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# Central European Economic Journal

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# Financial development and income inequality

#### Abstract

This paper analyses the influence of financial development on income inequality. Throughout this work, one may find the overview of theoretical and empirical literature as well as the empirical model using fixed panel data method. This research paper tries to disentangle the opposing views on the relationship between finance and income distribution, by evaluating the impact of the different dimensions of financial development on the level of income inequality. The important added value of this research is the usage of quintiles of income distribution as a dependent variable that may help to recognise the effect of financial development on the poorest and richest. Another novelty of the paper is the consideration of the effects of financial variables on Gini coefficient in the long and short run. The main results of the analysis using dataset from 2003 to 2014 indicate that financial access decreases income inequality.

#### Keywords

income inequality | financial development | access to finance | financial depth | financial stability | efficiency of financial sector

**JEL Codes** D63, G10, G20

# 1. Introduction

In many countries, income inequalities have increased in recent years and become the subject of serious concern for policymakers. So governments seek alternatives in fiscal policies to reduce income inequality. One of them is improving financial capacity; however, there is no clear theoretical or empirical evidence that this method is an effective one. As there are no convincing empirical results, this article focuses on verifying whether the impact of financial development on income inequality is positive, negative or insignificant. The main goal of our research is to determine whether financial development is significant in explaining the phenomenon of income inequality. Our results support an alternative policy approach: financial sector reforms that lower market frictions will decrease income inequality and increase growth without the potential incentive problems that might occur when applying redistributive policies.

In the literature, the relationship between income inequality and financial development was described in

theoretical models by Greenwood and Jovanovic (1990) and Galor and Zeira (1993). However, the interest of empirical researchers in the subject has increased after the financial crisis of 2007. Researchers, such as Barajas et al. (2015) and Naceur et al. (2016), found that increasing financial access decreases income inequality. However, according to Kumhof and Ranciére (2010), higher financialisation decreases financial stability and as a consequence increases income inequality as it was seen in the last financial crisis in 2007.

Although empirical research established the influence of financial development on income inequality very well, the short- and long-term effects have not been extensively studied. Therefore, it is sensible to modify the sample data to realise the full potential of underlying process. The empirical strategy applied to examine the process in the short and long run is based on building two separate datasets with the same number of variables but with the difference in the number of observations. The first one would have yearly observations from 2003 to 2014 and the second one would take the three-year averages also from the same time horizon. This statistical approach was previously done by Forbes (2001) in the analysis of determinants of GDP growth.

In previous research, financial development was seen rather as an additional variable. Consequently, our paper uses four different components of financial development, which is a new approach. The same approach was presented by Naceur and Zhang (2016), however, they did perform a very thorough empirical analysis of the four dimensions in comparison to the traditional measure of financial development: Domestic credit to private sector (% of GDP). When it comes to this particular variable, contradictory results are obtained about how it impacts income inequality. According to Jauch and Watzka (2012) and de Haan (2017), Domestic credit to private sector (% of GDP) has a positive influence on income inequality. On the other hand, Beck et al. (2007) reported that higher levels of Domestic credit to private sector (% of GDP) can reduce income inequality.

To test empirically the impact of several aspects of financial development, we used Global Financial Development Database (GFDD) (2018) that allows us to examine the influence of depth, stability, access and efficiency of financial sector. We found that financial efficiency measured by Bank noninterest income to total income (%) has no impact on Gini coefficient in the short- and long-term, however, better access determined by ATMs per 100,000 adults can significantly lower income inequality. The depth of financial system captured by Foreign banks among total banks (%) has also a negative impact on income distribution. Taking into account Kumhof and Ranciére (2010) considerations on financial crisis and income inequalities, we examine the influence of financial stability using the proxy of the share of three largest commercial banks in total commercial banking assets. It appeared to be insignificant in the short run but significant in the long run.

Our research adds value to the above-mentioned literature especially by implementing regressions by using quintiles of income distribution as dependent variable. To answer why it is so crucial to use quintiles of income distribution instead of widely applied Gini coefficient, one needs to understand the strength and weaknesses of the measurements.

Gini index is still the most popular due to its simplicity and comparability, however, its linear nature, i.e. it assigns increasing welfare weights for lower income consumers (Hindriks et al., 2013) that makes the response to a transfer to depend on locations. Nevertheless, quintiles of income distribution should be used to see how financial development influences the poor or the rich and not on the overall distribution between them.

Looking at the model with Gini coefficients helps us to examine the impact of financial aspects on income inequality, but it is also interesting to look at the income share by quintiles to get more in-depth understanding of who is gaining and who is losing due to financial development. The Gini coefficient has its disadvantages such as weighting changes in different parts of the income distribution identically. Using quintiles of income distribution allows for additional conclusions about the decomposition of income changes for different groups of income earners.

The hypothesis about the quintile estimation can be summarised in the following way: depth of financial development would decrease income share in the upper quintile and decrease it in the bottom quintiles, and inversely access, efficiency and stability. To understand the logic behind the regressions one may find that when a certain variable influences the bottom quintiles negatively, it decreases their share of total income, which results in becoming poorer. When a certain variable impacts positively on the top quintile, it increases its share of total income resulting in richer. The increase in the total income inequality might depend on the strength of the effect on the particular quintiles.

The basic sample consists of 59 countries with data over the years 2004-2014. This paper further controls year effects with year dummies and country characteristics to isolate the effect of financial development and reduce the omitted variable bias. All models appeared to be estimated using fixed effects (FE). We performed Hausman test that verifies which method of panel data we should use, random effects model or FE model. It is not uncommon in panel data estimations to consider macroeconomic data as most of the time countries differ significantly between themselves.

This paper is structured as follows: First, we will briefly present the literature review, outline challenges in measuring inequality in empirical research as well as shortcomings of existing econometrics results. Second, we will carry out empirical analysis using the panel data (FE) method.

# 2 Literature overview

Throughout the years, at the centre of academic discussion was the influence of the financial development on economic growth, however, its impact on the income inequality still leaves much room for debate. In the existing literature, one may distinguish two theoretical models one described by Galor and Moav (2004) and other by Greenwood and Jovanovic (1990).

Recent economists focussed on specifying how access to financial services can affect income distribution. In their model, entering the financial market requires paying an entry fee, which is affordable to people with sufficiently high level of initial capital, but out of reach to the poor. The engagement in the financial market can provide higher and more reliable profits for the rich. Yet, the poor will have no opportunity to access financial market and they use their savings to invest to get the returns. This results in widening the income gap over time.

Galor and Moav (2004) discussed financial development and inequality nexus by focussing on the role of human capital accumulation. The wider access to financial intermediaries makes it easier for the poor to borrow money for profitable projects.

For instance, the poor could start investing more in their children's education that might lead to higher wages of the latter, thus narrowing income gap in the future. The model of Galor and Zeira (1993) is relevant to the United States, where obtaining higher education is relatively more expensive than in Europe. Galor and Zeira (1993) have shown that wider access to financial services can be profitable for the poor. On the other hand, according to Greenwood and Jovanovic (1990), the creation of formal financial sector might be more beneficial for the rich who depend much less on capital-raising relationships.

Both theoretical models suggest through empirical analysis there is a relationship between the financial access along with other financial dimensions and the income inequality. Theoretical considerations on financial development are rather ambiguous and not as extensive as the empirical ones. In our empirical model, we would like to scrutinise all the aspects of the financial sector as well as create a reliable sample of countries, using not only the Gini coefficient but also quintiles of the income distribution. We hope that the systematisation of econometric approaches will give a more transparent view on whether financial dimensions reduce the income gap. Since the early 2000s, there was an attempt to measure the influence of financial development on income gap by including variable such as *private credit* to GDP. For example, Beck et al. (2007) used *private* credit to GDP to measure financial development and advocates that its increase causes a decline in poverty and income inequality.

After the financial crisis, interest in financial development has increased and new approaches have been introduced. The main novelty was the division of the financial development into four types; *access, stability, depth and efficiency*. Each type represents a different aspect and may have an opposite influence on the income inequality, so we would like to propose a novel division of empirical literature that would give a more systematic understanding of the particular dimensions of financial development and their relationship with the income inequality. It will help us to disentangle which dimension decreases the income gap.

#### 2.1 Financial depth

The influence of the financial depth on income inequality was mainly analysed with the use of *private credit, bank asset stock market capitalisation* and *portfolio debt and equity flows.* The positive and significant influence of income inequality was reported by Roine et al. (2009), Clarke et al. (2006), Jauch et al. (2012), de Haan et al. (2017) and Maldonado (2017). Opposing results regarding the *private credit to GDP* were supported by Beck et al. (2007) and Naceur et al. (2016).

#### 2.2 Stability and regulations

After the financial crisis of 2007–2008, financial stability has become one of the most significant components of financial development. In the presence of excessive financial access, financial stability was under pressure. 'Rising inequality in developed economies caused redistribution in subsidised housing finance, which led to a housing boom and later to a crash with known consequences' (Rajan et al., 2010, p. 5). Moreover, according to Kumhof and Ranciére (2010), when the income is maintained mainly by top earners, the poor are forced to borrow to sustain their level of consumption. If the gap is growing, then it may lead to financial instability and crisis. As a result of weak financial stability during the financial

crisis, some countries increased the role of financial supervision and regulation. 'Financial instability, in turn, can lower growth and worsen inequality (as evidenced, for example, in the United States following the global financial crisis), and thus undo the very objectives that were sought through inclusion' (Barajas et al., 2015, p. 5).

Empirically, stability was researched by de Haan et al. (2017) and Delis et al. (2012). de Haan et al. (2017) found that the banking crisis lowers the income shares of the top income earners. Delis et al. (2012) assessed the influence of bank regulatory policies on income inequality and stated that banking deregulation causes lower income inequality.

One of the main difficulties in the evaluation of the impact of financial stability on income inequality is the endogeneity variables of banking regulations. As suggested by Delis et al. (2012), the income inequality has an impact on the choice of bank regulation and the policy must promote the creditworthiness of banks as well as the stability of the financial sector. The link between financial stability and bank regulations remains an unresolved issue that requires further research on the liberalisation of banking markets, primarily via efficient banking supervision and abolishing credit controls, which can help the poor get easier access to credit (Delis et al., 2012, p. 32).

#### 2.3 Financial efficiency

Financial efficiency is related to the type of financial market that is deeply rooted in the legal origins of a given country. The main focus of discussions is about the financial efficiency of the market-based system and bank-based system. Maldonado (2017) and Roine et al. (2009) tried to include in the analysis the difference between the bank and market-oriented financial systems. The main results suggest that the financial development (relative share of the banking and stock market sectors in the economy) improves the income share of the top percentile. Maldonado (2017) in her research has shown that an increase in the market-based component of a financial system increases Gini coefficient. According to Maldonado (2017), the increase in capital market size and efficiency may increase income inequality and state that 'Bank-based systems, where indirect finance dominates, and market-based systems, which rely more on financial markets, where direct trading of securities takes place. In the EU, households channel

most of their savings in easily accessible deposits, while in the United States, households invest more in assets with maturity, such as shares, life insurances and pension funds' (Maldonado, 2017, p. 7). The more market-based economies exhibit a higher premium for the rich and promote higher income as compared with more bank-based ones.

#### 2.4 Financial access

Financial access is a primary concern for the developing countries, and it is a policy tool that can help alleviate poverty and income inequality (Beck et al., 2007; Naceur et al., 2016). However, there are also some dangers associated with the broader financial access that can lead to financial crisis and widening income inequality. The uncontrolled increase in financial services caused instability and was one of the reasons for the U.S. subprime mortgage crisis of 2007. The Rajan's (2010) well-known phrase 'let them eat credit' means that with the increasing acceptance of credit default, the poorest could smooth their consumption at the cost of financial instability. Increasing financial access needs to be cautious and accompanied by the rise of the quality of financial supervision. 'New evidence also shows that bank stability risks increase when access to credit is expanded, especially without adequate regulation and supervision' (Barajas et al., 2015, p. 22). In contrast, people who have bank accounts are the nation's top income earners in the majority of developing countries. The poorest must rely on their savings to invest in better education or to start entrepreneurial activity. 'In many EMDCs, lowincome households and small-scale firms often face challenges in accessing financial services due to lack of financial knowledge, complicated processes, onerous paperwork, and other market failures' (Dabla-Norris et al., 2015, p. 18).

Empirically, the access to financial sector is mainly measured by the number of ATMs. Barajas et al. (2015) and Naceur et al. (2016) have shown that the increase in the number of ATMs has a positive influence on economic growth and might mitigate income inequality. Authors who support financialisation in their literature are Jaumotte et al. (2013), de Haan et al. (2017), Maldonado (2017) and Jauch et al. (2012). On the other hand, authors who advocate that financialisation has negative influence are Naceur et al. (2016), Beck et al. (2007) and Delis et al. (2012)

#### 2.5 All together

The difference between various aspects of financial sector has recently become important and one scientific paper considered all the dimensions was written by Naceur et al. (2016). This evolution in the approach helps us establish a better policy implication and prompts solution to decrease income inequality via financial development. According to Naceur et al. (2016), financial access, stability and efficiency can reduce income inequality. However, financial liberalisation increases income inequality.

Despite contradicting results, the banking sector improvements can substantially help in closing the income gap. 'In addition, our evidence suggests that banking sector development has a better positive effect on income distribution rather than stock market development' (Naceur and Zhang, 2016, p. 11). Further, recommendations for diminishing inequality and increasing financial development are proposed and they are as follows: reducing credit and interest controls and improving banking and securities market. An important policy implication will be to strengthen the regulatory system for financial institutions that would protect the individuals from the risk that banks are taking. The summary of the empirical literature is presented in Table A3 in Appendix.

# **3 Empirical Strategy**

Before discussing the empirical strategy, we would like to deliberate why it is difficult to grasp the influence of financial development on income inequality and what has been proposed in the previous research to resolve data imperfections. Finding data about income inequality may be somewhat tricky due to several reasons as comparability between countries is problematic due to missing observations and gathering data in irregular periods is difficult.

The most commonly selected dependent variable is mostly net Gini coefficient, but some of the researchers, such as Delis et al. (2012), Maldonado (2017), Roine et al. (2009) and Beck et al. (2007), consider also other types of measuring income inequality such as quintile of income distribution and Theil index or S80/S20 ratio. Some of them, such as de Haan et al. (2017), also report the result for the gross income inequality.

Using quintile of the income distribution as a dependent variable helps to evaluate anti-poverty policies. It helps them to identify how a certain covariate influences on the poorest and the richest part of the society.

Considering the choice of control variables, the majority of researchers considered the following variables: quality of institutions, legal origin ethnic fractionalisation, inflation, openness to trade as well as government expenditure (Roine et al., 2009; de Haan et al., 2017).

To get rid of business cycle fluctuations, majority of researches such as Roine et al. (2009), de Haan et al. (2017), Jauch et al. (2012) and Clarke et al. (2006) used the averages over a specified period for all the variables.

Another difficulty in estimation the relations is endogeneity. 'Lower level of poverty implies that financial services are already more affordable and accessible to the poor, and thus, stimulating the development of the financial sector. Similarly, a narrower poverty gap or less income inequality might also promote economic growth according to the inverted-U pattern for the impact of income distribution on economic growth' (Naceur and Zhang, 2016, p. 8).

A most common method of dealing with endogeneity is 'two least stage regression' (2SLS). For example, Clarke et al. (2006) and Naceur et al. (2016) applied 2SLS for estimation by using following parameters or factors for financial development: ethnic fractionation, linguists, religion and legal framework within the state. Yet, Jauch et al. (2012) criticised having legal origin as an instrument because it (legal origin) is not independent of inequality.

Moreover, 2SLS is not an ideal method of dealing with endogeneity. According to Beck et al. (2007), applying an instrument only for financial development would not solve the endogeneity of the other variables. Hence, many researchers such as by Roine et al. (2009) and Beck et al. (2007) prefer to use the General Method of Moments (GMM). All of them decided to apply GMM, using the first differences and instrumented all explanatory variables with their lagged differences.

## 3.1 A panel data model linking financial systems and income inequality

Based on the theoretical considerations and previous studies, this section presents the econometric strategy for the empirical analysis in terms of methodology and data description.

This paper proposes a model that empirically estimates the impact of financial development dimensions on income distribution. We extended the model by including alternative and additional financial and inequality measures to better understand how they are interrelated. The analysis consists of three main statistical models, which together allow drawing robust conclusions of the influence of financial development on income inequality.

First, we verified the effect of financial development in terms of domestic credit to private sector (% of GDP) on income distribution, measured by Gini coefficient. It helps us to verify the hypothesis that financial development has an impact on inequality. Then to examine separately four of financial development the variables were extended with the list of financial indicators that was acquired from the Global Financial Development Database (GFDD).

 $Gini_{i,t} = credit_{i,t} + control variables_{i,t} + V_{i,t}$ (MODEL 1)

 $Gini_{i,i} =$ four financial dimensions<sub>i,i</sub> + control variables<sub>i,i</sub> +  $V_{i,i}$ (MODEL 2)

where *i* indicates the country, *t* is the year and  $V_{i,t}$  is an error term.

The primary considered variable private credit over GDP is describing how difficult is to get a credit in case of corporation or a household. According to Maldonado (2017), set of controls that are commonly used by economists such as the level of education, trade openness and the unemployment rate are used to avoid an omitted variable bias as these above factors are influencing income inequality and might be correlated with the explanatory variables. Our set of control variables contains the GDP growth (Jauch et al., 2012; Clarke et al., 2006; de Haan et al., 2017), general government final consumption expenditure (% of GDP) (Jauch et al., 2012; Naceur and Zhang,

2016), population growth (Maldonado, 2017; Beck et al., 2007) and trade as % of GDP (Beck et al., 2007; Clarke et al., 2006; de Haan et al., 2017; Naceur and Zhang, 2016).

Gini coefficient used by Clarke et al. (2006), Maldonado (2017), de Haan et al. (2017), Jauch and Watzka (2012) and Naceur and Zhang (2016) is one of the most popular measures of inequality. However, it has series of disadvantages and so it was decided to use alternative variables such as quintiles of income distribution, which were used by Delis et al. (2012), Roine et al. (2009) and Dollar and Kraay (2001). The regressions with quintiles of income distribution were in the form of the following model:

 $Quintiles_{i,t} = four financial dimensions_{i,t} +$ (MODEL 3) + control variables<sub>*i*,*t*</sub> +  $V_{i,t}$ 

Finally, as it was mentioned above, to compare the effect of financial development in the short and long run, we decided to build two datasets. The first one would have yearly observations with 165 observations from 2003 to 2014 and the second one would take the three-year averages also from the same time span of 2003-2014. This comparison was primarily suggested by Forbes (2001) that verified the effect of income inequality on GDP growth in this manner.

The comparison was performed having Gini coefficient as a dependent variable and the model exhibits model 2. This approach would show us whether the short-term fluctuations are significant for the explanation of the underlying phenomenon.

#### 3.2 Data description

The main dependent variable in our empirical models is Gini coefficient that measures the distribution of income among individuals or households in economy and it is acquired from the World Bank. To assess the particular parts of income distribution, we have also used quintiles that express the share of total income going to each fifth of the population according to the size of their incomes (World Income Inequality Database (WIID), 2018). The first quintile is the poorest 20%, while the fifth quintile is the richest 20% and they are taken from the World Income Inequality Database (WIID).

In the early empirical analysis, researchers such as Clarke et al. (2006) and Beck et al. (2007) used private credit to GDP. We have also decided to test the significance of private credit to GDP taken from the World Bank.

To measure other dimensions of financial development, we decided to use GFDD (2018). To include each of the dimensions (efficiency, stability, depth and access), we selected bank noninterest income to total income (%), ATMs per 100,000 adults, Bank concentration (%) and Foreign banks among total banks (%). To verify the robustness of the result, we used several controlled variables that arrive from the World Bank as suggested by literature such as trade is the sum of exports and imports of goods and services measured (% of GDP); general government final consumption expenditure (% of GDP); GDP per capita growth (annual %) and annual population growth rate. The descriptive statistics, as well as definition of variables, are presented in Tables A1 and A2 in Appendix.

To examine the effect in the short and long run, we decided to build two separate datasets with the same number of variables, but with the difference in the number of observations. The first one would have yearly observations from 2003 to 2014 and the second one would take the three-year averages also from the same time horizon. This comparison was primarily suggested by Forbes (2001) that verified the effect of income inequality on GDP growth in this manner. As it was suggested by Forbes (2001), to assess the shortand medium-term relationship within individual countries, we decided to estimate the models using three-year average and then to evaluate short-term effect regression was run on the yearly observations. Due to data imperfection and missing observations analysing at the averages or yearly data might appear to be misleading.

# **4 Empirical results**

This section presents the estimation results of the regression analysis of data and verifies the theoretical hypotheses of Galor and Zeira (1993), which states that financial development has a negative impact on income inequality (decrease levels of income inequality). The analysis was performed on a series of empirical models.

As it was mentioned earlier, two main models are estimated: first, a model is specified to measure the impact of private credit over GDP on an income inequality measure (model 1). This model is estimated for robustness for the Gini coefficient and quintile of income distribution, respectively. The second model examines the influence of four aspects of financial development (depth, stability, efficiency and access) on income inequality using Gini coefficient and quintile of income distribution. To make our results comparable with the other research conducted, the model 1 is first estimated for the Gini coefficient for each finance variable as a single explanatory variable and subsequently with all four finance indicators combined together. Then the four financial variables are tested together for robustness with the quintiles for income distribution as an alternative dependent variable.

## 4.1 Econometric hurdles, the choice of econometric method based on previous research

We have to deliberate carefully on possible statistical difficulties when choosing the right econometric method to estimate the underlying relationship. In case of investigation financial development and income inequality, econometrical obstacles such as the problem of reverse causality and endogeneity might arise. Considering this in the examination the relationship between financial development and income inequality, one may refer to the literature discussing the political dimension in the inequality and finance nexus.

One of the most prominent theoretical works in this area was written by Rajan (2010) in which he stated that increased credit given to US American households was the direct result of the rising inequality trend over the last two decades. Moreover, according to Rajan (2010) to use traditional forms of redistributive taxation together with the political inability will make it less difficult for authorities to make easier access to credit for the poor.

Other proponents, such as Kumhof and Ranciére (2010), in their theoretical model, explain endogenously how high credit growth and financial crises can be a consequence of rising income inequality.

However, the hypothesis that rising inequality can cause a credit boom is empirically rejected by Bordo and Meissner (2012), who advocate that there is no statistical evidence that rising inequality leads to credit booms. 'This is of course very important for our study because we ideally want to treat financial development as a variable that is reasonably independent from income inequality' (Jauch and Waztka, 2012). The issue seems empirically settled by Bordo and Meissner (2012) who proved that this view is incorrect; we believe that our results are not affected by endogenous variable.

From a statistical point of view, GMM has become widely used as it is a convenient way to overcome potential endogeneity problems. Nevertheless, the method is not a perfect one and has as usual several downsides. First, according to Wooldridge (2009), it can be a complicated method that can easily give invalid estimates. Also, it is susceptible to external instruments and does not solve cross-sectional dependence. Moreover, it is not advisable in cases where panels have a long time span.

We have chosen to perform panel data to take into account the individual heterogeneity. The main reason for this is the fact that FE regression explores the relationship between the dependent and independent variables within an entity, such as country and corrects for individual effect. Each country has its own individual characteristics that can influence the explanatory variables. According to Green (2017), using FE technique allows for controlling for the factors within the individual that result from the existing correlation between an entity's error term and predictor variables.

To arrive to a valid statistical model, regressions are first estimated by ordinary least squares (OLS), i.e. pooled regression, followed by random effects models, which are tested against FE models, and then it is verified for whether time FE or first differences need to be introduced. In every model, statistically non-significant variables are dropped as suggested by the general to a specific approach.

In the analysis, a time span of 11 years from 2003 to 2014 is used that contained 52 countries. Estimation results are presented in Table 1. Results for each finance dimension individually (1-5) are similar to the outcomes of the model with variables taken all together in model 6 in terms of direction, size and significance of the coefficients with some small differences.

Variable Domestic credit to private sector (% of GDP) is one of the most commonly used in research about finance and inequality. In Table 1, variable Private credit to GDP alone is insignificant but

in case of model 6 it becomes significant at 0.05. The direction of the sign near this variable is also interesting in comparison to other research because its increase leads to higher income inequality. This contradicts results of Beck et al. (2007) and Clarke et al. (2006) that advocate decreasing influence of financial depth (measured by Private credit to GDP) on income inequality. On the other hand, it appeared positive and significant to research conducted by Jauch and Watzka (2012) and de Hann et al. (2017). Our analysis reveals similar results. When Domestic credit to private sector (% of GDP) increases over time within countries by 10% of GDP, the Gini coefficient rises on average ceteris paribus by 0.11 points. This variable is however statistically insignificant at 1%, 5% and 10% level in regression where it is the only explanatory variable of the financial system. This positive significant effect on income inequality can confirm Greenwood and Jovanovic (1990) hypothesis partially regarding rising inequality due to higher financialisation.

An alternative variable for Domestic credit to private sector (% of GDP) for measuring financial depth is used. The Percentage of the number of foreign owned banks to the number of the total banks in an Economy is significant and increase in 1% point leads to decrease of Gini index by 0.12 points and it is statistically significant at the 1%.

Using this alternative measure reveals contradictory results to the previous variable that represented financial depth. However, it is more consistent with research conducted by Beck et al. (2007) and Clarke et al. (2006) that advocate decreasing influence of financial depth on income inequality. Also, it supports the theoretical hypotheses of Galor and Zeira (1993), which states that financial development has a negative impact on income inequality (decrease levels of income inequality). Nevertheless, this inconclusive effect of Domestic credit to private sector (% of GDP) requires looking at other variables that might reveal more in-depth analysis.

When we analyse all control variables, the only significant variable that is negatively correlated with income gap is government spending. It is not surprising since it captures the effects of redistributive policies. This variable in all previous research has the same direction and similar significance.

Claessens and Perotti (2007) and Beck et al. (2007) found evidence supporting the importance of access to finance in reducing poverty and inequality. Especially,

#### Tab. 1: Model 1 for the Gini Coefficient

	Dependent variable: Gini coefficient						
	1	2	3	4	5	6	7
Domestic credit to private sector % GDP	0.02 (0.01)					0.03**(0.01)	0.03*** (0.01)
ATM (access)		-0.05*** (0.01)				-0.05*** (0.01)	-0.06*** (0.01)
Foreign banks (depth)			-0.12*** (0.03)			-0.14*** (0.03)	-0.13*** (0.03)
Bank concentration (stability)				0.01 (0.02)		0.03 (0.02)	
Bank noninterest income (efficiency)					0.03* (0.02)	0.02 (0.01)	
GDP growth	0.12 (0.09)	0.01 (0.08)	0.04 (0.09)	0.12 (0.09)	0.07 (0.09)	0.05 (0.08)	
Trade	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.003 (0.01)	0.01 (0.01)	0.0000 (0.01)	
Population growth	-0.22 (0.49)	-0.06 (0.43)	-0.42 (0.51)	0.16 (0.51)	-0.02 (0.49)	-0.22 (0.44)	
Government spending	-0.36**(0.16)	-0.42*** (0.15)	-0.27*(0.16)	-0.28* (0.16)	-0.29* (0.16)	-0.39*** (0.14)	-0.42*** (0.12)
Observations	186	177	177	179	185	165	169
<i>R</i> <sup>2</sup>	0.09	0.22	0.18	0.08	0.09	0.44	0.41
Adjusted R <sup>2</sup>	-0.31	-0.13	-0.18	-0.34	-0.31	0.14	0.15
F Statistic	2.47** (df = 5; 129)	7.02*** (df = 5; 121)	5.25*** (df = 5; 123)	2.08* (df = 5; 122)	2.54** (df = 5; 128)	9.41*** (df = 9; 107)	20.37*** (df = 4; 116)

*Note:*\*,\*\*,\*\*\*p < 0.01.

Data Source: World Bank

Dependent variable is three-year average Gini coefficient from 2003 to 2014. Standard errors are in parentheses, fixed panel data method.

Naceur and Zhang (2016) found the negative and significant influence of Number of ATMs per 100,000 adults. In our research, we also confirm its statistical significance and negative relation to Gini coefficient. Considering Number of ATMs per 100,000 adults as the only explanatory variable of the financial system, the coefficient of Number of ATMs per 100,000 adults stays statistically significant in all well-specified models. Increasing the number of ATMs per 100,000 by 100 leads to an average decrease in Gini coefficient by 5 points at ceteris paribus. The results are confirming the importance of financial access in battling with rising inequality because a higher financial inclusion reduces the participation costs of the poorest that is in line with the theory of Greenwood and Jowanovic (1990).

Another significant variable at 5% level is Bank noninterest income to total income (%) (efficiency). Increasing by 1% point Bank noninterest income to total income (%) leads to increase in Gini coefficient by 0.03 points. This is not surprising, since Naceur and Zhang (2016) found that financial efficiency leads to higher income inequality.

Variable Bank concentration (%) (financial stability) is statistically insignificant. This seems interesting since Jeanneney and Kpodar (2011), de Haan et al. (2017) and Naceur and Zhang (2016) establish that financial stability lowers income inequality. Also, it is suggested by the theory that financial crises can cause rising income inequality (Rajan, 2010).

Summing up results for each finance dimension taken separately (regressions [1-5]), It is found that

better financial access and more financial depth to individuals leads to lower income gap. Financial stability appeared to be insignificant. However, increasing financial efficiency leads to higher income inequality.

The model comprising all four financial dimensions as explanatory variables gives us similar but not identical results. The best performing model contains country and time FE and the control variables such as government spending, education and unemployment, but the coefficients of the last two are statistically not significant. The primary difference is that Domestic credit to private sector % GDP became significant at 5% level. Increasing Domestic credit to private sector % GDP by 1% point lead to increase in Gini coefficient by 0.03 points.

Increasing the Number of ATMs per 100,000 by 100 leads to decrease on average ceteris paribus in Gini coefficient by 6 points and is statistically significant at 1% level. Percentage of the number of foreign owned banks to the number of the total banks in an Economy (Foreign banks [depth]) is significant and increase in 1% point leads to decrease of Gini index by 0.14 points and it is statistically significant at the 1%. Excluding the insignificant variables basically did not change anything, the significant variables stayed significant. Analysis of the missing values does not reveal any pattern, such that regressions of the unbalanced panel are likely to be consistent.

# 4.2 Regressions with quintiles of income distributions as dependent variables

Substituting the Gini coefficient by another inequality measure, quintile of income distribution gives us more in-depth understanding of how the rich and poor are influenced financial development. Results of the best performing model that includes all four finance variables (model 1E) are shown in Table 2. Again, country FE is included, but introducing time FE does not improve the model.

The sub-sample covers 52 countries from 2003 to 2014 with a total of 361 observations. Estimations by quintile are presented in Table 2. All estimations include country-FE and all except the bottom quintile regression include time-FE. Education and population growth remain statistically non-significant and are dropped in the final parsimonious model as determined by information criteria. Government spending influences income growth at all levels with an impact of between on average ceteris paribus 0.006% and 0.009% points for a 1% point increase in government spending, significant at the 1% level.

Foreign banks and ATM have a positive impact on income growth for all except the bottom quintile and are statistically significant at 1% level. But for the top quintile Foreign banks and ATM have a negative and significant effect, respectively. This supports their decreasing effect on income inequality. On the other hand, for all but the bottom quintile, domestic credit to private sector % GDP has a negative impact on income growth and is statistically significant at 1% level. But for the top quintile it has a positive meaning, that is, it increases their share of income and has a significant effect. This advocate the results of Jauch and Watzka (2012) and de Hann et al. (2017) about increasing influence of domestic credit to private sector % GDP on income inequality. Bank concentration (stability) is significant for Second, Third and Fifth quintile at 1% level of significance.

Then we decided to verify whether in the long and short run effects are similar in terms of significance and direction of the relationship. In the first regression in Table 3, the only significant variables are foreign banks (depth), ATM (access), private credit to GDP and government spending. In the second regression in Table 3, the above mentioned variables are also significant but bank concentration (stability) and population growth are also significant. The size and the direction of the variables remain rather the same in both regressions. What is surprising is that bank concentration (stability) stood out as a variable, which increases income inequality. Increasing financial depth and access reveal the increase in income share for the poor and shrinkage of income for the rich.

It is observed that the most significant variables that lower income inequality appeared to be numbers of ATMs. This confirms the theoretical as well as previous empirical results that financial inclusion is crucial in fighting inequality. Based upon the financial development and the level of financial services, one may conclude from our results that financial deepening will be unfavourable for reducing the level of income inequality if financial services are available to only a few in a given country. Enhancing access to finance is crucial for lowering income inequality and for better quality financial deepening.

<b>Tab. 2</b> : Model 2 for income growth by	quintile
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	Dependent variable: income growth by quintile as dependent variable				
	First	Second	Third	Fourth	Fifth
	-1	-2	-3	-4	-5
Foreign banks (depth)	0.03***(0.004)	0.03***(0.005)	0.03***(0.01)	0.02***(0.01)	-0.10***(0.02)
ATM (access)	0.01***(0.002)	0.01***(0.002)	0.01***(0.002)	0.01***(0.002)	-0.05***(0.01)
Bank noninterest income (efficiency)	0.001 (0.002)	-0.002 (0.002)	-0.003 (0.002)	-0.004**(0.002)	0.01 (0.01)
Bank concentration (stability)	-0.002 (0.002)	-0.01***(0.002)	-0.01**(0.003)	-0.004 (0.003)	0.02**(0.01)
Domestic credit to private sector % GDP	-0.004***(0.002)	-0.005***(0.002)	-0.01***(0.002)	-0.004**(0.002)	0.02***(0.01)
GDP growth	0.01**(0.01)	-0.003 (0.01)	-0.01* (0.01)	-0.02**(0.01)	0.02 (0.02)
Trade	-0.004**(0.002)	0.0004 (0.002)	0.003 (0.002)	0.005*(0.002)	-0.003 (0.01)
Population growth	0.22***(0.06)	0.06 (0.06)	-0.01 (0.07)	0.03 (0.08)	-0.31 (0.23)
Government spending	0.06***(0.02)	0.09***(0.02)	0.10***(0.02)	0.08***(0.02)	-0.33***(0.07)
Observations	361	361	361	361	361
R <sup>2</sup>	0.30	0.33	0.29	0.16	0.31
Adjusted <i>R</i> <sup>2</sup>	0.16	0.20	0.16	-0.004	0.17
<i>F</i> Statistic (df = 9; 301)	14.44***	16.26***	13.98***	6.39***	15.01***

*Note:*\*,\*\*,\*\*\*p < 0.01.

Data Source: World Bank.

Standard errors are in parentheses. Fixed panel data method.

Tab. 3: Comparison of long and short run having as dependent variable Gini coefficient

Dependent variable: Gini coefficient						
Foreign.banks	-0.14***(0.03)	-0.12***(0.02)				
ATM	-0.05***(0.01)	-0.06***(0.01)				
Bank.noninterest.income	0.02 (0.01)	0.01 (0.01)				
Bank.concentration	0.03 (0.02)	0.02**(0.01)				
Credit	0.03**(0.01)	0.02***(0.01)				
GDP	0.05 (0.08)	0.004 (0.03)				
Trade	0.0000 (0.01)	0.0002 (0.01)				
Рор	-0.22 (0.44)	-0.49*(0.26)				
Govt	-0.39***(0.14)	-0.39*** (0.08)				
Observations	165	361				
<i>R</i> <sup>2</sup>	0.44	0.32				
Adjusted R <sup>2</sup>	0.14	0.19				
<i>F</i> Statistic	9.41*** (df = 9; 107)	15.85*** (df = 9; 301)				

*Note:*\**,*\*\**,*\*\*\**p* < 0.01.

Standard errors are in parentheses. Fixed panel data method.

# **5** Conclusions

The occurrence of parallel increase between financial development and income inequality motivated researchers to investigate the phenomenon more in-depth. The empirical approach after the financial crisis of 2008 to the data became more complex and important because of the greater increase in inequality. Recently, researchers such as Naceur and Zhang (2016) have begun to consider the financial development in terms of four types such as efficiency, depth, stability and access.

The proposed estimation is consistent with the results achieved by Naceur and Zhang (2016). They also found that there is a relationship between the number of ATMs and income inequality. In general, it leads to the conclusion that all dimensions except the financial liberalisation reduce income inequality. In our research, this dimension appeared to be statistically insignificant. The government consumption is statistically significant and is reducing income inequality. Our results confirm the view presented in other articles that most of financial parameters help to mitigate income inequality. In contradiction to Naceur and Zhang (2016), we found that only government expenditure is statistically significant and negatively related to income inequality. This relationship is not surprising since the government plays a major role in income redistribution.

This article is a further extension of Naceur and Zhang (2016) in which we estimate the impact of four financial dimensions on income inequality using Gini coefficient, and quintiles as dependent variables. To analyse the effect in the short and long run as it was suggested by Forbes (2001), we estimate the effect for yearly observations as well as for the three-year average. Returning to the hypothesis, it is now possible to state that, based on estimated regression, there is a significant relationship between financial depth and access and income inequality. However, stability and efficiency did not turn out to be significant in the short run estimation.

Further work needs to be done using microlevel data as well as various measures of financial development that could confirm our results. The regression outcome indicates the importance of financial access that can be an alternative to redistributive policies, and they are the most common tool for reducing income inequality. The presented findings have important implications for emerging countries that suffer from insufficient financial access. The main policy implication that this study reveals is that financial development might be better than the redistribution because it does not hinder the work incentives.

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# Appendix

### Tab. A1. Descriptive statistics

	Mean	SD	Minimum	Maximum	Valid N
Trade	96.26	57.15	22.11	349.24	469
Рор	0.72	0.87	-2.26	2.89	468
Credit	82.78	52.98	0.19	312.12	451
GDP	1.97	3.76	-14.56	12.92	469
Govt	17.50	4.63	6.21	27.94	469
Bank.concentration	67.07	21.24	21.70	100	449
Foreign.banks	41.70	27.38	0	96	447
ATM	69.83	41.10	3.05	222.82	411
Bank.noninterest.income	37.76	14.63	2.28	84.51	467
Gini_reported	38.09	9.39	23.72	60.79	469
q1	6.41	2.13	1.90	10.23	469
q2	11.22	2.46	5.49	14.88	469
q3	15.57	2.15	9.97	18.31	469
q4	21.84	1.31	18.26	24.63	469
_q5	44.97	7.72	34.02	64.29	469

#### Tab. A2. Variable definition and source

Variable	Source description
Gini	Gini index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy
q1-q5	Express the share of total income going to each fifth of the population accor- ding to the size of their incomes. The first group is the poorest 20%, while the fifth quintile is the richest 20%; data from WIID
Controlled independent variables	
Population	Annual population growth rate for year $t$ is the exponential rate of growth of midyear population from year $t$ - 1 to $t$ , expressed as a percentage. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship
Trade	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product
Govt	General government final consumption expenditure (% of GDP)
GDP	GDP per capita growth (annual %)
Financial independent variables	
Credit	Domestic credit to private sector (% of GDP)

# Continued Tab. A2. Variable definition and source

Variable	Source description		
Bank noninterest income to total income (%)	Bank's income that has been generated by noninterest related activities as a percentage of total income (net-interest income plus noninterest income Noninterest related income includes net gains on trading and derivatives, net gains on other securities, net fees and commissions and other operati income		
ATMs per 100,000 adults	Number of ATMs per 100,000 adults		
Bank concentration (%)	Assets of three largest commercial banks as a share of total commercial banking assets. Total assets include total earning assets, cash and due from banks, foreclosed real estate, fixed assets, goodwill, other intangibles, current tax assets, deferred tax assets, discontinued operations and other assets		
Foreign banks among total banks (%)	Percentage of the number of foreign owned banks to the number of the total banks in an Economy. A foreign bank is a bank where 50% or more of its shares are owned by foreigners		

#### Tab. A3: Review of literature

	Author	Time span	Econometric methodology	Results	Increase/decrease income inequality
1	Clarke et al. (2006)	91 countries for the period 1960–1995	Y = log of Gini; X = private credit to GDP, bank asset; GMM; FE	No evidence of an inverted- U-shaped relation between financial sector development; consistent with the theoretical models in Galor and Zeira (1993) and Banerjee and Newman (1993)	Decrease 🛛
2	Roine et al. (2009)	16 countries over the entire twentieth century	Y = quintiles; X = Bank deposits, Stock market capitalisation, total market capitalisation; first difference estimator	Financial development is also pro-rich; it increases income inequality	Increase 🛛
3	Jaumotte et al. (2013)	51 countries over a 23-year period from 1981 to 2003	Y = Gini, quintiles; X = portfolio debt and equity flows, FDI, of private credit to GDP	Financial globalisation cause increase in inequality	Increase 🛛
4	Maldonado (2017)	A sample of 27 European Union member states from 1995 to 2012	Y = S80/S20 ratio, Gini; X = stock market capitalisation and bank assets to GDP	An increase in the market- based component of a financial system leads to higher income inequality measured by the Gini coefficient	Increase 🛛
5	de Haan et al. (2017)	A sample of 121 countries covering 1975–2005	Y = Gini; X = private credit to GDP, economic freedom, banking regulatory practices, banking crisis + interactions with institution; dynamic panel model instead of OLS cross- section regressions in our main analysis; G2SLS	All finance variables increase income inequality	Increase 🛛

Continued Tab. A3: Review of literature

	Author	Time span	Econometric methodology	Results	Increase/decrease income inequality
6	Jauch and Watzka (2012)	138 developed and developing countries over the years 1960–2008	Y = Gini gross and net; X = credit-to-GDP; GMM; FE	Financial development has a positive effect on income inequality	Increase 🛛
7	Delis et al. (2012)	91 countries for which information on bank regulations is available over the period 1973–2005	Y = Theil index, Gini, quintiles; X = ratio of bank deposits to bank credit, bank crisis, political orientation of the government, overall political-liberalisation processes, quality institutions, transparency (the inverse of Corruption); FE; 2SLS	Overall liberalization of banking systems decreases the Gini coefficient and the Theil index significantly	Decrease 🛛
8	Beck et al. (2007)	92 countries 1960–2000	Y = Gini, quintiles; X = private credit to GDP, commercial central bank; GMM; FE	Financial development reduces income inequality	Decrease 🛛
9	Naceur and Zhang (2016)	Sample of 143 countries from 1961 to 2011	Y = Gini; X = bank accounts per 1,000 adults, value traded of the top 10 trading companies to total value traded, private credit to GDP, the ratio of regulatory capital to risk- weighted assets, interest rate control, entry barriers, and privatisation, the ratio of consolidated foreign claims of BIS-reporting banks to GDP, GMM; FE	Access to finance, financial efficiency and stability reduce poverty and inequality; financial liberalisation increase inequality	Decrease 🛛

Source: Own elaboration based on discussed articles.

FE, fixed effects; GMM, General Method of Moments; OLS, ordinary least squares; WIID, World Income Inequality Database.