235), 1. https://doi.org/10.5089/9781484317556.001

Antonijević, M., Ljumović, I., & Lukić, V. (2021). Are digital financial payments constrained by the country's income: Evidence from the Global Findex database. *Anali Ekonomskog Fakulteta u Subotici*, *57*(46), 115–129. https://doi.org/10.5937/AnEkSub2146115A

Aurazo, J., & Vega, M. (2021). Why people use digital payments: Evidence from micro data in Peru. *Latin American Journal of Central Banking*, *2*(4), 100044. https://doi.org/10.1016/j.latcb.2021.100044

Chinoda, T., & Mashamba, T. (2021). Financial inclusion, bank competition and economic growth in Africa. *Journal of Economic and Financial Sciences*, *14*(1). https://doi.org/10.4102/jef.v14i1.649

Claessens, S. (2006). *Access to financial services: A review of the issues and public policy objectives*. Policy Research Working Papers. World Bank. https://doi.org/10.1596/1813-9450-3589

Demirgüç-Kunt, A., & Klapper, L. (2013). Measuring financial inclusion: Explaining variation in use of financial services across and within countries. *Brookings Papers on Economic Activity*, *2013*(1), 279–321. https://doi.org/10.1353/eca.2013.0002

Demirgüç-Kunt, A., Leora, K., Dorothe, S., & Oudheusden, P. V. (2015). *The Global Findex Database 2014: Measuring financial inclusion around the world* (Policy Research Working Paper 7255). World Bank. https://openknowledge.worldbank.org/entities/publication/f661fecd-3fc7-5a45-886e-95d6b881e278

Demirgüç-Kunt, A., Leora, K., Dorothe, S., & Saniya, A. (2022). *The Global Findex Database 2021: Financial inclusion, digital payments, and resilience in the age of COVID-19*. World Bank. https://openknowledge.worldbank.org/handle/10986/37578

Demirgüç-Kunt, A., Leora, K., Dorothe, S., Saniya, A., & Jake, H. (2018). *Global Findex Database 2017: The Global Findex measuring financial inclusion and the Fintech revolution*. World Bank. https://openknowledge.worldbank.org/entities/publication/ed800062-e062-5a05-acdd-90429d8a5a07

Erlando, A., Riyanto, F. D., & Masakazu, S. (2020). Financial inclusion, economic growth, and poverty alleviation: Evidence from eastern Indonesia. *Heliyon*, *6*(10), e05235. https://doi.org/10.1016/j.heliyon.2020.e05235

European Central Bank. (2022). *Study on the payment attitudes of consumers in the Euro Area (SPACE) – 2022*. European Central Bank Publications Office. https://doi.org/10.2866/85233

Fungáčová, Z., & Weill, L. (2015). Understanding financial inclusion in China. *China Economic Review*, *34*, 196–206. https://doi.org/10.1016/j.chieco.2014.12.004

Kabakova, O., & Plaksenkov, E. (2018). Analysis of factors affecting financial inclusion: Ecosystem view. *Journal of Business Research*, *89*, 198–205. https://doi.org/10.1016/j.jbusres.2018.01.066

Lenka, S. K., & Barik, R. (2018). Has expansion of mobile phone and internet use spurred financial inclusion in the SAARC countries? *Financial Innovation*, *4*(1), 1–19. https://doi.org/10.1186/s40854-018-0089-x

Leyshon, A., & Thrift, N. (1995). Geographies of financial exclusion: Financial abandonment

in Britain and the United States. *Transactions of the Institute of British Geographers*, *20*(3), 312. https://doi.org/10.2307/622654

Lotto, J. (2018). Examination of the status of financial inclusion and its determinants in Tanzania. *Sustainability*, *10*(8), 2873. https://doi.org/10.3390/su10082873

Martins, C., Oliveira, T., & Popovič, A. (2014). Understanding the internet banking adoption: A unified theory of acceptance and use of technology and perceived risk application. *International Journal of Information Management*, *34*(1), 1–13. https://doi.org/10.1016/j.ijinfomgt.2013.06.002

Motta, V. E. da, & Farias, L. E. G. (2018). *Determinants of financial inclusion in Latin America*. EnANPAD 2018, 16.

Nagpal, A., Jain, M., & Jain, A. (2020). Determining the role of digital technology, governance and institutions in advancing financial inclusion in BRICS nations using probit regression analysis. *Journal of Social and Economic Development*, *22*(2), 443–459. https://doi.org/10.1007/s40847-020-00112-2

Nandru, P., Chendragiri, M., & Velayutham, A. (2021). *Determinants of digital financial inclusion in India: Evidence from the World Bank's global findex database*. Research Square Platform LLC. https://doi.org/10.21203/rs.3.rs-329541/v1

Nuzzo, G., & Piermattei, S. (2020). Discussing measures of financial inclusion for the main Euro Area countries. *Social Indicators Research*, *148*(3), 765–786. https://doi.org/10.1007/s11205-019-02223-8

Ozili, P. K. (2021). Financial inclusion research around the world: A review. *Forum for Social Economics*, *50*(4), 457–479. https://doi.org/10.1080/07360932.2020.1715238

Simonsohn, U. (2018). Two lines: A valid alternative to the invalid testing of U-shaped relationships with quadratic regressions. *Advances in Methods and Practices in Psychological Science*, *1*(4), 538–555. https://doi.org/10.1177/2515245918805755

Sinclair, S. (2001). *Financial exclusion: An Introductory Survey*. CRSIS, Edinburgh College of Art, Heriot Watt University.

Sinclair, S. (2013). Financial inclusion and social financialisation: Britain in a European context. *International Journal of Sociology and Social Policy*, *33*(11/12), 658–676. https://doi.org/10.1108/ijssp-09-2012-0080

Susilowati, E., & Leonnard, L. (2019). Factors influence financial inclusion: Evidence from Indonesian micro data. *ETIKONOMI*, *18*(1), 121–132. https://doi.org/10.15408/etk.v18i1.9070

Tsatsou, P. (2020). Digital inclusion of people with disabilities: A qualitative study of intra-disability diversity in the digital realm. *Behaviour and Information Technology*, *39*(9), 995–1010. https://doi.org/10.1080/0144929x.2019.1636136

World Bank. (2022a). *Financial inclusion*. World Bank. https://www.worldbank.org/en/topic/financialinclusion/overview

World Bank. (2022b). *The Global Findex Database 2021*. World Bank. https://www.worldbank.org/en/publication/globalfindex/interactive-executive-summary-visualization

Zhongming, Z., Linong, L., Xiaona, Y., Wangqiang, Z., & Wei, L. (2019). *Closing the gender gap in financial inclusion through Fintech* (Policy Brief No. 2019-3 April). Asian Development Bank Institute.

Zins, A., & Weill, L. (2016). The determinants of financial inclusion in Africa. *Review of Development Finance*, *6*(1), 46–57. https://doi.org/10.1016/j.rdf.2016.05.001