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THE RELATIONSHIP BETWEEN FINANCIAL DEVELOPMENT AND INCOME INEQUALITY IN EUROPEAN COUNTRIES

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TABLE OF CONTENTS

ABSTRACT

A well-functioning financial system can help to broaden access to finance to lower-income households by improving the availability and use of financial services, therefore increasing investment opportunities and productivity, and consequently reducing the global pain-point that is income inequality. This adds to the ever-growing importance and continuous need to focus on building inclusive financial systems that expand and equalize individual opportunities in the society. Moreover, as globalisation and technological advancements in recent decades have strongly contributed to the development and liberalisation of the financial sector across the world, Europe has been no exception, raising the main aim of the thesis – to evaluate and determine whether there is evidence of a relationship between financial development and income inequality among European countries. To answer posed research questions, the author conducted an empirical analysis using panel data covering 2005-2019 for the sample of 35 European countries, later divided into 17 Western European countries and 18 Central and Eastern European countries. Using seven alternative indicators of financial development and three-year averages of variables of interest, as well as complimentary lagged annual data, on panel fixed and random effects models, however, yield no statistically significant nor robust estimations to determine the relationship between financial development and income inequality in Europe or in either of the separated regions.

Keywords: Financial development, financial inclusion, banking, income inequality

INTRODUCTION

Widening income inequality has been called the defining challenge of our time as in recent decades the gap between the rich and the poor has increased in nearly all world regions (Dabla-Norris et al. 2015, 4). While inequality is up to a certain extent inevitable, the inability to properly gauge and address the phenomenon and its consecutive problems can lead to various political, economic and social problems (Alvaredo et al. 2019, 22). Consequently, the extent of inequality, its drivers and remedies have become some of the most debated issues by policymakers and researchers alike (Dabla-Norris et al. 2015, 4).

From a social perspective equality, similarly to fairness, is an important feature in most societies, irrespective of ideologies, culture and religion. Inequality however can be a signal of lack of income mobility and opportunity, which puts particular segments of the society at a disadvantage. (Dabla-Norris et al. 2015, 5) Furthermore, the inability of the less well-off to improve their economic status can give rise to populism and anti-globalization (Čihák, Sahay 2020, 4). Widening inequality also has significant implications for growth and macroeconomic stability – it can concentrate political and decision-making power in the hands of a few, which can lead to suboptimal use of human resources, cause investment-reducing political and economic stability and raise the risk of crisis (Dabla-Norris et al. 2015, 5).

In 2016 the share of national income accounted for by nation's top 10% income earners was the highest in the Middle East at 61% and the lowest in Europe at 37% (Alvaredo et al. 2019, 8). While income inequality varies greatly across world regions, there are also vast differences between countries in the same geographical region – even though Europe as a whole could be considered the world's most equal region, in 2016 the same top 10% indicator was at 27% in Slovakia and at 40% in Bulgaria (World Inequality Database 2016). The sole fact that inequality levels are different between countries, even when countries are positioned in the same region, highlights the importance and effect of national policies and institutions when it comes to shaping the dynamics of inequality (Alvaredo et al. 2019, 9).

To this day pervasive inequalities in access to education, health care and finance remain, helping to explain why inequality and the increase in the speed varies within different countries and regions (Dabla-Norris et al. 2015, 4). Recent development theory sees the lack of access to financial institutions as a critical mechanism for generating income inequality, as well as slower economic growth. Without an access to the services provided by financial systems poorer individuals need to rely on their own limited earning and savings, making it harder to invest in their education, become entrepreneurs or take advantage of other growth opportunities. (World Bank 2008, 9) Meanwhile broader access to credit from commercial banks would allow more household decisions to be based on better allocation of spending over time, free from inherited wealth, thereby reducing income inequality (Čihák, Sahay 2020, 12).

The relationship between income inequality and the financial sector raises the question whether improving financial access and availability through the banking industry can potentially help to reduce the global pain point that is income inequality. The main aim of the thesis is to evaluate and determine whether there is evidence of a relationship between financial development and income inequality among European countries. Based on the importance and actuality of the issue of income inequality, as well as theoretical standpoints and previously conducted empirical studies, stem two research questions:

1. Can financial development be linked with income inequality among European countries?
2. How does the relationship between financial development and income inequality differ in Western Europe and Central and Eastern Europe?

Thesis differs from most studies on the matter for two reasons. Firstly, unlike most former empirical studies, the current empirical setup is concentrated solely on European countries and allows to compare the relationship between financial inclusion and income inequality in two different European regions with different levels of economic and financial development, as well as different pace and historical time frame of such development – while the leap of financial development and integration in Western Europe, fuelled by financial liberalization, date back to 1970s, then Central and Eastern European (CEE) countries only started taking the first steps towards financial development in early 1990s, when most transition economies experienced reforms and the expansion of the banking sector due to the entry of new banks, both domestic and foreign, and the decline in state ownership (Caporale et al. 2014, 5).

Secondly, while researching the relationship between financial development and income inequality in particular, scholars commonly use the size of the financial sector, also known as financial depth, as a proxy for financial development. Fewer studies view financial access as a multidimensional concept, rather than just depth. Consequently, current master thesis attempts to evaluate whether various indicators of financial access and inclusion have effect on income distribution. Finding answers to two posed research questions can first and foremost help to offer a potential remedy to reducing income inequalities by bringing light on whether financial development related variables contribute to the reduction of inequality and whether there are differences in two European focus regions.

The thesis is organised as follows. The first chapter explains the essence and core functions of financial development along with common methods of its measurement. Similarly, the essence, relevant causes and means of measurement of income inequality are introduced, as well as the theoretical relationship between financial development and income distribution. Additionally, empirical evidence of the relationship is examined based on existing literature, outlining the scopes and similarities and differences between former methodology and findings on the matter.

In the second chapter the author describes used research methodology, posed empirical model, reasoning behind variable selection and used data sources to further support the fulfilment of the main objective of the thesis. Furthermore, descriptive statistics of variables of interest are presented using complimentary charts and tables.

In the third chapter, an empirical analysis is carried out regarding the relationship between financial development and income inequality. The results and findings of relevant panel data models for the sample of 35 European countries are discussed and main conclusions are drawn. Finally, suggestions for further analysis will be provided.

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1. THEORETICAL FRAMEWORK

Financial sector and its development plays a huge role in overall economic development and in promoting growth, but can also help to reduce poverty and inequality by broadening access to finance to lower-income households and individuals (Beck et al. 2000 a, 1; Demirgüç-Kunt, Levine 2008, 38). Therefore, when approaching the wider issue of the reduction of income inequality, examining its essence and relationship with financial development and inclusion in particular, the latter defined as access to and use of financial services, is of great importance (Čihák, Sahay 2020, 4).

1.1. Financial Development

1.1.1. The Essence and Importance of Financial Development

A financial system consists of financial institutions and financial markets that permit transactions to be made by extending credit, thereby naturally influencing the allocation of resources across space and time (Estrada et al. 2010, 4). Financial intermediaries emerge and evolve due to the presence of market imperfections, such as the absence of perfect information and perfect competition. Hence, the overall function of a financial system is to reduce information and transaction costs impeding economic activity and its five core functions are to (Demirgüç-Kunt, Levine 2008, 3):

- Produce ex-ante information about possible investments and capital,
- Monitor investments and exert corporate governance after providing finance,
- Facilitate the trading, diversification and management of risk,
- Mobilize and pool savings,
- Ease the exchange of goods and services.

Conceptually, the process of improving the key functions of the financial system by reducing the costs of acquiring information, enforcing contracts and making transactions, can be defined as financial development (World Bank 2015, 17). Thereby, a sound, robust and efficient financial

system promotes growth by channelling resources to their most productive use and by fostering a more efficient allocation of resources (Estrada et al. 2010, 4).

A large body of evidence suggests a positive, first-order relationship between financial development and economic growth namely because better financial intermediaries can enhance resource allocation and accelerate growth. Therefore, well-functioning financial systems play an independent role in boosting long-run economic growth, causing economies with better-developed financial systems to grow faster over long periods of time. Furthermore, there is evidence that the effect is casual, meaning financial development both contributes to economic growth and is within itself an outcome of economic growth. (Čihák et al. 2012, 5)

While different theories agree that financial intermediaries arise to mitigate market frictions, there are competing views about specific and fundamental channels connecting financial intermediation to growth. Joseph Schumpeter argued in 1911 that financial intermediaries play a pivotal role in economic development by altering the path of economic progress by affecting the allocation of savings and not necessarily by altering the rate of savings. Thus, the Schumpeterian view of finance and development highlights the impact of financial intermediaries on productivity growth and technological change. Alternatively, some literature in development economics argues that the key factor underlying economic growth is capital accumulation. According to such view, well-functioning financial intermediaries influence growth primarily by raising domestic savings rates and attracting foreign capital. (Beck et al. 2000 b, 262)

1.1.2. Development of the Financial Sector

The overall impact of the financial sector in economy is to ensure sustainable growth by attracting deposits and providing loans from surplus to deficit side. By mobilizing savings and direct funds into production sectors, the financial sector facilitates efficient allocation of resources and increases overall productivity. It also facilitates delivery of products and services, management of risks and easier payments. In addition, it ensures the availability of different instruments, such as insurance packages, and information that facilitates trade activities. (Bakar, Sulong 2018, 1)

Although the underlying core functions of financial institutions change very little over time, the financial services industry and landscape has been transforming none the less, as the way each function is performed is changing. The change in the financial landscape can be associated with increased competition from non-traditional institutions, new information technologies and

declining processing costs, as well as the erosion of product and geographic boundaries, and less restrictive governmental regulations. (Crane, Bodie 1960, 3)

Since many market frictions exist and laws, regulations and policies differ markedly across economies and over time, improvements along any single dimension may have different implications for resource allocation and welfare, depending on other frictions in the economy. Central and Eastern European countries provide a particular case, as reforming the banking sector, alongside with the change in economic system, in 1990s was the first crucial step towards financial development. From that point onwards novel banking legislation was introduced, allowing private owned banks to develop, reducing the dependency on state ownership. Additionally, foreign banks were allowed to enter the market, and within a decade they held a majority share in most CEE counties banks, having turned the industry into a competitive one, meanwhile stimulating economic growth. Thus, most transition countries experience a rapid expansion of the banking sector in 1990s, which systematically was very similar to that already existing in the rest of Europe since 1970s. (Caporale et al. 2014, 2)

In the era of financial liberalisation and integration, both aspects of globalisation in general, one of the biggest contributors to the transformation of the financial landscape has been technological change. The financial industry all over the world has seen drastic technology-led changes in the recent decades, improving efficiency and facilitating game-changing innovation, meanwhile lowering operating costs and continuing to support legacy systems. One area in retail banking, that technology has greatly contributed to, has been expanding the outreach and access to financial infrastructure. This has been made possible by developing and improving digital financial services, which not only significantly simplify opening bank accounts or making payments, but also allow real-time financing offers and lending decisions via internet bank or mobile phone for instance. Furthermore, advances in robotics and artificial intelligence (AI) have improved automated teller machine (ATM) networks across geographical regions, making banking services more accessible. (PwC 2021, 5)

1.1.3. Measuring Financial Development

Since financial development matters for economic development and growth, measuring financial development is undeniably important. Empirically however, direct measurement of financial development is challenging as it has several dimensions. Furthermore, there is a surprising lack of comprehensive data on basic aspects of financial systems across countries and over time. For

example, there are gaps in data on financial institutions and micro-level data on their customers. (World Bank 2014, 22)

Financial development is most commonly measured with four characteristics: depth, access, efficiency and stability. Commonly used characteristics and their proxies are presented in Table 1. Financial depth measures the size of financial institutions and markets, financial access estimates the degree to which individuals can and do use financial systems. Financial efficiency shows the efficiency of financial markets and institutions in providing financial services, while financial stability benchmarks the stability of financial systems. (Čihák et al. 2012, 3)

Table 1. Characteristics of Financial Development, financial institutions perspective

Characteristic	Commonly Used Proxy Variables
Depth	Private sector credit to GDP
	Money to GDP
	Deposits to GDP
	Value-added of the financial sector to GDP
Access	Accounts per 1000 adults
	Branches per 100 000 adults
	Percent of People with a bank account
	Percent of firms with line of credit (all firms)
	Percent of firms with line of credit (small firms)
Efficiency	Net interest margin
	Lending-deposits spread
	Noninterest income to total income
	Overhead costs
	Profitability
	Boone indicator (Herfindahl or H-statistic)
Stability	Z-score
	Capital adequacy ratios
	Asset quality ratios
	Liquidity ratios

Source: The World Bank 2014, author's calculations

In order to obtain a comprehensive characterization of financial systems, all four categories should be measured for both key components of the financial system, meaning financial institutions and financial markets. For this reason, The World Bank has developed what is called a 4x2 framework, which assembles all four characteristics for the two components. (World Bank 2014, 22) In the context of current thesis, the focus is primarily on the financial institutions perspective – using proxy variables across four characteristics help to better describe, compare and analyse financial institutions around the world.

1.2. Income Inequality

1.2.1. The Essence of Income Inequality

The discourse on inequality often makes a distinction between inequality of outcomes, measured by income, wealth or expenditure and inequality of opportunities. The latter is attributed to differences in circumstances beyond the individual's control, such as gender, location of birth or family background, as opposed to inequality of outcomes, which arises from differences in opportunities and individual's efforts and talent. However, it is difficult to separate effort from opportunity, as parental income for example, determines the opportunity of their children, linking inequality of opportunities with income inequality. (Dabla-Norris et al. 2015, 6)

Income can be defined as a flow which corresponds to the quantity of goods and services produced and distributed each year. Income can be decomposed as the sum of labour income, such as wages, salaries and bonuses, as well as capital income, such as rent, dividends, interests and business profits. Income inequality therefore refers to the extent to which income is evenly distributed within a population. Income inequalities can be analysed from the perspective of primary income, defined as income before taxes and government transfers, and from the perspective of disposable income, defined as the income after taxes and government transfers. (Piketty, Saez 2014, 842)

There can be a clear distinction made between income and wealth. While income is a flow, wealth is a stock, corresponding to the total wealth owned at a given point in time (Ibid. 2014, 842). Inequalities in wealth, accounting for various savings, property and other forms of wealth, are typically even higher and spread out more unevenly than income because they are accumulated over time. Despite such tendency, in some ways income however matters more than wealth, as it is usually a better indicator of people's day-to-day economic resources. (Keeley 2015, 18) Furthermore, not all countries measure wealth the same way – for example, some may include the value of a pension, while others may not. For this reason, empirical papers analysing the relationship between inequality and financial development have predominantly concentrated on income inequality instead of wealth inequality.

A certain level of inequality can be seen essential and not as a problem. Some degree of inequality can help to incentivize entrepreneurial risk-taking, competition and innovation, as well as provide incentives for studying longer, working harder and saving more to move ahead in life, thereby increasing economic activity, efficiency and growth. For example, returns to education and

differentiation in labour earnings can spur human capital accumulation and economic growth, despite being associated with higher income inequality. (OECD 2015, 28; Dabla-Norris et al. 2015, 6)

However, there is growing concern, what happens when the gap between the rich and the poor grows too wide and when economic growth delivers benefits only to the well-off, as more inequality means that the rich are more likely to take advantage of economic opportunities than the poor. Poor families may be unable to keep their children in education for as long as is optimal or to afford high-quality education, thereby harming their future earnings. Furthermore, poorer families may find it difficult to borrow to invest in new opportunities. (Mankiw 2013, 24; Keeley 2015, 12) Consequently, lack of social mobility and inequality of opportunities will affect economic performance as whole, slowing down growth, meanwhile disproportionately benefitting the rich (OECD 2015, 28).

1.2.2. Causes of Income Inequality

Besides differences in individual and pre-set socio-economic circumstances, such as family background or gender, there are many factors that explain the causes of changes in income inequality. Globalisation along with technological progress are one of the most widely debated roots of unequal income distribution, but policy choices, regulations and institutions can also have a crucial impact, as they can shape how globalisation and technological changes affect the income distribution. Furthermore, policy choices, regulations and institutions can also influence income distribution directly, for instance through changes in social transfers or wage-setting mechanisms. However, connecting these factors with overall income inequality is not always straightforward, as regulatory and policy reforms may have counteracting effects on employment and wage inequality among workers. (OECD 2011, 26) Therefore, the main focus of the following subsection is on the key drivers of inequality that have also had an impact on the financial sector, but also on the financial sector itself as a contributor to the cause.

One important exogenous driver of income inequalities is the impact of globalization. Economic globalisation includes the growing weight of international trade in goods and services, international mobility of capital and labour, the increasing availability of information worldwide, facilitated by declining costs of transport and communication. (Dorn et al. 2017, 5) This has largely been possible due to rapid technological process and ever-growing role of technology in our economies over the past four decades. Automatization and robotization has opened new markets,

allowed greater financial integration and provided novel growth opportunities, which has had positive effect on poverty reduction over time. However, inequality has been on the rise and has most often been associated with technological change. (Dabla-Norris et al. 2015, 18)

Technological change affects the world of work, devaluing and revaluing skills and of course, creating whole new skills and jobs, leading to a race between technology and education (Keeley 2015, 45). Technological change is skill-biased, continually increasing the demand for skilled labour, often causing the demand to even exceed supply as educational system is struggling to keep up. By itself, this force tends to increase the earnings cap between skilled and unskilled workers, thereby increasing inequality. Meanwhile the process of automatization eliminates jobs of the low-skilled and unskilled labour, further increasing inequality. This angle also highlights the power of education, as it can play an important role in determining the levels of inequality by determining occupational choices and future income, as well as compatibility, ability and productivity on the job market. (Mankiw 2013, 23; Dabla-Norris et al. 2015, 19,22)

The integration of global economy, accompanied by technological progress, has also been shifting the balance between labour and capital, delivering a larger share of income to the owners of the capital, such as entrepreneurs, and a smaller share to the people who work for them. The increased use of robots and automatization, as well as the growing sophistication of information processing allows to replace workers, especially the low-skilled, directly benefitting the capital owners. (Keeley 2015, 42, 48) Furthermore, technological advances have enabled higher trade and financial flows between countries, leading to potential offshoring and lower wages as import prices decrease, which can result in increasing income inequality (Dabla-Norris et al. 2015, 19).

Globalisation and technological change have also fuelled so called financialisation – the rapid expansion of finance and financial services, which can also contribute to income inequality in a number of ways. Firstly, financial sector workers are considered high-skilled workers and tend to be very highly paid. In Europe, they account for one in five of the top 1% of earners even though they account for one in 25 of the total workforce. Financial workers usually have a wage premium over other comparable workers, as despite high income their productivity is not higher than of similarly skilled workers in other sectors. (Keeley 2015, 42, 59) Financial globalisation and increased financial flows, foreign direct investment for example, can increase income inequality by directing foreign assets in relatively higher skill- and technology intensive sectors, which pushes up the demand for and wages of higher skilled workers (Dabla-Norris et al. 2015, 20).

While financial sectors are essential to ensuring that capital and resources flow from those that have them to those who need them and to help balance risk with reward, there is increasing evidence that their usefulness diminishes at a certain point or when they favour certain activities over others. For example, providing credit rather than facilitating financing through stock markets offers a wider availability for high earners to increase their borrowings, allowing them to gain more from investment opportunities than people on lower incomes. In addition, higher earners also benefit from the expansion of stock markets because they are always more likely to hold shares than lower earners. This can lead to higher inequality and lower growth by delivering a larger slice of the benefits of economic growth to a small number of high earners. (Keeley 2015, 42, 59)

1.2.3. Measuring Income Inequality

One of the earliest scholars to attempt to measure income inequality was Max Lorenz, who in 1905 introduced the Lorenz curve, widely used graphical device to represent and analyse the size distribution of income and wealth. The curve relates the cumulative proportion of income units to the cumulative proportion of income received when the units are arranged in ascending order of their income. (Kakwani 1980, 30) The Lorenz curve plots the proportion of the total income (y axis) and the amount that each quantile of population (x axis) has, in cumulative terms. The Lorenz curve coinciding with the 45-degree diagonal egalitarian line indicates perfect equality of incomes. The area between the 45-degree diagonal and the actual distribution curve shows the depth of income inequality. The further the Lorenz curve reaches from the diagonal, the more inequality dominates the distribution. (Charles-Coll 2011, 25)

The Lorenz graph performs as the natural instrument for graphically depicting the Gini coefficient, which developed by Corrado Gini in 1912, can be calculated as the ratio between the Lorenz curve and the absolute equality line, divided over the total area under the 45-degree line (Charles-Coll 2011, 25). The Gini coefficient is the main inequality measure employed in literature, with value 0 indicating perfect equality and 1 perfect inequality. As an alternative to such market (gross) Gini, net Gini coefficient can be used as a measure of inequality, which nets out taxes and transfers. (Dabla-Norris et al. 2015, 6, 9) Additionally, tracking changes in income shares of the population can be used for measuring inequality, for instance deciles and quintiles. They generally consist of comparing extreme values of the distribution, for example the highest over the lower quantile, or any other combination that can depict the relationship between higher and lower income earners. (Charles-Coll 2011, 23)

1.3. Financial Development and Income Inequality

1.3.1. The Relationship Between Financial Development and Income Distribution

A growing body of literature suggests that allowing all market participants to take advantage of the best investment opportunities via financial institutions and financial markets not only exerts a powerful influence on economic development, but also on poverty alleviation, income distribution improvement and economic stability (World Bank 2008, 1). Financial development reduces poverty and inequality by broadening access to finance to lower-income households and individuals, facilitating risk management by reducing their vulnerability to shocks, and increasing investment and productivity that result in higher income generation. Inclusive financial systems provide individuals with greater access to resources to meet their financial needs, such as saving for retirement, investing in education, capitalizing business opportunities and confronting economic shocks. (World Bank 2015, 9) Thus, a well-functioning financial system that overcomes market imperfections will effectively provide financial services to a wide range of households, not just rich individuals (Čihák et al. 2012, 12).

Besides individual skill and initiative, parental wealth, social status and political connections, the financial system and its development can greatly influence who can attempt to realize one's economic aspirations and who cannot by determining credit extension for entrepreneurship and education for example (Demirgüç-Kunt et al. 2009, 1). Financial frictions, such as information and transaction costs, may be especially binding on the poor, as they lack collateral and credit histories. Any relaxation of these credit constraints will disproportionately benefit the lower-income individuals, improving the efficiency of capital allocation and reduce income inequality by facilitate funding to poor with productive investments. Thus, financial development helps the poor both by improving the efficiency of capital allocation, which also accelerates aggregate growth, and by relaxing credit constraints that more extensively restrain the poor, reduces income inequality. (Claessens et al. 2007 b, 4)

Economic literature investigating the relationship between financial development and income inequality provides mixed findings. A distinction can be made between financial market operating on the extensive and intensive margin. The extensive margin is about the use of financial services by individuals who had not been using said services prior, thereby increasing the availability and use of such services. Thus, financial development might expand the economic opportunities of disadvantaged groups and reduce the intergenerational persistence of relative incomes. For

example, financial development may help poor families to borrow to pay for education and therefore contribute to the acquisition and accumulation of human capital. (de Haan, Sturm 2016, 5; Demirgüç-Kunt et al. 2009, 2) Since human capital accumulation is larger if it shared by a larger segment of society, equality, in the presence of credit constraints, stimulates further investment in human capital and promotes economic growth (Galor, Moav 2002, 26).

On the other hand, the effect of financial development on income inequality on the intensive margin is different. Improvements in the quality and range of financial services do not tend to broaden access to financial services, but instead improve the quality of financial services for those who are already purchasing financial services, often high income individuals, widening the distribution of income as a result, as poorer individuals are limited to their own savings. (de Haan, Sturm 2016, 5) Thus, the direct effect from improving the quality of financial services could fall disproportionally on the rich, not only widening inequality, but also conserving cross-dynasty differences in economic opportunity (Demirgüç-Kunt et al. 2009, 2).

In conclusion, when financial systems do not work well, opportunities for growth are missed, inequalities persist, and in the extreme cases, costly crises follow. Without inclusive financial systems, poorer individuals need to rely on their personal wealth or internal resources to invest in their education, become entrepreneurs, or take advantage of promising growth opportunities. (World Bank 2008, 1) Therefore, finance can help reduce inequality but is also associated with greater inequality if the financial system is not inclusive and well managed.

1.3.2. Financial Access and Income Inequality

Besides focusing on depth of financial systems, modern development theories increasingly emphasize the key role of access to finance, as lack of finance is often the critical element underlying persistent income inequality, as well as slower economic growth (World Bank 2008, 2). Today's real-world financial systems are far from inclusive, due to which many of the world's poor would and could benefit from financial services but cannot access them because of market failures or inadequate public policies (Claessens et al. 2007 a, 14). This of course adds to the ever-growing importance and continuous need to focus on building inclusive financial systems that expand and equalize individual opportunities in the society.

In essence, broad access to financial services, whether through traditional financial institutions or through microfinance and other specialized institutions, implies an absence of price and nonprice

barriers to finance (Demirgüç-Kunt et al. 2008, 39). Broad-ranging access to finance can expand the opportunities for poorer households in order to engage in productive activities (Estrada et al. 2010, 7). Well-functioning financial systems expand economic opportunities, so that the allocation of credit, and hence opportunity, is less closely tied to accumulated wealth and more closely connected to the social value of the financed project (Čihák et al. 2012, 6).

Furthermore, access to finance confers substantial welfare gains for poorer households by allowing them to smooth their lifetime consumption and cope with negative economic shocks. Therefore, financial inclusion can contribute to economic growth as well as social development. (Estrada et al. 2010, 7) Consequently, lack of access to finance can be viewed as a critical mechanism for generating persistent income inequality, as well as slower growth, emphasizing the raising worldwide attention and added importance on access to financial services financial inclusion (Claessens et al. 2007 a, 14).

1.3.3. Previous Empirical Studies

The relationship between financial development and income inequality, along with effect of financial development on poverty and in particular, inequality reduction, has been extensively researched in literature. According to economic theory the impact of financial development on income distribution is mainly dependent on both, the depth and access to financial institutions, such as banks. However, most earlier studies use traditional indicators of financial development, mostly financial depth proxies, which appropriately capture the indirect impact of financial development on poverty through economic growth, but are less adequate to reflect the impact of increased access to financial services by the poor. (Kiendrebeogo, Minea 2016, 8) Among such work, the findings of scholars are ambiguous and an overview of studies that were found to be relevant in the thesis context can be found from Table 2.

Many studies report that countries with higher levels of financial development have less income inequality. To come to this finding, Hamori & Hashigurchi (2012) use panel data models for the sample of 126 countries worldwide, over 40-year period. Financial development variables reflect the measurement of financial depth, as M2 as a percentage of GDP and domestic credit to the private sector as a percentage of GDP are used, the latter for robustness checks. Additionally, for robustness checks, the inequality measure is used as a natural logarithm. Total of four proposed models also include a measure of trade openness (trade-to-GDP ratio), the natural logarithm of GDP per capita and inflation rate. Additionally, Generalized Method of Moment (GMM) approach

is used with additional 4 models and the inequality measure is used as an dynamic instrumented variable. Their work slightly differs from most, as estimated household income inequality (EHII) data is used as an inequality measure instead of Gini, however, this selection is not explained.

Table 2. Overview of empirical literature on the relationship between financial development and income inequality

Author(s)	Scope	Financial Development Measure	Main Findings
Hamori, Hashiguchi 2012	126 countries, years 1963-2002	Private credit/GDP, M2/GDP	Countries with higher levels of financial development have less income inequality
Batuo et al. 2010	22 African countries, years 1990- 2004	Constructed aggregate financial development index based on private credit/GDP, M2/GDP, liquid liabilities/GDP	
Beck et al. 2007	65 countries, years 1960-2005	Private credit/GDP	
Clarke et al. 2006	83 countries, years 1960-1995	Private credit/GDP	
Bahmani, Zhang 2015	17 random countries, for which time-series data was available	Private credit/GDP	Mixed results
Law et al. 2014	81 countries, years 1985-2010	Private credit/GDP, bank credit/GDP, number of commercial bank branches	
Kim, Lin 2011	65 countries, years 1960-2005	Private credit/GDP	
De Haan, Sturm 2016	121 countries, years 1975-2005	Private credit/GDP	Countries with higher levels of financial development have more income inequality
Jauch, Watzka 2012	138 countries, years 1960-2008	Private credit/GDP	

Source: Author's calculations

With similar findings Beck et al. (2007) also used both, panel data models and GMM method, and slightly differing from most, used annual growth of each country's Gini index as an inequality measure. They controlled for the initial level of income inequality, GDP per capita growth, average years of school attainment for human capital stock proxy, as well as inflation and trade openness, meanwhile measuring financial depth as private credit to GDP ratio. GMM technique was also used by Batuo & Others (2010), who also used the Gini coefficient as income inequality proxy. In this case the scope was limited to African countries, as income inequality in the region is reported to be very high, despite economic and financial reforms. To measure financial development, they

construct a composite financial sector development index from three financial depth measures. Per capita GDP, primary school enrolment rate as a proxy for human capital development, inflation and manufacture and service sector as a share of GDP are used as control variables.

While empirical literature commonly supports a favourable linear effect of financial development on poverty alleviation and the reduction of income inequality, mixed results and even counterarguments are not unheard of. Bahmani and Zhang (2015) found that short-run effects of financial market development on income distribution were equalizing in some countries and unequalising in others. In the long run however, the equalizing effects were only found to last in three countries out of the 17 analysed. In their analysis they included a small number of countries for which the time-series data was available and presented findings for each country separately.

For example, Kim and Lin (2011) find with the help of instrumental variable threshold regression and GMM, conclude that the benefits of financial development on income distribution only occur if the country has reached a threshold level of financial development. Interestingly, Kim and Lin used the same dataset for the sample 65 countries and the same control variables as Beck and others (2007), but additionally added measures of stock market development to the model. Law et. Al (2014) contribute that institutional quality affects the link between financial development and income inequality, indicating that better quality finance results in more equal income distribution. Similarly to many other authors, their model incorporates indicators of financial depth, human capital, inflation and real income per capita.

In contrast with most previous work, Jauch and Watzka (2012) and de Haan and Sturm (2016) results suggest that a higher level of financial development increase income inequality in a country. Jauch & Watzka try to combine one of the largest datasets concerning financial development and income inequality, the latter measured both as gross and net Gini coefficients. They control for many variables, including the most commonly used GDP per capita, inflation and end up finding a positive relationship between variables – better-developed financial markets lead to higher gross income inequality within countries and an increase in the provision of credit by ten percent leads to an increase in the Gini coefficient by 0,23 for the within estimation. De Haan and Sturm (2016) also control for the size of the government, as economic theory suggests that a larger government may have stronger determination to redistribute income.

While economic theory explicitly refers to a link between financial access and income inequality, earlier empirical literature has predominantly focused on the impact of financial depth on income inequality, using private sector credit to GDP as a measure of financial depth and development. (Aslan et al. 2017, 6) However, more recent analyses focus on financial access or financial inclusion as a broader concept when researching its relationship with economic outcomes, such as income inequality. Albeit, the time-series for financial access variables are usually shorter than those of financial depth, which partially explains why most scholars opt for the latter when choosing financial development proxies. Studies that have attempted to measure financial inclusion and exclusion look mostly at supply-side data such as number of bank branches, ATMs and number of bank deposit and loan accounts.

Authors like Moockerjee & Kalipioni (2011) and Honohan (2007) found that better access to financial services reduce income inequality. Moockerjee & Kalipioni used a dataset composed of 70 countries, including developing and developed and the Gini coefficient average over the period 2000-2005. With OLS and IV regression, the number of bank branches per 100,000 people was used as the proxy for financial development. Honohan included 160 countries in the dataset and calculated financial access measures based on household level surveys.

Aslan et al. (2017) constructed a Financial Inclusion Index based on information about using different services by commercial banks, taking into consideration factors like owning an account, a credit card, saving and borrowing and making different payments. While focusing on African countries, they found that inequality in financial access is in fact related to income inequality. Similarly, Čihák and Sahay (2020) find that greater financial inclusion is associated with reductions in inequality, especially so for the inclusion of payment services, but less so for credit use and inclusion. As for methods, panel regressions and, due to endogeneity concerns, GMM were used. They also used Gini index to proxy income inequality, while for robustness checks also included the first quintile income share, the Palma ratio and the quintile ratio.

Based on the evaluation and comparison of previous empirical studies on the relationship between financial development and income distribution, it can be concluded that most authors do provide support to the link between the two, just as economic theory suggests. However, while empirical literature commonly supports a favourable linear effect of financial development on the reduction of income inequality, there is also evidence of mixed results and even counterarguments. Albeit, empirical methodology, models and variable selection in former studies are largely overlapping.

Many authors use panel data models, both fixed and random effects, as well as GMM – the latter due to endogeneity concerns. Gini coefficient is the most commonly used proxy for income inequality and financial depth a very commonly used proxy for financial development, meanwhile financial access proxies are not used as often. Most authors use GDP growth rates, inflation rates, trade openness indicators and human capital measures as control variables.

2. DATA AND RESEARCH METHODOLOGY

2.1. Scope, Variable Selection and Data Sources

As was shown in previous sub-section, most former empirical studies financial depth characteristic as a financial development indicator. Current thesis attempts to differ and thereby add additional insight, as financial development will not just be limited to financial depth proxies but will also include various financial access measures to models.

For grasping the depth of financial institutions, the commonly used variable in empirical literature on financial development is private credit, defined as extended credit to the private sector by financial intermediaries, shown as a percentage of gross domestic product (GDP). Such measure shows the size and depth of financial institutions, relative to the size of the whole economy. There is vast amount of empirical literature demonstrating the link between financial depth, approximated by private sector credit to GDP, on one hand, and long-term economic growth and poverty reduction on the other hand (for example Demirgüç-Kunt and Levine 2008). (Čihák et al. 2012, 10)

An alternative to private credit is the ratio of broad money (M2) to GDP. Generally, a higher ratio of broad money to GDP is associated with greater financial liquidity and depth and the ratio may decline rather than rise as a financial system develops because people have more opportunities to invest in long-term or less liquid financial instruments. (Creane et al. 2003) Additionally, the ratio of bank deposits to GDP and value added by the financial sector to GDP are used empirically, although worldwide data availability is scarce. Such financial depth indicators, measured as a ratio of GDP, are substantially influenced by the state of financial and general economic development in individual countries. Therefore, cross-country comparisons on the depth of the financial sector are more reliable for economies at similar stages of development. (World Bank 2005, 16)

When going beyond the size of financial institutions, the ability of individuals in an economy to access financial services is of great importance. Measures of financial access are strongly associated with economic development, the relationship however, is separate from the association

between financial depth and economic development. Furthermore, enhanced access to financial services contributes to the reduction of inequality. (World Bank 2014, 26) A common proxy variable of access to financial institutions is the number of bank accounts per 1000 adults. Additionally, the number of bank branches per 100 000 adults help to analyse the outreach of banks.

However, when using such financial access proxies, one needs to be aware of their weaknesses. For example, the number of bank branches is becoming increasingly misleading with digitalisation and the move towards branchless banking. The number of bank accounts does not suffer from the same issue, but it has its own limitations – in particular, it focuses on banks only, and does not correct for the fact that some bank clients have numerous accounts. (Čihák et al. 2012, 13) In earlier empirical studies, financial access has often been overlooked on financial system characteristics, mostly due to data gaps and inconsistency in data availability. However, since the focus of the master thesis is on European countries specifically and not worldwide, data on most countries in the region is available.

In order to combine a dataset for financial inclusion indicators, IMF's Financial Access Survey (FAS) database was used. The FAS, launched in 2009, is a supply-side dataset on access and use of financial services, helping to monitor and measure financial inclusion, as well as compare countries and different regions. The FAS is based on administrative country-level annual data, collected by central banks and other financial regulators. The dataset covers 189 countries worldwide, spanning more than 10 years and contains 121 time-series on financial access and the use of financial services. The FAS data is disaggregated by the type of financial service provider and in current thesis commercial banks are under focus. (IMF 2021) The FAS data on financial inclusion indicators is available for years 2005 to 2019, allowing to create an unbalanced panel for 15 years.

Income inequality will be measured with the Gini index, which is the most commonly used measure in literature and can be retrieved from World Inequality Database (WID). The World Inequality Database is the most extensive available database on the historical evolution of the world distribution of income and wealth, both within countries and between countries (WID 2021). For robustness checks, scholars often opt for the net Gini, the Palma ratio or the quintile ratio. The Palma ratio is the ratio of the richest 10 percent of the population's share of total gross national income, divided by the poorest 40 percent's income share. The quintile ratio is defined as the ratio

of the richest 20 percent of the population's share of income, divided by the income share of the poorest 20 percent. (Čihák, Sahay 2020, 25)

2.2. Dataset, Methodology and Model

The aim of the thesis is to evaluate and determine whether there is empirical evidence of a link between financial development and income inequality among European countries. Besides including several characteristics of financial development, current thesis additionally differs from most studies on the matter, because the empirical setup is concentrated solely on European countries and allows to compare the relation between financial inclusion and income inequality in different European geographical regions with different levels of development. To compare Western and Eastern Europe, World Inequality Database country split will be used to distinct Western European countries (20) and Eastern European countries (18).

Based on former empirical studies and general data availability two main panel datasets were combined for 38 European countries, consisting of relevant indicators of income inequality, financial development, as well as of macroeconomic control variables (see Appendix 1 for variable explanations and data sources). One dataset holds annual country-level data from 2005 to 2019, while the other is composed of three-year non-overlapping averages of all variables, splitting the 15-year time-series into five time periods. Finding multiple year averages is a common practice in former studies, as it helps to make up for data gaps or little variation in variables and helps to purge the effects of short-term cyclical developments in the economy. For example, Aslan et al. (2017) use four-year averages and de Haan & Sturm (2016) and Altunbaş & Thornton (2019) use five-year averages of selected variables. Five-year averages are most common used, yet with current combined dataset the use is not possible, as the time-series would become too short for further analysis. Even the use on three-year averages in subsamples for two European regions may suffer from such econometric hurdle.

Fixed and random effect models were assessed on both main datasets including all 35 European countries, as well as on separate samples on Eastern and Western European regions. Fixed effects (FE) models take into account unobserved and time invariant country-specific effects that are correlated with the explanatory variables. Considering the variables chosen and research questions posed, this is expected to be a more reasonable supposition as countries institutional structures are

affected by historical and cultural background for instance. On the contrary, random effect models assume that the country-specific effect is a random variable that is uncorrelated with the explanatory variables in the model, resulting in likely omitted variable bias. However, even though estimations with fixed effects are expected, the short time-series available might cause further complications, as there is little within group variation for variables. Moreover, either of the used models do not address endogeneity concerns, relevant due to likely reverse causality as greater income inequality itself might impact financial development.

The structure of panel data models that are estimated with fixed effects in this thesis can be expressed as follows:

$$Gini_{it} = \alpha_i + \beta FD_{it} + \gamma X_{it} + \varepsilon_{it} \quad (1)$$

where:
Gini – Gini coefficient,
α_i – unknown FE constant, specific to country i
β, γ – intercepts to be estimated,
FD – Financial Development measures,
X – vector of control variables,
ε – error term,
i – country indicator,
t – time period indicator.

Presented panel model structure largely resembles the one's of Altunbaş & Thornton (2019) and Čihák and Sahay (2020). In constructed model to assess the relationship between financial development and income inequality, Gini coefficient (Gini) was used as a dependent variable. The Gini coefficient is based on households' income before taxes to proxy for income inequality before redistribution via the tax system (Altunbaş, Thornton 2019, 2). Financial development (FD) is measured as either as share of outstanding loans or deposits from commercial banks (share of GDP) or as a number of ATMs, branch offices, credit cards and debit cards (per 100 000 adults). In both datasets all variables in absolute values, i.e. not expressed as ratios, are transformed with natural logarithm form for easier interpretation of results and skewness reduction.

In estimated models seven chosen financial development measures are used independently, as there are strong correlations between many of the indicators (see Table 3). For the sample of all

countries, there is a strong positive correlation between debit card ownership and loans-to-GDP ratio, as well as between digital banking transaction activity and loans-to-GDP ratio. This is likely to indicate that countries with higher use of daily banking services, such as debit card and internet bank transactions, are likely to have larger size of the financial sector, relative to the economy. Meanwhile, a relatively strong negative correlation exists between digital banking transactions and branch density, which supports the trend of digitalisation and the move towards branchless banking.

Table 3. Correlation between Financial Development indicators of interest, sample of all European countries

	ATM	loans	branches	credit-cards	debit-cards	deposits	digital-Banking
ATM	1.00						
loans	0.46	1.00					
branches	0.40	0.10	1.00				
creditcards	0.40	0.48	0.26	1.00			
debitcards	0.47	0.77	-0.13	0.53	1.00		
deposits	0.27	0.18	0.25	0.22	0.37	1.00	
digitalBanking	-0.15	0.63	-0.61	0.57	0.52	-0.10	1.00

Source: Author's calculations in RStudio

As concluded in sub-section 1.3.3., commonly used determinants of income distribution include GDP or GDP per capita growth rate, inflation rate, trade openness, size of the government and human capital indicators. Therefore, the vector X is comprised of a number of estimates of control variables – GDP growth rate, GDP per capita growth rate, the rate of inflation, the ratio of foreign trade to GDP, the ration of government consumption to GDP and the share of school enrolment on a secondary level. The vector is used to control for the endogeneity of financial sector development, as chosen variables are also expected to have impact on income inequality. When choosing between different combinations of controls for each model, tertiary and secondary level educational enrolment were tested as possible alternatives, the latter was preferred, showing better results in terms of higher explanatory power of models and statistical significance of estimations.

Low growth in aggregate income, measured as GDP or GDP per capita growth, is associated with greater inequality. Inflation rate aims to proxy macroeconomic instability, as greater price instability is more likely to hurt the poor, as they cannot access finance as easily as the rich to hedge their exposure to inflation. (Clarke et al. 2006, 585) According to some empirical evidence

trade liberalisation, a by-product of globalization, is likely to lead to a more equal income distribution (Winters 2004, 106). The size of the government, measured in government expenditure, is expected to affect income inequality. A larger government might have a stronger determination to redistribute income and thereby reduce inequality (Jauch, Watzka 2012, 300). The school enrolment rate in secondary school is included to capture heterogeneity in human capital. Based on literature it is expected that better availability and access to education results in a more equal income distribution.

The analysis was conducted using RStudio software.

2.3. Descriptive Statistics

It is important to analyse the relationship between financial development and income inequality among European regions, as the level of inequality varies. As seen in Figure 1, in 2019 the Gini coefficient, used as proxy for income inequality, was higher in Central and Easter European countries than in Western European countries. In 2019 the coefficient was 0.49 in CEE and 0.45 in Western Europe, higher coefficient showing greater inequality.

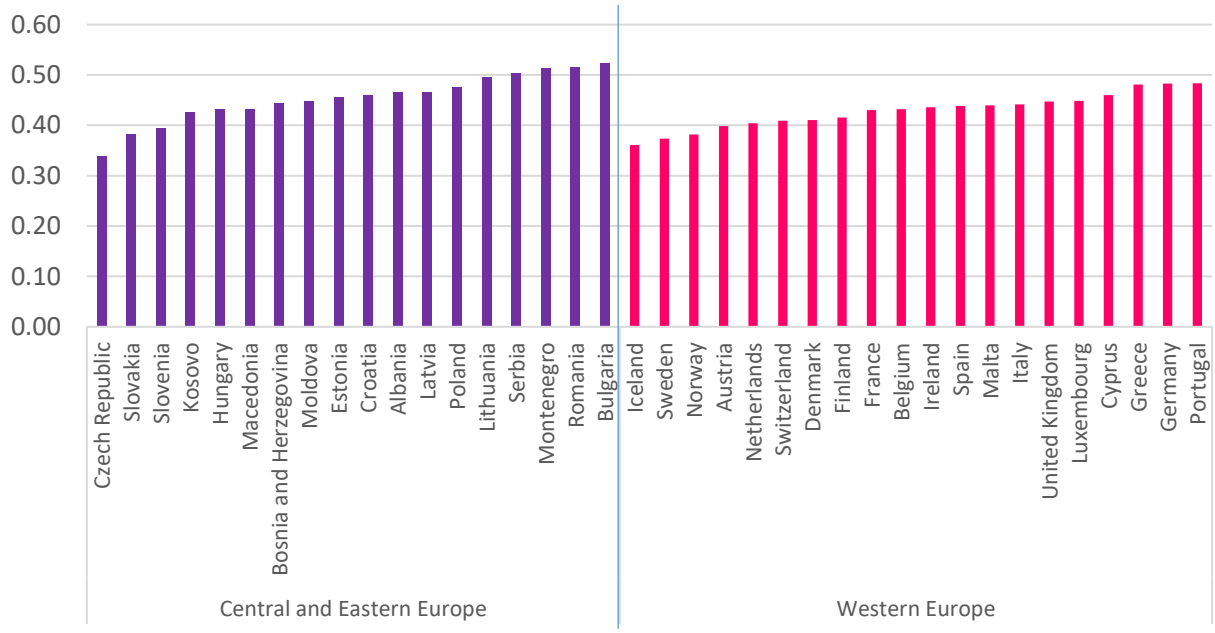

Figure 1. Gini coefficient among European countries in 2019

Source: World Inequality Database (WID), author's calculations

Both, among all European countries and within CEE region, income inequality in 2019 was the highest in Bulgaria (0.52). Surprisingly it was the lowest in Czech Republic (0.34), also in located in Central-Eastern Europe, followed by Iceland (0.36) in Western region. Meanwhile, Figure 2 shows that the change of the Gini coefficient over time for the scope period between years 2005 and 2019 has been quite stable in both European regions. However, the difference between the regions has also remained the same consequently.

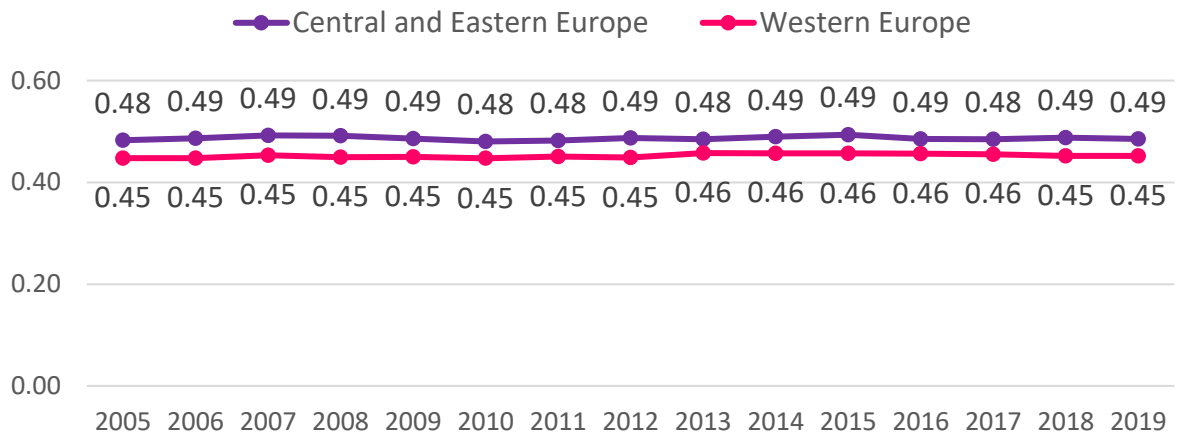

Figure 2. Gini coefficient among European regions 2005-2019
Source: WID, author's calculations

While the change on region level has been with very minor fluctuations, changes on country level have been more significant. When comparing the Gini coefficient in 2019 with that of in 2005, there have been changes among countries in both regions (see Figure 3). In CEE, income inequality has increased in seven countries, strongest increase has occurred in Montenegro (+0.05pp) and in Bulgaria (+0.05pp). Meanwhile in Estonia there has been a decrease in income inequality (-0.10pp), meaning the income distribution has become more equal over time. This has also been the case for 11 CEE countries in total and for 12 Western European countries. Among the latter, United Kingdom has experienced the largest decrease in inequality (-0.03pp), while in Cyprus (+0.05pp) and in seven other countries inequality has become more severe.

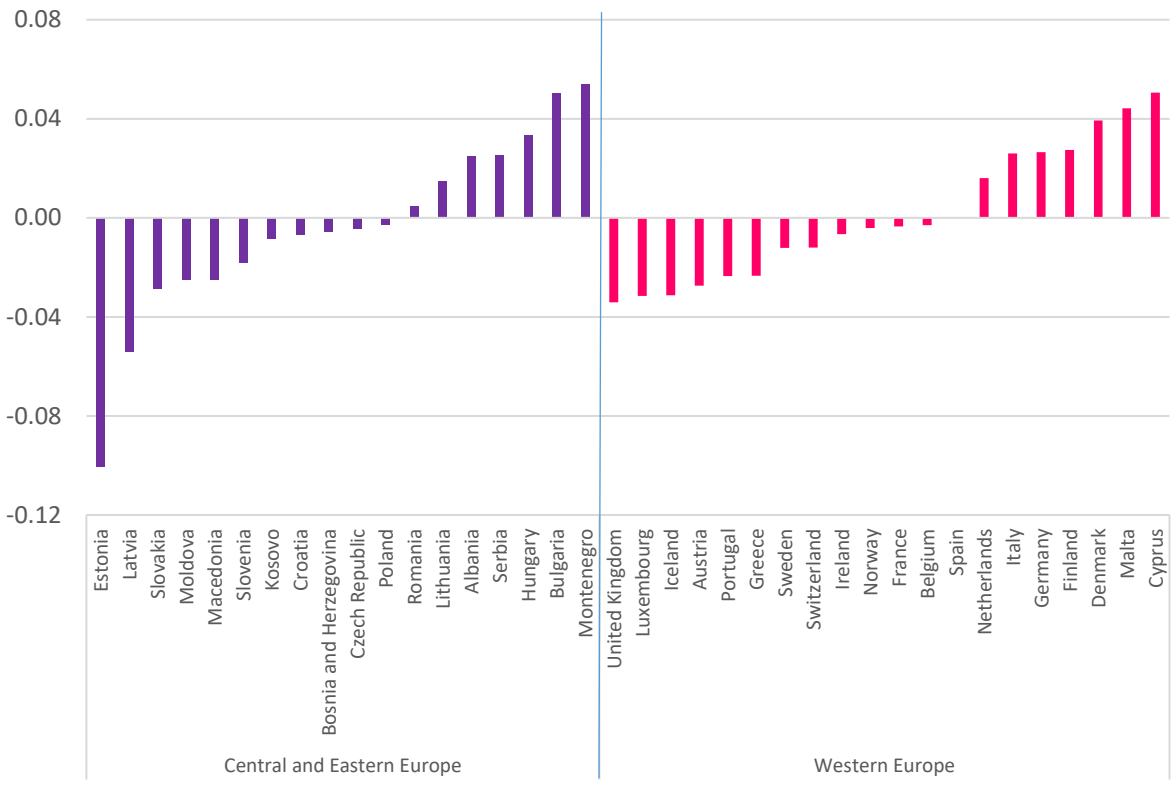

Figure 3. Change in Gini coefficient among European regions (2019 vs 2005)
Source: WID, author's calculations

One potential proxy for financial development can be the share of outstanding loans from commercial banks (% of GDP), with a higher share indicating better access to credit from commercial banks. According to a large body of literature, higher levels of financial development should be related to lower levels of income inequality. When looking at the relationship between the Gini coefficient and the share of outstanding loans from commercial banks in European countries (see Figure 4), a weak negative relationship between a higher financial development and lower income inequality is evident. This however is not statistically significant. Additionally, five Western European countries, Cyprus, Luxembourg, Netherlands, Switzerland and the United Kingdom, appear as outliers, as the share of outstanding loans exceeds 100%.

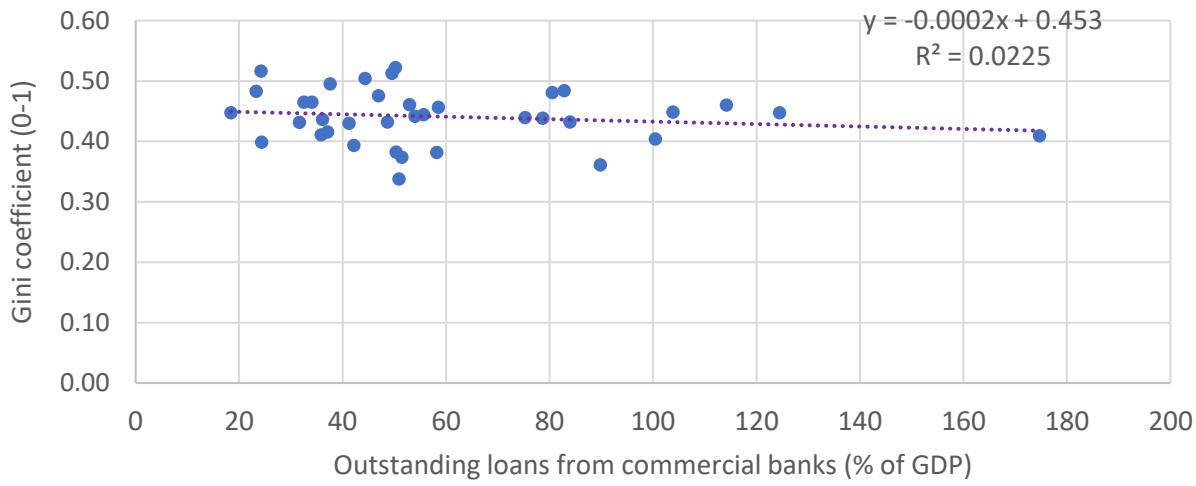

Figure 4. Relationship between the Gini coefficient and the share of outstanding loans from commercial banks in European countries

Source: WID&FAS, author's calculations

After separating CEE and Western European regions, descriptive power of the relationship slightly improves for Central and Eastern European region, suggesting a negative relationship between the financial development proxy and income inequality. However, the correlation is still statistically insignificant. In Western Europe's case, even after removing outliers, presumed negative relationship is not apparent, as can be seen from Figure 5.

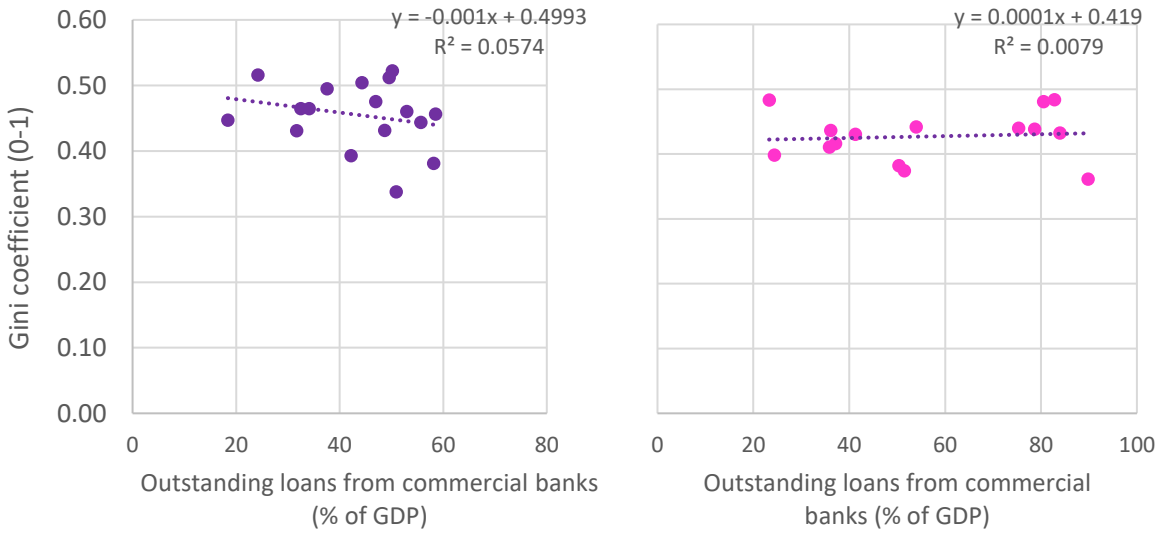

Figure 5. Relationship between the Gini coefficient and the share of outstanding loans from commercial banks in CEE countries (left panel) and Western European countries (right panel)

Source: WID&FAS, author's calculations

Main variables of interest, chosen based on economic theory, former literature and data availability, are presented in Table 4 below. Number of branch offices and ATM's indicate geographical outreach, or in other words, access to financial services, while others show the use of financial services. In order to gauge changes in such financial inclusion indicators, the change in averages of variables of interest between years 2019 and 2005 has been compared. An increase in average values in the region has been shaded green, meanwhile red fill colour indicates a decrease in variable average. The changes in averages variables of interest in Western Europe are not as significant as in CEE, suggesting different speed and initial levels of development in the two regions – changes in Western Europe has been more subtle as the financial sector has already reached a higher level of development than one of Central and Eastern Europe.

Table 4. Changes in averages of variables of interest in Eastern and Western European regions (2019 vs 2005)

Variable	Western Europe			Central and Eastern Europe		
	2005	2019	Change	2005	2019	Change
Gini Index	0,45	0,45	+0.00	0,48	0,49	+0.01
Outstanding loans from commercial banks (% of GDP)	80	73	-6pp	33	43	10pp
Outstanding deposits with commercial banks (% of GDP)	63	78	14pp	35	52	17pp
Number of commercial bank branches per 100 000 adults	46	28	-39%	29	26	-13%
Number of ATMs per 100 000 adults	87	85	-2%	34	68	99%
Number of debit cards per 1 000 adults	1 046	1 571	50%	681	1 087	60%
Number of credit cards per 1 000 adults	687	946	38%	166	224	34%
Number of mobile and internet banking transactions (during the reference year) per 1 000 adults	75 087	69 296	-8%	19 360	51 288	165%

Source: WID&FAS, Author's calculations

Based on relative change in annual averages of financial development proxies, by 2019 there has been an increase in both regions in outstanding deposits share, and in debit and credit card ownership density. In both regions the number of commercial bank branches per 100 000 adults has been decreasing in both regions, but especially so in Western Europe. This indicates the impact

of globalisation on the financial industry, as the rise and use of digital banking channels have started to replace traditional face-to-face channels, such as branch offices. Slightly surprisingly, the average number of mobile and internet banking transactions per 1 000 adults has decreased in Western Europe, however the indicator in 2019 was still on a higher level than in CEE.

The summary of descriptive statistics of the dataset consisting of three-year averages of all variables (between 2005 and 2019) is presented in Table 5. The average number of credit cards per 1 000 adults (creditcards) is over three times higher in Western Europe than in Central and Eastern Europe and the average number of mobile and internet banking transactions (digitalBanking) almost two times higher in the Western region.

Table 5. Summary Statistics on financial development indicators, based on three-year averages of variables (2005-2019)

	Gini		loans		creditcards		debitcards	
	Western	CEE	Western	CEE	Western	CEE	Western	CEE
Min	36	34	21	18	239	3	669	131
Max	51	55	167	94	1 482	923	2 240	1 871
Median	43	46	70	45	466	166	1 292	876
Mean	43	46	78	47	685	207	1 357	889
StdDev	4	5	40	15	384	186	371	401
	branches		ATM		digitalBanking		deposits	
	Western	CEE	Western	CEE	Western	CEE	Western	CEE
Min	5	10	32	10	8 478	57	20	25
Max	102	92	191	148	160 821	128 707	147	73
Median	32	28	86	55	78 412	39 207	59	44
Mean	34	30	89	58	71 706	38 261	65	46
StdDev	21	14	40	25	40 782	31 844	32	12

Source: WID&FAS, Author's calculations

As was already evident from Figure 4, outstanding loans and also deposits from commercial banks (share of GDP) can exceed 100%. This is usually associated with higher share of outstanding loans extended to non-residents and is commonly known to be the case in Switzerland and Luxembourg.

3. RESULTS AND DISCUSSION

The aim of the following chapter is to describe the process of empirical analysis, as well as give an overview of relevant findings. Additionally, a discussion follows, attempting to synthesize results with economic rationale in order to find answers to posed research questions and explain encountered econometric hurdles.

3.1. Main Results

To estimate panel regressions, both fixed and random effect models were used on two datasets, one containing three-year averages of all variables and another containing annual data, first aiming to capture long-term links between variables of interest while the latter was used to prevail short-term relations. Later both datasets were split to separate Eastern and Western European region. Initially combined dataset consisted of 38 countries, but after descriptive data analysis Switzerland, Luxembourg and Cyprus were excluded from the sample, as the share of non-resident debt holders within those countries is very high, distorting the size of financial sector. While the size of the financial sector, relative to the size of the economy, is also on a high level in United Kingdom (124% in 2019) and Netherlands (100%), the share of non-resident debt holders is lower than in already excluded countries (Eurostat 2020).

Therefore, panel data models were first estimated for the total sample of 35 European countries and later additionally for the sample of 17 Western European countries and for the sample of 18 Central and Eastern European countries. The complete list of countries included is presented in Appendix 2. All variables of interest in annual dataset were tested and found to be stationary with the Maddala-Wu unit root test, appropriate for unbalanced panels.

3.1.1. All European Countries, using three-year averages of variables

Seven panel data regression models were initially estimated with fixed country and year effects, using three-year averages of variables. Consequently, seven alternative financial development

proxies were used to assess the long-term relationship with income distribution. However, in none of the model variations was the coefficient on the financial development variable statistically significant (see Appendix 3). As the inclusion of fixed effects means that variables with little within-country time variation are not estimated with precision, panels were then further estimated with random effects. Additionally, Hausman test was conducted to differentiate between fixed and random effects in models and the latter was the preferred for all models, meaning according to the test group-level effects and explanatory variables must be uncorrelated.

In Model 3, estimated with random effects, there is a positive and statistically significant relationship between ATM density and income inequality (see Table 6). However, robust standard error is high, meaning the used sample is not likely to representative and findings should therefore be interpreted cautiously. Based on former studies, a negative relationship was expected, as improving availability and access to financial services by enhancing geographical outreach should help to reduce inequalities. Although, a positive relationship might indicate that the distribution of ATM's is concentrated in larger cities, making financial intermediation more accessible for the richer city-dwellers, while poorer households in rural areas lack access and inequalities persist.

For each of the seven models, all with unique financial development indicators, slightly different control variable vectors were used in order to assess the stability and reliability of models – in case of stability the coefficients of the controls should be similar. In random effect Models 1-3 and 6-7 GDP or GDP per capita (GDPcapita) growth rate had a statistically significant positive relationship with income inequality, indicating that economic growth leads to higher inequality, which is contradicting what was hypothesised when choosing control variables. However, this could be explained by the Kuznets hypothesis, which suggests that early and late phases of economic development might see lower inequalities, while income inequality should be particularly high during the high phase of economic development, associated with urbanization and industrialization (Jauch, Watzka 2013, 300). Alternatively, the positive relationship may show cyclical correlation between economic growth and income inequality.

Table 6. Random Effects models, all European countries (35), three-year averages

FD Indicator	loans	deposits	ATM	branches	digital-Banking	credit-cards	debitcards
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
FD Coefficient	0.010	0.020	1.023 *	0.017	0.276	0.287	-0.021
	(0.010)	(0.016)	(0.586)	(0.556)	(0.343)	(0.395)	(0.564)
GDP	0.115 **	0.106 **	0.176 **				0.096 *
	(0.054)	(0.050)	(0.048)				(0.051)
GDPcapita				0.081	0.090	0.109 **	
				(0.052)	(0.063)	(0.051)	
Infl	0.094	0.140 *	0.102	0.112	0.489 ***	0.206 ***	0.198 **
	(0.079)	(0.078)	(0.081)	(0.086)	(0.129)	(0.079)	(0.083)
Trade			-0.010				
			(0.009)				
Secondary	0.010	0.014 *	0.009	0.010	0.030 ***	0.014 *	0.013 *
	(0.08)	(0.08)	(0.08)	(0.08)	(0.010)	(0.08)	(0.08)
Expend	-0.277 ***	-0.274 ***		-0.281 ***	-0.326 **	-0.342 ***	-0.345 ***
	(0.103)	(0.102)		(0.105)	(0.154)	(0.111)	(0.109)
Constant	47.307 ***	46.235 ***	39.213 ***	47.966 ***	43.528 ***	46.931 ***	48.889 ***
	(2.192)	(2.352)	(3.114)	(2.925)	(4.363)	(3.189)	(4.944)
Observations	157	157	157	154	62	130	134
R2	0.133	0.136	0.117	0.205	0.759	0.429	0.426
Adjusted R2	0.104	0.107	0.088	0.178	0.738	0.406	0.404
F Statistic	18.673 ***	19.335 ***	15.715 ***	17.297 ***	25.678 ***	23.695 ***	23.751 ***

Source: Author's calculations in RStudio

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% confidence level, respectively.

The results of Models 2, 5, 6 and 7 show that inflation rates (Infl) have a positive relationship with inequality, which was anticipated when choosing control variables. Similarly, the negative relationship between government size (Expend) and income distribution also supports former empirical findings, as lower government expenditure might indicate less effort to redistribute. Disputing literature and somewhat surprising is the positive and statistically significant relationship between educational enrolment (Secondary) and Gini coefficient in four different

models. Better access to education is usually associated with more equality in a large body of literature, especially in low-income countries (Aslan et al. 2017, 3). A positive relationship might indicate inequalities in access to education, which can be especially binding on members of lower-income households and result in lower earnings, widening the gap between the rich and the poor.

3.1.2 All European Countries, using annual data of variables

A possible explanation why fixed effects estimations were not found consistent is due to the three-year average dataset consisting of only five time periods and therefore resulting in small deviation from common mean. However, it seems empirically reasonable to expect that group means are in fact country-specific and not random. Hence, panel data models, first with fixed and then with random effects, were also estimated using the sample of all 35 European countries, but with annual data on all variables, in order to use longer time-series. Moreover, while using three-year averages of variables aim to capture long-term associations, then the use of annual data can potentially help to yield short-term links between financial development and income inequality. When using annual data, independent variables were lagged by one period under the assumption that the dependent variable is changing slowly in time and is dependent on the values of independent variables in previous time-periods.

After proceeding to do so, Hausman test indicated that in Models 2 and 5, when using deposits ratio and digital banking services usage as a financial development proxy, the models are best estimated with fixed effects. Models controlled for GDP (per capita) growth, inflation rate, secondary education enrolment and government expenditure. By finding fixed effects models consistent, estimations thereby suggest time invariant country specific variables being linked with income distribution. Although said models, also presented in Appendix 4, failed to find a statistically significant relationship between either of the development indicators and income distribution, but overall do indicate a positive relationship, which suggests that higher use of financial services is associated with higher income inequality. Robust standard errors, however, remain high. A positive short-term relationship could be explained by the fact that financial services have become more available for the wealthy, but not for lower-income households, widening income inequality.

For Models 1, 3, 4, 6 and 7 random effects results were found to be consistent and the estimations are shown in Table 7. No statistically significant relationship between any of the financial development measures and the Gini coefficient was confirmed. Similar to the random effects

models when using three-year averages are the estimations of control variables GDP or GDP per capita, which have a positive association with the dependent variable.

Table 7. Random Effects models, all European countries (35), annual data

FD Indicator	loans	deposits	ATM	branches	digital-Banking	credit-cards	debit-cards
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
lag FD Coefficient	0.004	0.013	0.252	0.112	0.088	0.130	-0.339
	(0.005)	(0.010)	(0.322)	(0.364)	(0.244)	(0.233)	(0.338)
lagGDP	0.064 ***	0.062 ***	0.076 ***				0.051 **
	(0.023)	(0.022)	(0.021)				(0.023)
lagGDPcapita				0.041 *	0.040	0.060 ***	
				(0.022)	(0.034)	(0.023)	
lagInfl	-0.037	-0.025	-0.033	-0.032	0.060	0.012	0.006
	(0.035)	(0.034)	(0.034)	(0.035)	(0.051)	(0.036)	(0.036)
lagTrade			-0.005				
			(0.006)				
lagSecondary	-0.008	-0.012	-0.009	0.001	-0.037 ***	-0.015	-0.013
	(0.010)	(0.010)	(0.010)	(0.011)	(0.014)	(0.012)	(0.012)
lagExpend	-0.084	-0.078		-0.106*	-0.026	-0.020	-0.041
	(0.056)	(0.055)		(0.055)	(0.106)	(0.066)	(0.066)
Constant	46.140 ***	45.933 ***	44.267 ***	45.577 ***	47.299 ***	45.196 ***	48.343 ***
	(1.642)	(1.649)	(1.905)	(2.331)	(2.835)	(2.146)	(2.880)
Observations	438	438	434	430	154	345	362
R2	0.157	0.159	0.149	0.171	0.681	0.273	0.289
Adjusted R2	0.147	0.149	0.139	0.161	0.670	0.262	0.279
F Statistic	15.545 ***	16.641 ***	14.682 **	13.052 **	12.931 **	10.813 *	11.798 **

Source: Author's calculations in RStudio

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% confidence level, respectively. Highlighted FD indicator represents Hausman test result, i.e. cell is highlighted when the use of random effects model was indicated.

Additionally, in Model 4, estimated with random effects, government expenditure had a statistically significant and negative relationship with the dependent variable, consistent with random effects models estimations when using three-year averages of variables.

3.1.3. Central and Eastern Europe

When limiting the initial sample to 18 Central and Eastern European countries, the same seven models, all with different financial development proxies were estimated using both fixed and random effects. This region was of great interest as the rapid financial sector development since 1990s, driven by financial liberalisation and globalisation, could presumably be associated with inequalities.

First, when using data with three-year averages, and therefore shorter time-series, Hausman test preferred random effects for all models in question. The estimations for random effects models, however, do not indicate a statistically significant long-term relationship between financial development measures and income inequality in any of the models (see Table 8 for combined results). Moreover, the estimation of Model 5, with digital banking usage as a financial development indicator, is unreliable in CEE context, as the number of observations is very low (43), making estimations and any further interpretation of results impossible. The estimations of all seven models with fixed effects, albeit found inconsistent with the Hausman test, are presented in Appendix 5.

In terms of control variables, as can be seen from random effects model estimations, presented in Appendix 6, in Models 5-7 inflation was found to have a positive and statistically significant relationship with income distribution. Model 5 suggested a positive relationship between school enrolment and the Gini coefficient, while Model 7 indicated a negative relationship between government expenditure and Gini. Similar dependencies between control variables and the income distribution proxy were apparent also when all European countries were included in data.

Table 8. Central and Eastern European countries (18), combined results

Variables in dataset	Three-year averages		Annual, lagged	
	FD Coefficient		Lagged FD Coefficient	
FD Indicator (Model Nbr)	Fixed Effects	Random Effects	Fixed Effects	Random Effects
loans (1)	-0.011	-0.008	-0.001	0.002
	(0.026)	(0.024)	(0.011)	(0.011)
deposits (2)	0.064	0.031	0.037**	0.030*
	(0.040)	(0.038)	(0.018)	(0.018)
ATM (3)	0.910	1.068	-0.070	-0.011
	(0.691)	(0.679)	(0.331)	(0.333)
branches (4)	1.003	1.171	0.303	0.341
	(1.075)	(0.992)	(0.449)	(0.443)
digitalBanking (5)	0.660	0.435	0.204	0.174
	(0.469)	(0.415)	(0.294)	(0.281)
creditcards (6)	-0.153	-0.129	-0.058	-0.063
	(0.442)	(0.397)	(0.202)	(0.198)
debitcards (7)	-0.884	-0.798	-0.478	-0.471
	(0.710)	(0.649)	(0.337)	(0.332)

Source: Author's calculations in RStudio

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% confidence level, respectively. Highlighted FD indicator represents Hausman test result when the use of fixed effects model was indicated.

When using annual data on variables of interest, independent all lagged by one year, the Hausman test indicated that fixed effects applied only for Model 3 (see Appendix 7 for estimations), which used ATM density as a financial development measure. A negative, yet statistically insignificant, short-term relation with Gini coefficient was found, over-shadowed by high standard error. Rest of the models, consistent with random effects assumption, are presented in more detail in Appendix 8. Outstanding deposits ratio, measured as a share of GDP, was found to be in a statistically significant and positive relation with income inequality proxy. This might indicate that savings are predominantly accumulated and deposited by wealthier households, consequently widening the income distribution.

3.1.4. Western Europe

Limiting the sample to 17 Western European countries, in which the financial development has been more stable over time than in CEE countries, and using data with three-year averages showed

more support to the use of fixed effects models, for Models 3 and 4 in particular, but the results lack statistical significance, as can be seen from Appendix 9. Albeit statistically insignificant, a positive long-term relation between ATM and branch office density was suggested, meaning higher levels of financial development result in a more unequal income distribution, possibly because financial intermediation has become more accessible to the higher-income individuals who reap the benefits of improving financial access and inclusion.

Random effect models on the other hand (see Appendix 10) show a significant positive relationship between both, outstanding loans and deposits ratio, and income inequality in Western European countries. Outstanding loans ratio is a widely used proxy for financial depth and some scholars have also used it to conclude that higher levels of financial development can lead to higher income inequality (for instance de Haan & Sturm 2016; Jauch & Watzka 2012). The number of digital banking transactions (in Model 5) has a negative relationship with the Gini coefficient, meaning lower dependency on digital banking is associated with an increase income inequality. This relationship was expected based on literature review, however model estimation is with high robust standard error and the number of observations is very low, making generalizations about the relationship impossible. Combined results, showing estimations of financial development variable coefficients, are also presented in Table 9.

Random effects model estimations of Models 1, 2 and 7 found a statistically significant positive relationship between GDP growth rate and Gini coefficient. Meanwhile in Models 6 and 7 a negative relation between government expenditure and income inequality was indicated, consistent with findings and economic rationale for the sample of all 35 countries.

When using annual data and lagged independent variables for the same models to prevail short-term relationships, Hausman test favoured the use of fixed effects for Models 2, 3, 6 and 7 (presented in Appendix 11). A positive, yet statistically insignificant, relation was indicated between income inequality and deposit ratio and debit card ownership as financial development indicators. ATM density, which when using three-year averages had a positive relation with the dependent variable, now led to a estimation of a negative relationship, highlighting statistical insignificance. On the contrary, a statistically significant negative relationship was found between credit card ownership and income inequality in Western European countries, suggesting that enhanced access to financial services contributes to the reduction of inequality. Model 6, estimated with fixed effects and using credit card ownership as financial development proxy, controlled for

GDP per capita growth rate, inflation rate, secondary education enrolment and government expenditure, indicating a statistically significant negative relationship between inflation rate and income inequality.

Table 9. Western European countries (17), combined results

Variables in dataset	Three-year averages		Annual, lagged	
	FD Coefficient		Lagged FD Coefficient	
FD Indicator (Model Nbr)	Fixed Effects	Random Effects	Fixed Effects	Random Effects
loans (1)	-0.011	0.023**	0.003	0.005
	(0.026)	(0.010)	(0.005)	(0.005)
deposits (2)	0.064	0.027*	0.007	0.010
	(0.040)	(0.015)	(0.007)	(0.007)
ATM (3)	0.910	2.020**	-0.126	0.722
	(0.691)	(0.929)	(0.571)	(0.547)
branches (4)	1.003	-0.246	0.059	0.152
	(1.075)	(0.601)	(0.278)	(0.276)
digitalBanking (5)	0.660	-2.589***	-1.878***	-2.369***
	(0.469)	(0.551)	(0.514)	(0.404)
creditcards (6)	-0.153	-0.427	-0.765*	-0.816**
	(0.442)	(0.854)	(0.423)	(0.414)
debitcards (7)	-0.884	1.348	0.603	0.642
	(0.710)	(1.205)	(0.613)	(0.614)

Source: Author's calculations in RStudio

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% confidence level, respectively. Highlighted FD indicator represents Hausman test result when the use of fixed effects model was indicated.

Results of random effects models on annual data show a negative statistically significant relationship between digital banking transactions and income inequality, but the number of observations is too low (62) to consider estimations reliable (see Appendix 12). As for the control variables, findings are consistent with previously stated, as an increase in GDP or GDP per capita growth rates appear to have an positive relationship with inequality, evident from the estimations of Models 1 and 4. Meanwhile the relationship between inflation and income inequality is negative, although when choosing control variables a positive coefficient for inflation was expected. Some studies have found a U-shaped link between inflation and income inequality in

developed economies, where inequality decreases while inflation goes up to a certain level, after which inequality starts rising again (Monnin 2014, 2).

3.2. Conclusions and Discussion

Panel regression estimations did not show profound support to the short or long-term relationship between financial development and income inequality among European countries nor in the Western or Central and Eastern European region specifically. Results were predominantly found to not be statistically significant and evaluations had high robust standard errors, which complicate making generalizations about the relationship in question, leaving the first posed research question unanswered. Furthermore, as it is not possible to differentiate the link between financial development and income inequality in Western European nor in Central and Eastern European countries, the second posed research question remains unanswered as well.

For the sample of all European countries and using the dataset with three-year averages of variables, two additional measures were taken in the attempts of finding empirical support to the posed research questions. Firstly, the seven models were similarly estimated with fixed and random effects, but using fewer control variables since using multiple controls at once with a low number of observations could have added insignificance to the estimations. However, using either GDP growth rate, GDP per capita growth rate or inflation rate as a single control in each model did not have an impact on the statistical significance of the financial development coefficients. Using multiple combinations of two different control variables at a time also failed to prevail statistical significance and the results were not added.

Secondly, while the Gini index is by far the most commonly used income inequality proxy in former empirical studies, it has had little variance in Europe throughout the current thesis scope period of 2005-2019, complicating the robust estimation of posed models. Therefore, it was decided to use an alternative dependent variable – income share held by the richest 10%, which compares only the share of highest earning individuals, unlike the Gini, which captures the income distributions of the entire population. Using an alternative dependent variable also compensates for one of the disadvantages of the Gini coefficient – the value for the Gini can be the same for different sets of distributions (Charles-Coll 2011, 26). However, such attempt still failed to show profound support to the relationship between financial development and income inequality, as the

Hausman test indicated random effects models to be consistent, in which the variation between countries is assumed to be random and uncorrelated with independent variables. Nevertheless, the results are presented in Appendices 13 and 14, as the explanatory power of all models improved slightly, reflected in increased R-squared values of all fixed and random effects models, when compared to the respective initial models which used Gini index as dependent variable.

It was decided to look at Eastern and Western European regions in particular due to different historical time frame of financial development and liberalization, and the precise splitting of countries into two groups was done following the World Income Inequality database. However, in the hopes of finding statistically significant associations between financial development proxies and the income distribution in different European regions, it was also decided to try out a different sample split between countries. To do so, k-means cluster analysis was performed to create two groups on countries based on the level of financial development, one with a higher and another with lower level respectively. This had very minor impact when compared to the initial country split (presented in Appendix 2), only change being that Estonia, Croatia and Slovenia were re-classified as highly developed, along with all previously classified Western European countries. Using the alternative country split and annual data on variables, meanwhile lagging all independent variables by one year, seven models were estimated again using both fixed and random effects, with no improvement in results in terms of statistical significance of financial development indicator estimations in either country group, therefore the results are not presented.

Additionally, complimentary use of the GMM method could be added to the thesis due to endogeneity concerns and due to the use of lagged variables for annual data, which affects fixed effects models estimations. However, the lack of statistically significant results leaves little to no hope that it would yield better results. Ideally, in order to assess the relationship between financial development, and financial inclusion in particular, and income inequality, a longer time-series would be needed, but data availability on many related variables is scarce. Contributing to the hurdle of low number of observations and hence unreliable estimations, is limiting the sample to European countries and its two regions. Using panel data on more countries, as many scholars have done in the past, is believed to be more value-adding in the attempts of finding empirical support to the research matter. Furthermore, some scholars have constructed their own indices on financial inclusion (for example Aslan et al. 2017 or Batuo et al. 2010), which may create a more wholesome proxy for financial development to be used in panel regressions.

CONCLUSION

The aim of current master thesis was to evaluate whether various indicators of financial development are associated with income distribution among European countries. When approaching the pressing issue of the reduction of income inequality, examining its relationship with financial development is of great importance. Well-functioning financial systems can offer a remedy for widening income equality by improving the availability and use of financial services for the lower-income households, as it makes poorer individuals less dependent on own savings, more resilient to economic shocks and enables more productive investments. Therefore, providing financial intermediation to a wide range of households, rather than solely focusing on improving the quality of financial services for the existing customers, the latter often from higher income households, can result in a more equal income distribution in the society and highlights the need to focus on building inclusive financial systems that expand and equalize individual opportunities in the society.

To determine the relationship between financial development and income inequality among European countries specifically, an empirical analysis was carried out, using panel data models for the sample of 35 countries, covering the time period between 2005-2019. Fixed and random effects panel data methods were used, along with seven alternative indicators of financial development, covering its depth and access characteristics, and Gini coefficient as dependent variable. In one dataset all variables of interest were calculated as non-overlapping three-year averages, to purge the effects driven by business cycles and make up for gaps or little variation in data. Additionally, an annual dataset was used, offering a longer time series, especially crucial when the original sample was split into two – one group consisting of 17 Western European countries and the other of 18 Central and Eastern European countries. When using annual data, independent variables were lagged by one year as the dependent variable is believed to changing slowly in time and to be dependent on the values of independent variables in previous time-periods.

Despite relevant economic theory and the results of previous empirical studies offering plenty of support and evidence of the relationship between financial development and income inequality,

the results of carried out empirical analysis in current master thesis failed to determine and confirm the relationship. In other words, results do not suggest clear evidence of financial development being linked with income distribution among European countries, nor in either of the two European regions under focus. When using fixed and random effects panel data methods, it was expected that the results are best estimated with fixed effects, as fixed effects models take into account unobserved and time invariant country-specific effects, which are correlated with chosen independent variables. This is expected to be a more reasonable supposition as countries institutional structures are affected by historical and cultural background for instance. However, Hausman tests, used to determine the best estimation, commonly indicated the consistency of random effect models, misleadingly suggesting that the country-specific effect is a random variable that is uncorrelated with the explanatory variables in the model.

When using the sample of all 35 European countries and the annual dataset, fixed effects models were found to be consistent when using outstanding deposit ratio and the number of digital banking transactions as financial development indicators. However, models failed to find a statistically significant relationship between either of the development indicators and income distribution, yet overall do indicate a positive relationship, suggesting that higher use of financial services results in higher income inequality. A positive relationship could be explained by the fact that financial services have become more available for the wealthy, but not for lower-income households, hence widening income inequality. Robust standard errors, however, remain high, making estimations unreliable. Moreover, using annual data is more likely to reflect short-term associations, rather than long-term trends.

In addition, the initial sample was limited to 18 Central and Eastern European countries as the region has experienced rapid financial sector liberalisation and development only since the 1990s, which could be associated with inequalities. While using the annual dataset in which the independent variables are all lagged by one year, the model using ATM density as financial development measure was found to be consistent with fixed effects. A negative, yet statistically insignificant relation with Gini coefficient was found, over-shadowed by high standard error. In essence, a negative relationship might indicate that better availability of ATM's, and hence wider outreach of financial intermediation, can decrease income inequality in a society.

The sample for 17 Western European countries, portraying a region with a longer and more stable history of financial development, led by globalisation and techonologial progress since the 1970s,

also failed to yield any reliable estimations. Using three-year averages of variables, models using ATM and branch network outreach as financial development proxies were found consistent with fixed effects, but estimations which suggest a positive relationship remain statistically insignificant. The use of annual data, providing a longer time series and hence a larger number of observations, resulted in four models being consistent when using fixed effects. Whereas the use of outstanding deposit ratio, ATM density or debit card ownership as financial development indicator provided statistically insignificant estimations, a statistically significant negative relationship was found between credit card ownership and income inequality in Western European countries. Such relation, although with high robust standard errors, suggests that in short-term, enhanced access to financial services can be associated with the reduction of inequality.

In spite of using various combinations of control variables, only GDP and GDP per capita growth rate were found to have an effect on income inequality as the relation remained positive and statistically significant for most sample splits and for both, fixed and random effects estimations. The inflation rate, government expenditure, trade openness and secondary educational level capacity were not found to have a clear link with inequality, as the associated coefficients are positive or negative depending on the specification under consideration, in addition to often lacking statistical significance.

Since model estimations for financial development proxies were predominantly statistically insignificant and with high robust standard errors, and hence unreliable, no generalisations about the short- or long-term relationship between financial development and income inequality can be made, leaving both posed research questions unanswered. It is presumed that the lack of reliable findings is due to a short time-series used, even though the longest available time period was extracted from data sources. Moreover, the Gini coefficient, albeit heavily used in former empirical studies as a dependent variable, has remained relatively stable in scope period, especially in European context, further complicating econometric analysis. Using income share held by the richest 10% as an alternative dependent variable did not reveal any more profound estimations to answer the research questions, initially posed in the attempts to help to offer a potential remedy to reduce income inequalities.

KOKKUVÕTE

FINANTSSEKTORI ARENGU SEOS SISSETULEKUTE EBAVÕRDSUSEGA EUROOPA RIIKIDE NÄITEL

Kristiina Johanna Kangro

Sissetulekute ebavõrdsus ehk lõhe rikaste ja vaeste leibkondade sissetulekutes on viimaste aastakümnete jooksul olnud aina süvenevaks valukohaks ning ühtlasi ka väljakutseks kõikjal maailmas, tuues piisava tähelepanuta jätmisel endaga kaasa nii majanduslikke, poliitilisi kui sotsiaalseid probleeme. Suurenev ebavõrdsus ohustab muuhulgas nii majanduskasvu kui üleüldist majandusstabiilsust, sest vaesema elanikkonna jaoks on limiteeritud nii majanduslikud kui sotsiaalsed võimalused, näiteks tegeleda ettevõtlusega või investeerida kinnisvarasse. Sellest lähtuvalt on tegu vägagi aktuaalse probleemiga ning on ülimalt oluline mõista fenomeni tekkepõhjuseid, olulisi mõjutegureid ja võimalusi ebavõrdsuse vähendamiseks.

Üheks ebavõrdsust mõjutavaks faktoriks on finantssektor ja selle areng, mis mõjutab muuhulgas finantsteenuste kättesaadavust ühiskonnas. Võimaldades laialdasemat ligipääsetavust ning kasutatavust finantsvahendusele just madalamate sissetulekutega leibkondadele, väheneb viimaste sõltuvus isiklikest säästudest ja suureneb võimalus saada osa produktiivsust stimuleerivatest investeerimisvõimalustest, seda näiteks haridusse või pensionivaradesse, mis suurendavad potentsiaalseid edasisi sissetulekuid ning parandavad ka vastuvõtlikkust majandušokkidele, muutes ka üldist majanduskeskkonda stabiilsemaks ning stimuleerides majanduskasvu. Sellest tulenevalt on kriitiliselt oluline, et tänases globaliseeruvas ning digitaliseeruvas maailmas toimuv üha kiirem finantssektori areng oleks kõiki ühiskonna liikmeid kaasav ning ei keskenduks vaid finantsteenuste ning nende kättesaadavuse ja kasutuse parendamisele jõukama elanikkonna jaoks.

Magistritöö uurimisprobleemi püstitus on lisaks probleemi aktuaalsusele ning seda toetavatele teoreetilistele seisukohtadele ajendatud ka sellest, et varasemates sissetulekute ebavõrdsuse ning finantssektori arengu seost käsitlevates uurimustes on peaasjalikult keskendutud finantssektori

suurusest, mõõdetuna kommertspankade väljastatud laenude osakaaluna SKP-st, tingitud sissetulekute jaotusele avalduvatele mõjudele. Mitmed autorid on aga finantsarengu hindamiseks kasutusele võtnud alternatiivseid mõõdikuid, mis võtavad arvesse ka arengu teisi dimensioone, seal hulgas pakutavate teenuste ligipääsetavust ning kasutatavust. Autorile teadaolevalt ei ole aga sellist lähenemist senini rakendatud Euroopa riikide kontekstis, kus on viimastel aastakümnetel finantssüsteemide areng hoogustunud väga erineval ajahetkedel – kui Lääne-Euroopas toimus tehnoloogiliste muutuste kaasabil suur edasiminek juba 1970. aastatel, siis Kesk- ja Ida-Euroopas algas märkimisväärne hüpe liberaliseerumise suunas alles 1990. aastatel, mistõttu võib ka seos sissetulekute ebavõrdsuse ning finantsarengu vahel kahes Euroopa piirkonnas olla erinev.

Magistritöös püstitati alljärgnevad uurimisküsimused:

1. Kas Euroopa riikide seas on finantsteenuste kättesaadavust ja kasutust võimalik seostada sissetulekute ebavõrdsusega?
2. Kas ja mille poolest erinevad finantsinstitutsioonide arengu ja sissetulekute ebavõrdsuse seosed Lääne-Euroopa ning Kesk- ja Ida-Euroopa riikide vahel?

Uurimisküsimustele vastamiseks viidi fikseeritud ja juhuslikke efekte kasutades läbi paneelandmete ökonomeetriline analüüs, kuhu kaasati 35 Euroopa riiki, neist 18 Kesk- ja Ida-Euroopas ning 17 Lääne-Euroopas. Paneelandmete perioodiks oli 2005-2019 ning moodustati kaks andmestikku, millest ühes kasutati muutujate kolmeaastaste perioodide keskmisi, et kompenseerida esinevaid andmelünkasid ning et leida seoseid üle pikema perioodi, taandades näitajate lühiajalised muutused, mis võivad olla tingitud majandustsüklitest. Teises andmestikus kasutati aastaseid andmeid, millega on eelkõige võimalik hinnata lühiajalisi seoseid, ning mudelites kasutati kõiki sõltumatuid muutujaid ühe-perioodilise viitajaga, sest on alust arvata, et nende mõju sõltuvale muutujale ei ole kohene. Sõltuvaks muutujaks valiti kirjanduse analüüsi põhjal Gini indeks, mis kirjeldab sissetulekute jaotuse ebavõrdsust ühiskonnas. Lisaks kasutati seitset alternatiivset finantsarengu indikaatorit ning kontrollmuutujatena SKP ning SKP *per capita* kasvumäära, valitsuse kulutusi (osakaaluna SKP-st), inflatsioonimäära, kaubanduse suhet SKP-sse ning keskhariduse omandamise määra.

Selleks, et välja selgitada kas ja kuidas on omavahel seotud pangandussektori areng ning sissetulekute ebavõrdsus vaadeldi esmalt 35 Euroopa riiki korraga, kasutades andmestiku kolmeaastaste perioodide keskmistega, mille puhul tekib viis uut ajaperioodi. Hausmani spetsifikatsiooni test viitas kõigi seitsme mudeli puhul juhuslike efektide meetodi kasutamisele,

mille kohaselt ei ole riikide-spetsiifilised efektid korrelleerunud teiste sõltumatute muutujatega, mis on aga empiiriliselt ebaloogiline, sest kaasatud riigid on paratamatult mõjutatud näiteks ajaloolistest ning kultuurilistest eripäradest. Kasutades aastaseid andmeid, ning ühtlasi ka pikemat aegrida ja vaatluste arvu, osutus kaks mudelit fikseeritud efektidega hinnatavaks – mudelid, kus finantsarengu indikaatoritena kasutati kommertspankade poolt väljastatud deposiitide osakaalu SKP-st ning mobiili- ja internetipanga tehingute arvu tuhande täisealise elaniku kohta. Kummagi muutuja koefitsiendid ei omanud statistilist olulisust ning olid suurde standardvigadega, kuid indikeerivad positiivset seost finantsarengu ning sissetulekute ebavõrdsuse vahel, mis võib viidata sellele, et finantsteenused on muutunud kättesaadavamaks vaid suuremate sissetulekutega leibkondade jaoks, muutes sissetulekute jaotust ebavõrdsemaks.

Võttes vaatluse alla üksnes Kesk- ja Ida-Euroopa riigid ning kasutades muutujate kolmeaastaseid keskmisi ei leitud ühtegi mudelit fikseeritud efektidega hinnatavaks. Aastaseid andmeid kasutades leiti selliseks üksnes mudel, mis kasutab pangaautomaatide arvu saja tuhande täisealise elaniku kohta finantsarengu indikaatorina. Negatiivne, kuid statistiliselt mitteoluline koefitsient viitab sellele, et pangaautomaatide arvu vähenemisel sissetulekute ebavõrdsus suureneb, kuid suurte standardvigade tõttu ei ole aga usaldusväärsete üldistuste tegemine võimalik. Ka üksnes Lääne-Euroopa riike analüüsides ei suudetud kolmeaastaseid keskmisi kasutades tuvastada fikseeritud efektidega statistiliselt olulisi seoseid finantsarengu indikaatorite ning sõltuva muutuja vahel. Aastaseid andmeid kasutades leiti neli mudelit fikseeritud efektidega meetodil hinnatavaks ning kasutades krediitkaartide arvu tuhande täisealise elaniku kohta pangandussektori arengu mõõdikuna ilmnes ka statistiliselt oluline negatiivne seos Gini koefitsiendiga, mis viitab sellele, et väiksem krediitkaartide levik suurendab sissetulekute ebavõrdsust Lääne-Euroopa ühiskonnas.

Läbiviidud empiirilise analüüsi käigus ei leitud piisavalt statistiliselt olulisi lühi- ega pikaajalisi seoseid finantsarengu indikaatorite ning Gini indeksi vahel, et vastata püstitatud uurimisküsimustele. Põhjuseks võib olla liialt lühikese perioodiga andmekogumi kasutamine, mis oli aga valitud indikaatorite puhul pikim võimalik aegrida. Samuti oli suure tõenäosusega takistuseks Gini koefitsiendi kasutamine sõltuva muutujana, mis oli vaatlusalusel perioodil vähe muutuv ning raskendas seega tulemusteni jõudmist. Samas ka vähemate kontrollmuutujate, alternatiivse sõltuva muutuja kasutamine ega riigigruppide koosseisu muutmine ei viinud püsivamate või statistiliselt oluliste tulemusteni. Edaspidi võiks täiendavalt proovida mitmete erinevate finantsarengu indikaatorite kasutamise asemel ühe koondindikaatori loomist ning mudelisse lülitamist.

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APPENDICES

Appendix 1. Description and Data Sources of Used Variables

Variable Type	Coding in Models	Description	Data Source
Dependent variable	Gini	Gini coefficient using pre-tax household income	WID
Financial Development Indicators	loans	Outstanding loans from commercial banks (% of GDP)	FAS
	deposits	Outstanding deposits with commercial banks (% of GDP)	FAS
	ATM	Number of ATMs per 100 000 adults	FAS
	branches	Number of commercial bank branches per 100.000 adults	FAS
	debitcards	Number of debit cards per 1 000 adults	FAS
	creditcards	Number of credit cards per 1 000 adults	FAS
	digitalBanking	Number of mobile and internet banking transactions (during the reference year) per 1 000 adults	FAS
Control Variables	GDP	GDP growth (annual %)	World Bank
	GDPcapita	GDP per capita growth (annual %)	World Bank
	Infl	Inflation, consumer prices (annual %)	World Bank
	Expend	General government final consumption expenditure (% of GDP). Includes all government current expenditures for purchases of goods and services	World Bank
	Trade	The sum of exports and imports of goods and services (% of GDP)	World Bank
	Secondary	School enrolment, secondary (% gross). Indicates the capacity of secondary educational level of the education system.	World Bank

Source: WID & FAS, author's calculations

Appendix 2. List of European Countries Included in the Dataset

Central and Eastern European Countries (18)	Western European Countries (17)
Albania	Austria
Bosnia and Herzegovina	Belgium
Bulgaria	Denmark
Croatia	Finland
Czech Republic	France
Estonia	Germany
Hungary	Greece
Kosovo	Iceland
Latvia	Ireland
Lithuania	Italy
Moldova	Malta
Montenegro	Norway
North Macedonia	Portugal
Poland	Spain
Romania	Sweden
Serbia	The Netherlands
Slovak Republic	United Kingdom
Slovenia	

Source: WID, author's calculations

Appendix 3. Fixed Effects models for the sample of all European countries, three-year averages of variables

	loans	deposits	ATM	branches	digital-Banking	credit-cards	debit-cards
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
FD Coefficient	0.009	0.031	0.826	-0.206	0.508	0.639	0.141
	(0.011)	(0.020)	(0.617)	(0.604)	(0.384)	(0.466)	(0.614)
GDP	0.135 **	0.132 ***	0.166 ***				0.116 **
	(0.055)	(0.051)	(0.048)				(0.052)
GDPcapita				0.090 *	0.112 *	0.130 **	
				(0.053)	(0.064)	(0.053)	
Infl	0.072	0.129	0.093	0.108	0.528 ***	0.193 **	0.190 **
	(0.080)	(0.080)	(0.083)	(0.089)	(0.131)	(0.081)	(0.084)
Trade			-0.005				
			(0.011)				
Secondary	0.011	0.016 **	0.012	0.012	0.034 ***	0.015 *	0.014 *
	(0.008)	(0.008)	(0.008)	(0.008)	(0.011)	(0.008)	(0.008)
Expend	-0.170	-0.181		-0.199 *	-0.162	-0.251 **	-0.249 *
	(0.113)	(0.112)		(0.115)	(0.177)	(0.125)	(0.127)
Observations	157	157	157	154	62	130	134
R2	0.106	0.119	0.102	0.095	0.400	0.167	0.154
Adjusted R2	-0.162	-0.145	-0.167	-0.184	-0.016	-0.131	-0.147
F Statistic	2.853 **	3.239 ***	2.733 **	2.443 **	4.804 ***	3.815 ***	3.581 ***

Source: Author's calculations in RStudio

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% confidence level, respectively.

Appendix 4. Fixed Effects models for the sample of all European countries, annual data, lagged variables

	loans	deposits	ATM	branches	digital-Banking	credit-cards	debit-cards
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
lag FD Coefficient	0.004	0.015	0.175	0.060	0.235	0.251	-0.271
	(0.006)	(0.011)	(0.329)	(0.377)	(0.259)	(0.244)	(0.344)
lagGDP	0.069***	0.068***	0.073***				0.059**
	(0.023)	(0.022)	(0.021)				(0.023)
lagGDPcapita				0.044**	0.053	0.066***	
				(0.022)	(0.034)	(0.023)	
lagInfl	-0.039	-0.026	-0.033	-0.031	0.065	0.011	0.006
	(0.035)	(0.034)	(0.034)	(0.035)	(0.050)	(0.036)	(0.036)
lagTrade			-0.003				
			(0.006)				
lagSecondary	-0.006	-0.010	-0.007	0.002	-0.042***	-0.014	-0.011
	(0.010)	(0.010)	(0.010)	(0.011)	(0.015)	(0.012)	(0.012)
lagExpend	-0.045	-0.042		-0.073	0.086	0.027	0.015
	(0.058)	(0.056)		(0.056)	(0.114)	(0.069)	(0.069)
Observations	438	438	434	430	154	345	362
R2	0.033	0.036	0.033	0.027	0.093	0.033	0.031
Adjusted R2	-0.056	-0.053	-0.058	-0.065	-0.101	-0.077	-0.076
F Statistic	2.738**	3.002**	2.688**	2.137*	2.583**	2.101*	2.077*

Source: Author's calculations in RStudio

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% confidence level, respectively.

Appendix 5. Fixed Effects models for the sample of CEE countries, three-year averages of variables

	loans	deposits	ATM	branches	digital-Banking	credit-cards	debit-cards
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
FD Coefficient	-0.011	0.064	0.910	1.003	0.660	-0.153	-0.884
	(0.026)	(0.040)	(0.691)	(1.075)	(0.469)	(0.442)	(0.710)
GDP	0.010	0.076	0.096				0.034
	(0.083)	(0.067)	(0.069)				(0.066)
GDPcapita				0.040	0.127	0.055	
				(0.064)	(0.083)	(0.068)	
Infl	0.163	0.229 **	0.143	0.100	0.631 ***	0.236 **	0.208 **
	(0.106)	(0.109)	(0.106)	(0.111)	(0.161)	(0.097)	(0.098)
Trade			-0.006				
			(0.016)				
Secondary	0.021	0.028 *	0.019	0.014	0.061 ***	0.020	0.017
	(0.016)	(0.016)	(0.016)	(0.016)	(0.018)	(0.014)	(0.014)
Expend	-0.256 *	-0.155		-0.249 *	0.003	-0.202	-0.268 *
	(0.143)	(0.150)		(0.142)	(0.285)	(0.156)	(0.152)
Observations	90	90	90	89	43	85	85
R2	0.084	0.114	0.064	0.092	0.467	0.130	0.151
Adjusted R2	-0.217	-0.176	-0.243	-0.210	0.066	-0.179	-0.151
F Statistic	1.222	1.731	0.922	1.339	4.198 ***	1.852	2.200 *

Source: Author's calculations in RStudio

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% confidence level, respectively.

Appendix 6. Random Effects models for the sample of CEE countries, three-year averages of variables

	loans	deposits	ATM	branches	digital-Banking	credit-cards	debit-cards
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
FD Coefficient	-0.008	0.031	1.068	1.171	0.435	-0.129	-0.798
	(0.024)	(0.038)	(0.679)	(0.992)	(0.415)	(0.397)	(0.649)
GDP	0.016	0.053	0.112				0.037
	(0.079)	(0.067)	(0.070)				(0.063)
GDPcapita				0.044	0.112	0.058	
				(0.063)	(0.081)	(0.065)	
Infl	0.160	0.189 *	0.125	0.094	0.560 ***	0.235 **	0.209 **
	(0.100)	(0.108)	(0.105)	(0.107)	(0.153)	(0.094)	(0.095)
Trade			-0.022				
			(0.014)				
Secondary	0.020	0.023	0.018	0.014	0.053 ***	0.020	0.018
	-0.014	(0.014)	(0.014)	(0.014)	(0.017)	(0.013)	(0.013)
Expend	-0.258 *	-0.211		-0.258 *	-0.073	-0.206	-0.262 *
	(0.133)	(0.144)		(0.134)	(0.259)	(0.141)	(0.139)
Constant	48.441 ***	45.422 ***	41.669 ***	44.745 ***	36.949 ***	47.561 ***	53.558 ***
	(3.099)	(4.314)	(3.516)	(3.964)	(6.312)	(4.076)	(6.245)
Observations	90	90	90	89	43	85	85
R2	0.080	0.085	0.084	0.134	0.666	0.205	0.212
Adjusted R2	0.025	0.030	0.029	0.082	0.621	0.154	0.162
F Statistic	7.262	7.784	7.656	8.446	19.315 ***	10.603 *	12.292 **

Source: Author's calculations in RStudio

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% confidence level, respectively.

Appendix 7. Fixed Effects models for the sample of CEE countries, annual data, lagged variables

	loans	deposits	ATM	branches	digital-Banking	credit-cards	debit-cards
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
lag FD Coefficient	-0.0001	0.037 **	-0.070	0.303	0.204	-0.058	-0.478
	(0.011)	(0.018)	(0.331)	(0.449)	(0.297)	(0.202)	(0.337)
lagGDP	0.020	0.034	0.026				0.036
	(0.033)	(0.030)	(0.030)				(0.031)
lagGDPcapita				0.010	0.046	0.044	
				(0.029)	(0.049)	(0.031)	
lagInfl	0.007	0.039	0.002	-0.007	0.110	0.040	0.029
	(0.042)	(0.043)	(0.042)	(0.043)	(0.073)	(0.043)	(0.044)
lagTrade			-0.002				
			(0.007)				
lagSecondary	-0.004	-0.002	-0.003	-0.004	-0.011 *	-0.003	-0.003
	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)	(0.004)	(0.004)
lagExpend	-0.052	0.008		-0.064	0.146	0.053	0.023
	(0.064)	(0.070)		(0.064)	(0.168)	(0.071)	(0.072)
Observations	268	268	267	265	118	245	246
R2	0.009	0.026	0.007	0.009	0.077	0.020	0.027
Adjusted R2	-0.080	-0.062	-0.083	-0.081	-0.137	-0.077	-0.069
F Statistic	0.428	1.286	0.328	0.445	1.585	0.896	1.238

Source: Author's calculations in RStudio

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% confidence level, respectively.

Appendix 8. Random Effects models for the sample of CEE countries, annual data, lagged variables

	loans	deposits	ATM	branches	digital-Banking	credit-cards	debit-cards
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
lag FD Coefficient	0.0002	0.030 *	-0.011	0.341	0.174	-0.063	-0.471
	(0.011)	(0.018)	(0.333)	(0.443)	(0.281)	(0.198)	(0.332)
lagGDP	0.020	0.031	0.030				0.035
	(0.033)	(0.030)	(0.031)				(0.031)
lagGDPcapita				0.010	0.040	0.044	
				(0.029)	(0.048)	(0.031)	
lagInfl	0.007	0.034	0.004	-0.007	0.106	0.041	0.031
	(0.042)	(0.044)	(0.042)	(0.042)	(0.071)	(0.043)	(0.044)
lagTrade			-0.005				
			(0.007)				
lagSecondary	-0.003	-0.002	-0.003	-0.004	-0.011 **	-0.002	-0.003
	(0.004)	(0.004)	(0.004)	(0.004)	(0.006)	(0.004)	(0.004)
lagExpend	-0.057	-0.010		-0.069	0.104	0.045	0.016
	(0.063)	(0.069)		(0.063)	(0.160)	(0.070)	(0.071)
Constant	46.716 ***	44.134 ***	46.286 ***	45.900 ***	42.661 ***	45.107 ***	48.533 ***
	(1.817)	(2.165)	(1.759)	(2.126)	(3.560)	(2.185)	(3.156)
Observations	268	268	267	265	118	245	246
R2	0.010	0.021	0.010	0.028	0.643	0.071	0.076
Adjusted R2	-0.009	0.003	-0.009	0.009	0.627	0.051	0.056
F Statistic	2.244	5.104	1.952	2.472	7.688	4.409	6.044

Source: Author's calculations in RStudio

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% confidence level, respectively.

Appendix 9. Fixed Effects models for the sample of Western European countries, three-year averages of variables

	loans	deposits	ATM	branches	digital-Banking	credit-cards	debit-cards
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
FD Coefficient	-0.011	0.064	0.910	1.003	0.660	-0.153	-0.884
	(0.026)	(0.040)	(0.691)	(1.075)	(0.469)	(0.442)	(0.710)
GDP	0.010	0.076	0.096				0.034
	(0.083)	(0.067)	(0.069)				(0.066)
GDPcapita				0.040	0.127	0.055	
				(0.064)	(0.083)	(0.068)	
Infl	0.163	0.229 **	0.143	0.100	0.631 ***	0.236 **	0.208 **
	(0.106)	(0.109)	(0.106)	(0.111)	(0.161)	(0.097)	(0.098)
Trade			-0.006				
			(0.016)				
Secondary	0.021	0.028 *	0.019	0.014	0.061 ***	0.020	0.017
	(0.016)	(0.016)	(0.016)	(0.016)	(0.018)	(0.014)	(0.014)
Expend	-0.256 *	-0.155		-0.249	0.003	-0.202	-0.268 *
	(0.143)	(0.150)		(0.142)	(0.285)	(0.156)	(0.152)
Observations	90	90	90	89	43	85	85
R2	0.084	0.114	0.064	0.092	0.467	0.130	0.151
Adjusted R2	-0.217	-0.176	-0.243	-0.21	0.066	-0.179	-0.151
F Statistic	1.222	1.731	0.922	1.339	4.198 ***	1.852	2.200 *

Source: Author's calculations in RStudio

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% confidence level, respectively.

Appendix 10. Random Effects models for the sample of Western European countries, three-year averages of variables

	loans	deposits	ATM	branches	digital-Banking	credit-cards	debit-cards
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
FD Coefficient	0.023 **	0.027 *	2.020 **	-0.246	-2.589 ***	-0.427	1.348
	(0.010)	(0.015)	(0.929)	(0.601)	(0.551)	(0.854)	(1.205)
GDP	0.235 ***	0.169 **	0.222 ***				0.158 *
	(0.085)	(0.081)	(0.067)				(0.086)
GDPcapita				0.109	0.093	0.183*	
				(0.085)	(0.261)	(0.094)	
Infl	-0.163	-0.062	-0.107	-0.048	-0.211	-0.039	-0.017
	(0.131)	(0.126)	(0.129)	(0.139)	(0.515)	(0.140)	(0.138)
Trade			-0.007				
			(0.009)				
Secondary	0.001	0.008	0.004	0.006	0.003	0.006	0.010
	(0.009)	(0.009)	(0.009)	(0.009)	(0.0014)	(0.009)	(0.009)
Expend	-0.195	-0.195		-0.224	-0.228	-0.308 **	-0.332 **
	(0.133)	(0.134)		(0.138)	(0.163)	(0.149)	(0.138)
Constant	44.798 ***	43.974 ***	33.940 ***	47.580 ***	74.809 ***	50.835 ***	38.511 ***
	(2.992)	(3.141)	(4.472)	(3.804)	(5.462)	(5.702)	(9.420)
Observations	85	85	85	83	25	61	65
R2	0.208	0.183	0.187	0.304	0.959	0.677	0.672
Adjusted R2	0.157	0.131	0.135	0.529	0.948	0.648	0.644
F Statistic	20.688 ***	17.683 ***	18.150 ***	13.776 **	39.546 ***	19.118 ***	20.987 ***

Source: Author's calculations in RStudio

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% confidence level, respectively.

Appendix 11. Fixed Effects models for the sample of Western European countries, annual data, lagged variables

	loans	deposits	ATM	branches	digital-Banking	credit-cards	debit-cards
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
lag FD Coefficient	0.003	0.007	-0.126	0.059	-1.878***	-0.765*	0.603
	(0.005)	(0.007)	(0.571)	(0.278)	(0.514)	(0.423)	(0.613)
lagGDP	0.096***	0.093***	0.085***				0.051
	(0.033)	(0.032)	(0.028)				(0.035)
lagGDPcapita				0.065**	0.024	0.047	
				(0.032)	(0.071)	(0.037)	
lagInfl	-0.167***	-0.158***	-0.156***	-0.170***	-0.321***	-0.169***	-0.186***
	(0.058)	(0.054)	(0.054)	(0.057)	(0.129)	(0.064)	(0.062)
lagTrade			0.002				
			(0.003)				
lagSecondary	0.002	0.002	0.002	0.003	0.005	0.005	0.006**
	(0.003)	(0.002)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)
lagExpend	0.010	0.010		-0.034	0.01	-0.033	-0.027
	(0.061)	(0.060)		(0.059)	(0.109)	(0.071)	(0.071)
Observations	251	251	244	242	62	164	180
R2	0.089	0.092	0.093	0.084	0.354	0.142	0.128
Adjusted R2	0.005	0.008	0.007	-0.003	0.143	0.028	0.019
F Statistic	4.467***	4.621***	4.532***	4.058***	5.037***	4.750***	4.677***

Source: Author's calculations in RStudio

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% confidence level, respectively.

Appendix 12. Random Effects models for the sample of Western European countries, annual data, lagged variables

	loans	deposits	ATM	branches	digital-Banking	credit-cards	debit-cards
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
lag FD Coefficient	0.005	0.010	0.722	0.152	-2.369***	-0.816**	0.642
	(0.005)	(0.007)	(0.547)	(0.276)	(0.404)	(0.414)	(0.614)
lagGDP	0.084**	0.076**	0.082***				0.033
	(0.033)	(0.032)	(0.029)				(0.036)
lagGDPcapita				0.056*	0.027	0.036	
				(0.032)	(0.074)	(0.037)	
lagInfl	-0.185***	-0.168***	-0.174***	-0.182***	-0.337**	-0.176***	-0.196***
	(0.059)	(0.055)	(0.056)	(0.058)	(0.137)	(0.065)	(0.063)
lagTrade			0.001				
			(0.003)				
lagSecondary	0.002	0.002	0.002	0.003	0.009**	0.005*	0.007**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
lagExpend	-0.044	-0.042		-0.067	-0.108	-0.083	-0.090
	(0.061)	(0.060)		(0.059)	(0.099)	(0.070)	(0.069)
Constant	43.197***	42.802***	39.298***	43.609***	68.991***	49.037***	39.227***
	(1.440)	(1.468)	(2.608)	(1.651)	(4.132)	(3.069)	(4.727)
Observations	251	251	244	242	62	164	180
R2	0.082	0.086	0.129	0.144	0.957	0.452	0.468
Adjusted R2	0.064	0.068	0.111	0.126	0.953	0.435	0.452
F Statistic	22.017***	23.231***	22.267***	21.078***	58.808***	26.109***	24.862***

Source: Author's calculations in RStudio

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% confidence level, respectively.

Appendix 13. Fixed Effects models, all European countries (35), three-year averages of variables, Top 10% income share as dependent variable

	loans	deposits	ATM	branches	digital-Banking	credit-cards	debit-cards
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
FD Coefficient	0.0001	0.0002	0.013 **	0.0004	0.006	0.009 **	0.005
	(0.0001)	(0.0002)	(0.006)	(0.006)	(0.004)	(0.004)	(0.006)
GDP	0.001 ***	0.001 **	0.002 ***				0.001 **
	(0.001)	(0.0005)	(0.0005)				(0.0005)
GDPcapita				0.001	0.001	0.001 **	
				(0.001)	(0.001)	(0.0005)	
Infl	0.0004	0.001	0.001	0.001	0.005 ***	0.002 **	0.002 **
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Trade			-0.0003				
			(0.0001)				
Secondary	0.0001	0.0001	0.0001	0.0001	0.0003 **	0.0001	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Expend	-0.003 ***	-0.003 ***		-0.003 ***	-0.005 **	-0.003 ***	-0.003 ***
	(0.001)	(0.001)		(0.001)	(0.002)	(0.001)	(0.001)
Observations	157	157	157	154	62	130	134
R2	0.151	0.149	0.132	0.135	0.414	0.210	0.183
Adjusted R2	-0.103	-0.107	-0.128	-0.132	0.008	-0.073	-0.108
F Statistic	4.276 ***	4.188 ***	3.661 ***	3.640 ***	5.092 ***	5.040 ***	4.400 ***

Source: Author's calculations in RStudio

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% confidence level, respectively.

Appendix 14. Random Effects models, all European countries (35), three-year averages of variables, Top 10% income share as dependent variable

	loans	deposits	ATM	branches	digital-Banking	credit-cards	debit-cards
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
FD Coefficient	0.0001	0.0001	0.015***	0.001	0.006*	0.007**	0.006
	(0.0001)	(0.0001)	(0.005)	(0.005)	(0.003)	(0.003)	(0.005)
GDP	0.001**	0.001**	0.002***				0.001**
	(0.001)	(0.0005)	(0.0005)				(0.0005)
GDPcapita				0.001	0.001	0.001**	
				(0.0005)	(0.001)	(0.0005)	
Infl	0.001	0.001	0.001	0.001	0.004***	0.002**	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Trade			-0.0001				
			(0.0001)				
Secondary	0.0001	0.0001	0.00004	0.0001	0.0002**	0.0001	0.0001
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Expend	-0.003***	-0.003***		-0.003***	-0.005***	-0.004***	-0.004***
	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)	(0.001)
Constant	0.384***	0.380***	0.268***	0.389***	0.335***	0.355***	0.348***
	(0.019)	(0.021)	(0.028)	(0.026)	(0.037)	(0.027)	(0.043)
Observations	157	157	157	154	62	130	134
R2	0.182	0.176	0.165	0.253	0.782	0.478	0.473
Adjusted R2	0.155	0.149	0.137	0.228	0.763	0.457	0.453
F Statistic	27.368***	26.045***	23.122***	24.719***	30.959***	32.015***	30.043***

Source: Author's calculations in RStudio

Note: ***, ** and * indicate statistical significance at the 1%, 5% and 10% confidence level, respectively.

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