THE IMPACT OF FINANCIAL SYSTEM DEVELOPMENT ON INCOME INEQUALITY

A Bank-based vs Market-based Approach

by

Jorn Driessen

(Student Nr. 4481518)

Supervisor

K.J.M. van der Veer

A Master's Thesis

Submitted to the Faculty of Management Sciences

Radboud University Nijmegen

In Partial Fulfilment of the Requirements

for the Degree of Master in Financial Economics

July 2020

The Impact of Financial System Development on Income Inequality – A Bank-based vs Market-based Approach

Jorn Driessen (Radboud University)

Abstract

Against a background of rising income inequality within countries across the world, this thesis empirically studies the effect of financial development on income inequality whilst distinguishing between bank-based and market-based financial systems. Conducting a fixed effects analysis on an unbalanced panel of 72 countries over the period of 1990-2017, the data shows that more financial development decreases income inequality up to a certain threshold, after which it starts to rise again. However, this relationship becomes apparent only when looking at a subsample of 36 OECD countries. When it comes to market-based financial development, no clear relationship is found with income inequality. These findings are robust to alternative measurement as well as the addition of a previously neglected control variable for the welfare state.

Keywords: Financial Development, Income Inequality, Financial System, Market-based, Bank-based, Welfare State, Social Security

List of Contents

1. Introduction

Over the last three decades, Western Europe saw its economic growth slowing down, whilst in Asia and particularly China, the growth was tremendous. As a result, global income inequality *between* countries has reduced (Alvaredo et al., 2018). *Within* nearly all countries, however, income inequality has been on the rise, albeit with difference in magnitude. Whilst increasing at a rapid pace in North America and Asia, it has grown at a moderate rate in Europe, and stabilized at a high level in the Middle East, sub-Saharan Africa, and Brazil (Alvaredo et al., 2018). Amongst those factors considered to play a role in this trend of rising income inequality, is the financial system.

Since the main task of the financial system is to channel funds from those who have a surplus to those that have a shortage, having a well-developed financial system in place is detrimental to a country's economic growth (de Haan et al., 2018). However, this does not mean that all of a country's inhabitants benefit equally from this growth. Therefore, a discussion about the link between different levels of financial development and income inequality is currently ongoing, but the literature is still in its early years (Beck, 2011) and the empirical evidence presented has been rather conflicting. On the one hand, there are several studies that find a negative relationship between financial development and income inequality, such as those conducted by Batuo et al. (2010) and Beck et al. (2007). On the other hand, studies with more recent data conducted by Maldonado (2017) and Brei et al. (2018) seem to have found a positive and a U-shaped relationship, respectively. Additionally, there is only a limited number of studies that differentiate between the traditionally distinguished market-based and bank-based structures of financial systems when looking at the impact of financial development on income inequality (Brei et al., 2018; Maldonado, 2017). Not every country's financial system is the same, since the size of the financial markets and the importance of the banking sector differ substantially between countries (Brei et al., 2018; de Haan et al., 2018; Kalara & Zhang, 2018).

Therefore, against a background where inequality is gaining attention in the public policy debate (Brei et al., 2018) and developed countries are moving towards more market-based financial systems (Rajan & Zingales, 2003), this study looks at the impact of financial system development on income inequality whilst making a distinction between bank- and market-based structures. Through an empirical panel approach based on data from, amongst others, the Standardized World Income Inequality Database (SWIID) and the Financial Structure database (Beck et al., 2019), this thesis aims to answer the question: What is the impact of financial system development on income inequality in 72 countries during the period of 1990-2017, and does this differ between countries with market-based and bank-based financial systems? Additionally, this study tries to control for the impact of the welfare state on income inequality which previous studies have not taken into account, thereby causing their results to potentially suffer from an omitted variable bias.

Whilst no clear conclusion can be drawn from the entire sample, estimations on a subsample of 36 OECD countries show a U-shaped relationship between bank-based financial development and

income inequality, indicating that income inequality decreases before increasing again as bank-based financial development reaches higher levels. Since these findings are robust to omitting a control variable and lagging all independent variables, they could be of great relevance to policy makers in their struggle against poverty and the uneven distribution of income. Additionally, the results contribute to the current body of empirical evidence that fuels the finance-inequality discussion.

In the remainder of this thesis, the existing literature is reviewed first, leading up to the formulation of several hypotheses. Next, a detailed description of the research method is given, before exploring the data. Afterwards, the results of the analysis are presented and discussed which leads to the conclusion and ideas for future studies.

2. Literature Review

2.1 Income Inequality, Economic Growth, and the Welfare State

Economists have long believed that in solving the problem of income inequality, economic growth would be the answer. In the years after the Second World War, with income inequality within countries across the world in a downward trend (İnam, 2019), Simon Kuznets was such an economist. He theorized that, as a country's economy develops, it moves through a stage of greater income inequality, causing the curve that resembles the relationship to have an inverted U-shape (Kuznets, 1955). The reasoning behind this was that, when a country industrializes and people move from agricultural sectors to industrialized urban centers, asset owners will initially enjoy higher income that fuels further investment. In the meanwhile, the large supply of cheap labor moving to these urban centers will hold down wages, resulting in greater income inequality. However, when the economy keeps developing, the income differentials will incentivize people to invest in themselves through better education and seize urban opportunities, thereby increasing their income and reducing the amount of income inequality.

In this process of reducing inequality through economic growth, Kuznets (1955) considered the development of a welfare state to be an accelerating factor. According to Obst (2013), the two major objectives of the welfare state are to reallocate income through social insurance and to lower income inequality through the redistribution of transfers. However, the effectiveness of governments in achieving those objectives differs substantially across countries.

In a paper by Marx et al. (2014), a detailed overview is given of the current literature linking redistribution and social protection, i.e. the welfare state, to income inequality. When comparing empirical studies conducted during the last decades, they find social cash spending as a percentage of GDP to be the most widely used indicator of the direct income redistribution effort being made by governments. They state that, over the past decades, multiple empirical studies have established a strong relationship between the overall level of this social spending and several measures of inequality and poverty (Marx et al., 2014). The common finding presented by these studies was that no developed economy seemed to achieve a low level of inequality or relative income poverty without a high level of

social spending (Marx et al., 2014). In theory, a country with low or moderate levels of social spending should be able to produce a high level of redistribution by efficient low-income targeting. However, the empirical evidence seems to have proven otherwise.

In an influential paper, Korpi and Palme (1998) have named this contradiction the 'paradox of redistribution', claiming that a low-income targeting approach has less redistributive impact than a universal approach that is being combined with a strategy of equality[1]. They stated that there tends to be a tradeoff between the degree of low-income targeting and the size of redistributive budgets, where the size of the redistributive budget is not fixed but dependent on the structure of the welfare institutions in place (Korpi & Palme, 1998). The smaller the redistributive budget, the greater the degree of low-income targeting tends to be (Korpi & Palme, 1998). Hence, when the welfare state really is the accelerating factor in reducing income inequality as envisioned by Kuznets (1955), it can be stated that the size of the redistributive budget should be large, as this is an indicator of the system being universal, thus having a bigger impact in reducing income inequality.

2.2 Income Inequality and Financial System Development

Going back to the inverted U-shaped relationship between income inequality and economic growth as proposed by Kuznets (1955), it has to be noted that, the welfare state aside, sufficient development of the financial system is required for his argument of urban opportunities to hold. In order to increase their income, agricultural migrants need financing to be able to enjoy an education and profit from urban opportunities (Brei et al., 2018). Thus, if the financial system is not able to connect those with a surplus of funds to those for which funds are scarce, very little productive investments will take place (de Haan et al., 2018). This is supported by a large body of empirical analyses that show a strong positive relation between financial system development and economic growth (Clarke et al., 2003; Levine, 1997).

In their influential theoretical paper "financial development, growth, and the distribution of income", Greenwood & Jovanovich (1990) tried to combine this finance-growth link with the link between income inequality and economic growth. Through a single model, they proposed an inverted U-shaped relationship, reminiscent of the one proposed by Kuznets. They reasoned that making use of financial intermediaries requires a small fixed cost. Initially, those with a low income will not be able to afford making use of a bank for their savings. Hence, inequality increases in early stages of financial development, as only those with higher incomes are able to afford making use of a bank. However, as the country's financial system and economy develop further, those with a low income will become richer, allowing them to start using banks. Therefore, after a certain threshold of financial and economic development, income inequality will decrease.

---

[1] Think about, for example, minimum income protection, income security, and cost compensations (Marx et al., 2014)

One could argue this hypothesis by Greenwood & Jovanovich to be the starting point of the finance-inequality discussion, as two subsequent theoretical papers hypothesized a negative relationship (Brei et al., 2018). Banerjee & Newman (1993) modeled the occupational choice of households, and thus their income, to depend on their access to credit. They theorized that due to capital market imperfections, the amount that people can borrow is limited, which causes well-paying occupations that require high levels of investment to be out of reach for those with a low income. However, as the financial system develops, more funds become available to those with a low income, thereby decreasing the amount of income inequality. Galor & Zeira (1993) theorized that disparity in income levels depends on differences in human capital investment, where human capital investment depends on the availability of credit. Hence, when the financial system develops, those with less inherited wealth gain better access to credit, allowing them to invest more in human capital, thereby decreasing income inequality.

Since these three papers merely made predictions, it naturally follows that several empirical studies then tried to find proof of their theorized relationships. For example, Clarke, Xu, and Zou (2003) tried to test the three theories by making use of a panel approach of 91 countries during the period of 1960-1995. Based on a significantly negative coefficient on measures of financial system development, they concluded their results to be consistent with both papers of Banerjee & Newman (1993) and Galor & Zeira (1993). However, the inverse U-shaped relationship that was proposed by Greenwood & Jovanovich (1990) was rejected, since the squared financial system indicator included to check for this was never statistically significant.

Beck et al. (2007) found similar results for up to 72 countries during the period of 1960-2005. Their results showed that greater financial development causes the incomes of the poor to grow faster than the average GDP per capita, helping them disproportionally and thus reducing income inequality. Whilst their results are consistent with Banerjee & Newman and Galor & Zeira, they do not seem to show the relationship proposed by Greenwood & Jovanovich.

For the African case, Batuo et al. (2010) also found a negative relationship between financial development and income inequality for 22 countries during the period of 1990-2004. However, again, no evidence was found that supported the inverse U-shape.

Even though several empirical studies thus seemed to favor the inequality-narrowing hypothesis as proposed by Banerjee & Newman and Galor & Zeira over the inverse U-shape hypothesis as proposed by Greenwood & Jovanovich (1990), this did not end the discussion. Using one of the most extensive datasets on inequality which ranges from the 18th century up to the beginning of the second decade of the 21st century, Thomas Piketty (2014) showed that the evolution of wealth distribution takes on a U-shape (as cited by Lyubimov, 2017). Looking at the three well-developed economies of Germany, France, and the UK during the period of 1914-2010, he noticed that income inequality started to decrease around the First World War, before leveling out around the end of the Second World War. Then, shortly before the end of the Cold War, it started to increase (as cited by Lyubimov, 2017).

These developments, contrary to the earlier models, would thus point to an inequality-widening hypothesis (Tan & Law, 2012). According to this hypothesis, the rich are able to offer collateral and have a high probability of repaying loans. Whilst the poor often do not meet these criteria, they could have a difficult time in obtaining loans, even with well-developed financial markets. This limits their ability to realize potential high-return investments such as education (Cournede et al., 2015). In line with this hypothesis, evidence was presented by Jauch & Watzka (2012), who detected a positive relationship through a panel dataset of 138 countries during the period of 1960-2008. They stated that better developed financial systems thus lead to greater income inequality.

As becomes clear from the theoretical and empirical literature discussed up until now, the most frequently discussed factor to link financial systems and income inequality is the availability of credit. As it enables those with a low income to make high return investments in for example education, it is seen as essential for them to achieve a higher income, and thus for the reduction of inequality in income from labor. As a result, most empirical studies have analyzed the effect of credit expansion on inequality. However, according to Piketty (as cited by Maldonado, 2017), income inequality across all societies can be decomposed into three terms, namely "inequality in income from labor; inequality in the ownership of capital and the income to which it gives rise; and the interaction between these two terms" (Piketty, 2014, p. 238). Therefore, it appears as though the part of income inequality that is caused by the uneven distribution of capital is somewhat neglected in the earlier literature.

Neglecting this income inequality arising due to the uneven distribution of capital is something that should be reconsidered, especially in light of economic and financial globalization, which is thought to have increased the importance of income arising from capital relative to income from labor in the more developed countries (Maldonado, 2017). Due to globalization, the ratio of skilled to unskilled wages has increased as high-skilled workers benefit from opportunities abroad whereas low-skilled workers face additional competition from cheap foreign labor (Domanski et al., 2016). As a result, the rate of return on labor relative to capital has been reduced, leading to increased returns on wealth[2] and an increased share of capital in total income (Domanski et al., 2016). Therefore, given that capital is much more concentrated than income from labor, a rising share of capital could be causing income inequality to increase (Lyubimov, 2017; Piketty, 2014).

Piketty (2014) states that for inequality arising from capital income, several determining factors are important (as cited by Maldonado, 2017). The first factor is savings, which plays a role due to the fact that those earning a higher income tend to save more, thus adding to the uneven distribution of capital and causing a "snowball effect" (Domanski et al., 2016). A second factor is inheritance law, which, if having less redistributive properties, causes a larger amount of accumulated capital to be inherited by the next generation, thereby not changing its distribution across the population (Lyubimov,

---

[2] Take for example corporate profits, dividends, rents, sales of property, and capital gains

2017). Finally, there are two factors that move together, namely the financial markets and investment behavior. For example, when wanting to enter the stock market, an investor faces some form of actual or perceived fixed cost[3] (Guiso et al., 2003). This causes those with a low income and low amounts of capital to refrain from entering the stock market in most cases. Furthermore, risky assets such as stocks are proven to have a higher return than safe or riskless assets such as savings (Maldonado, 2017).

Based on especially these last two factors, one should not focus solely on financial development without differentiating between the frequently distinguished bank-based and market-based structures of financial systems (Maldonado, 2017). It is likely that in those countries where the financial system is more market-based and stock markets are dominant, those with a high income and high amounts of capital have a large amount of their portfolio in risky assets, causing them to receive a higher return than those with a low income. However, up until now, the amount of studies that have made this distinction when investigating the link between finance and inequality is very limited. Furthermore, the results have been mixed and rather inconclusive. For example, the results of Maldonado (2017) show that, for a sample of 27 European Union member states during the period of 1995-2012, an increase in the market-based component of the financial system causes income inequality to increase. However, the positive effect is only small and not robust to alternative measurement. Furthermore, they show that increases in the bank-based component of the financial system lead to lower income inequality, indicating a negative relationship.

In another study, Brei et al. (2018) state that, based on their analysis of 97 economies over the period of 1989-2012, there exists a U-shaped relationship between financial development and inequality. They show that financial development initially causes income inequality to decrease when growing through either of the two structures. However, when income inequality starts to rise after a certain threshold is reached, it seems to do so through the more market-based systems, as the U-shaped relationship between bank-based systems and income inequality fails to reach statistical significance.

These mixed results could be caused by the fact that the study by Maldonado (2017) is limited to relatively developed countries and does not allow the relationship to be non-linear as the empirical studies by Brei et al. (2018) and Jauch & Watzka (2012) suggest. As a result, their model might pick up only part of the relationship and fail to disentangle its decreasing and increasing parts. Therefore, departing from the results of Brei et al. (2018) and Jauch & Watzka (2012), the following hypotheses are formed:

H₁: The impact of financial development is non-linear, causing income inequality to decrease for countries in the early stages of development whilst leading to an income inequality increase in more developed countries.

---

[3] For example, think about a certain level of financial literacy or the risk of losing the money invested.

H₂: The positive part of the relationship between financial development and income inequality in more developed countries is stronger when the market-based component of the financial system is larger.

Given these two hypotheses, the contribution of this thesis to the existing finance-inequality literature is twofold. First, in testing these two hypotheses with more recent data, this thesis provides either strengthening or contradictory evidence to the ongoing finance-inequality discussion. Additionally, this thesis tries to increase the reliability of the results by controlling for an important factor influencing income inequality, namely the presence of the welfare state (i.e. social security). As mentioned in the first paragraph of this section, multiple empirical studies have established a strong negative relationship between the overall level of a country's social spending and several measures of inequality and poverty (Marx et al., 2014). However, both studies by Brei et al. (2018) and Maldonado (2017) do not make any mention of it, and a government consumption indicator that was included in the model of Jauch & Watzka (2012) seems too broad to effectively capture the welfare state factor. This neglect of the welfare state factor may have therefore caused these previous studies to suffer from an omitted variable bias, leading their models to attribute its effects to their included explanatory variables.

3. Methodology

Since the goal of this study is to examine the relationship between Financial development and income inequality, the units of observation are 72 countries across the world from 1990 to 2017. This means cross-country comparisons have to be made over time, making a panel data approach the appropriate method of analysis, since it combines cross-sectional and time-series dimensions (Woolridge, 2013).

In order to properly test the hypotheses and dynamics regarding the finance-inequality relationship, the analysis will consist of two phases. In the first phase, a base model will be tested to assess whether the relationship between financial development and income inequality is really U-shaped, and if so, whether the relationship differs between market-based and bank-based financial systems. Following the theoretical considerations and models of similar empirical studies, the base model for this first phase can be specified as follows:

$$Gini_{i,t} = a + \beta_1 FD_{i,t} + \beta_2 FD_{i,t}^2 + \beta_3 GDPcap_{i,t} + \beta_4 GDPcap_{i,t}^2 + \beta_5 Inflation_{i,t} + \qquad (1)$$
$$\beta_6 TradeOpenness_{i,t} + \beta_7 Education_{i,t} + \beta_8 Industry_{i,t} + \varepsilon_{i,t}$$

Where i indicates the country, t the year, and $\varepsilon_{i,t}$ is the error term.
The dependent variable of $Gini_{i,t}$ indicates the income inequality in a given country in a given year as measured by the Gini coefficient. On a scale of 0 to 100, the Gini coefficient measures the extent to

which incomes vary within a population. When the Gini coefficient has a value of 0, then the distribution is exactly equal. If the total income of a society accrues to only one person/household unit, leaving the rest with no income at all, then the Gini coefficient approaches 100 (UNU-WIDER, 2019).

The main independent variable $\beta_1 FD_{i,t}$ indicates the development level of the financial system in a given country during a given year. Therefore, following both Jauch & Watzka (2012) and Brei et al. (2018), a squared term $\beta_2 FD_{i,t}^2$ is included to allow for a non-linear relationship. Following Maldonado (2017), the financial system is assumed to be the weighted sum of a bank component and a market component, such that it can be expressed as follows:

$$\beta_1 FD_{i,t} = \gamma_1 BCprivate_{i,t} + \gamma_2 Mcap_{i,t} \tag{2}$$

Where $\gamma_1 + \gamma_2 = 1$. It has to be mentioned here, however, that a third component consisting of finance intermediated by pension funds, insurance companies and other investment funds is not taken into account. Even though it is a component of increasing importance in the present day, it is hard to measure and very little data on it is available (Maldonado, 2017). Therefore, the financial system is composed of $\gamma_1 BCprivate_{i,t}$, which indicates the size of the banking sector as measured by the ratio of claims on the private sector by deposit money banks to GDP, and $\gamma_2 Mcap_{i,t}$, which indicates the size of the stock market component as measured by the stock market capitalization of a given country in a given year as a percentage of GDP. Adding their squared terms to allow for the expected non-linear relationship, the base model then looks as follows:

$$
\begin{aligned}
Gini_{i,t} = {}& a + \gamma_1 BCprivate_{i,t} + \gamma_2 BCprivate_{it}^2 + \gamma_3 Mcap_{i,t} + \gamma_4 Mcap_{i,t}^2 + \\
& \beta_5 GDPcap_{i,t} + \beta_6 GDPcap_{i,t}^2 + \beta_7 Inflation_{i,t} + \beta_8 TradeOpenness_{i,t} + \\
& \beta_9 Education_{i,t} + \beta_{10} Industry_{i,t} + \varepsilon_{i,t}
\end{aligned}
\tag{3}
$$

Given that several studies have previously used the claims on the private sector by deposit money banks to GDP as an indicator for financial development[4] (Beck et al., 2007; Jauch & Watzka, 2012), the specification of this baseline model allows for a comparison with previous findings.

Next to the dependent and main independent variables, several control variables need to be included to prevent omitted variable bias. In order to measure the effects central to the thesis, other factors that might have an impact on income inequality need to be included into the model, since their effect would otherwise be picked up by the coefficients of the independent variable(s) and the error term. Following Jauch & Watzka (2012) and Brei et al. (2018), $\beta_3 GDPcap_{i,t}$ is the first control variable to be included in the model. It indicates the GDP per capita in a given country during a given year and

---

[4] They did not consider the market component

is included to control for economic development. The squared term $\beta_4 GDPcap_{i,t}^2$ is also included in the model to be able to take the Kuznets Curve into account. Since the Kuznets curve has an inverse U-shape, the coefficient of GDP per capita is expected to be positive, whilst the coefficient of its squared term is expected to be negative.

Aside from GDP per capita, several controls are needed for inflation, openness to trade, education, and the sectoral structure of the economy, as they are often stated to influence income inequality (Brei et al., 2018; Clarke et al., 2006; Jauch & Watzka, 2012; Maldonado, 2017). The control variable $\beta_7 Inflation_{i,t}$ as measured by the consumer price index (CPI) reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services (The World Bank, 2019). It is included in the model to control for any macroeconomic instability that might disproportionately hurt the poor and middle class, who, unlike the rich, have less access to financial instruments that help them hedge against it (Clarke et al., 2006). In line with this reasoning, the coefficient of inflation is therefore expected to be positive. The control variable $\beta_8 TradeOpenness_{i,t}$ measures the sum of exports and imports of goods and services as a percentage of GDP. A country's openness to trade is often used as a proxy for globalization, of which the argued effect is that it causes the return on low-skilled labor to go down due to increased supply of cheap labor (Domanski et al., 2016). Therefore, it is expected to positively affect income inequality. The third control variable $\beta_9 Education_{i,t}$ is measured as the average years of education attained by the population between 25 and 64 years old. It is included in the model as it is argued to negatively impact income inequality by most theoretical and empirical studies on this topic[5]. The fourth control variable of $\beta_{10} Industry_{i,t}$ measures industrial value added as a percentage of GDP and is included in line with the reasoning of Brei et al. (2018) to control for the sectoral structure of a country's economy. A higher share of industrial value added to GDP would indicate a larger modern sector[6], which, in line with the reasoning of Kuznets (1955), should lead to a lower income inequality (Clarke et al., 2006).

In the second phase, the additional consideration of the welfare state comes into play. As can be seen on the next page, the variable of $\beta_8 WelfareState_{i,t}$ is added to the baseline model, serving as an additional control to prevent a possible omitted variable bias. This causes the model to look as follows:

$$Gini_{i,t} = a + \gamma_1 BCprivate_{i,t} + \gamma_2 BCprivate_{it}^2 + \gamma_3 Mcap_{i,t} + \gamma_4 Mcap_{i,t}^2 + \qquad (4)$$
$$\beta_5 GDPcap_{i,t} + \beta_6 GDPcap_{i,t}^2 + \beta_7 Inflation_{i,t} + \beta_8 TradeOpenness_{i,t} +$$
$$\beta_9 Education_{i,t} + \beta_{10} Industry_{i,t} + \beta_{11} WelfareState_{it} + \varepsilon_{i,t}$$

---

[5] As mentioned earlier, most studies argue education to disproportionally help the poor
[6] As opposed to the agricultural sector

Since Marx et al. (2014) identified social cash spending as a percentage of GDP to be the most widely used indicator of the direct income redistribution effort being made by governments, the welfare state control is measured by the amount of social benefits to households as a percentage of GDP. Next to social benefits (typically in cash), it also takes into account social transfers in kind.

Based on the claims of Korpi and Palme (1998) regarding the 'paradox of distribution', the relationship between the development of the welfare state and income inequality is expected to be negative. However, given that the variable is only available for 36 OECD countries, it does not cover the entire sample of 72 countries. Furthermore, the data is only available from the year 1995 onwards. Therefore, the variable is not included in the baseline model, causing the extended model to function similarly to a robustness check with the results from the baseline model as a benchmark. Hence, the regressions for the extended model are conducted on a subsample of 36 OECD countries during the period of 1995-2017. Comparing these results with those of the baseline model could then provide insights in the importance of the welfare state (social security) in keeping inequality down and how this affects the finance-inequality relationship.

Given the specified models, there is only so much that can be controlled for by adding additional explanatory variables to the model. Next to the control variables currently included, there are still numerous unobserved country-fixed (time-invariant) effects that might have an impact on the results. However, since this thesis deals with the influence of financial development on income inequality *within* countries and not *between* countries, the fixed effects estimator can be used (Jauch & Watzka, 2012; Woolridge, 2013). The fixed effects estimator, also known as the within estimator, controls for any unobserved effects that are time-invariant, thus keeping any country fixed effects from impacting the results[7]. By modifying the baseline model as described earlier, the fixed effects estimation equation then looks as follows:

$$Gini_{i,t} = \gamma_1 BCprivate_{i,t} + \gamma_2 BCprivate_{i,t}^2 + \gamma_3 Mcap_{i,t} + \gamma_4 Mcap_{i,t}^2 + \qquad (5)$$
$$\beta_5 GDPcap_{i,t} + \beta_6 GDPcap_{i,t}^2 + \beta_7 Inflation_{i,t} + \beta_8 TradeOpenness_{i,t} +$$
$$\beta_9 Education_{i,t} + \beta_{10} Industry_{i,t} + \alpha_i + \varepsilon_{i,t}$$

With unobserved country-specific time-invariable effects α_i and error term $\varepsilon_{i,t}$. The fixed effects equation for the extended model follows from this, again, by simply adding the additional control variable $\beta_{11} WelfareState_{i,t}$. Through the 'within transformation', which involves the time-demeaning of the variables in the model, the fixed effects estimator removes the unobserved effect α_i from the equation (Woolridge, 2013).

---

[7] The choice for the fixed-effect estimator over the random-effect estimator is reinforced by a Hausman test which produced a Chi-squared value of 746.01 that is significant at the .05 level (see Appendix A).

Having controlled for the country fixed effects, the yearly data obtained for the analysis might still be affected by business cycle fluctuations. Following previous studies, non-overlapping 5-year averages are used to control for these fluctuations. Whilst this leads to a decrease in the total amount of observations, it smooths out the business cycle fluctuations and strengthens the results (Brei et al., 2018; Jauch & Watzka, 2012). Additionally, as can be seen from the fixed effect estimation equation, any remaining year-effects are controlled for by including time-dummies y_t, further controlling for any omitted variable bias (Jauch & Watzka, 2012).

4. Data

4.1 Dataset Construction

In order to construct the dataset on which to perform the analysis, several datasets are combined. On the next page, Table 1 provides a quick overview of all variables used in the analysis, their definitions and source included. Starting off with the data on income inequality, the Gini coefficients based on household disposable income are obtained from Solt's Standardized World Income Inequality Database (SWIID) (2019). With the data of the Luxembourg Income Study (LIS) Cross-National Data Center as a starting point, the SWIID pools data from all major sources of inequality data[8] and makes their Gini coefficients comparable to those estimated by the LIS[9] (Ortiz & Cummins, 2012; Solt, 2019). As a result, the SWIID is the most broad and comparable source of data for cross-national research on income inequality (Jauch & Watzka, 2012; Ortiz & Cummins, 2012) with a coverage of 191 countries in its current state (Solt, 2019). Therefore, the SWIID is preferred over the World Income Inequality Database (WIID) published by UNU-WIDER (2019), primarily due to the fact that the estimation methodology of the Gini coefficients reported by the WIID is inconsistent and their quality debatable (Solt, 2015).

In obtaining the data for the indicators of financial development – bank credit divided by GDP and market capitalization divided by GDP – the widely recognized and frequently used Financial Structure Database is used. For its construction, Beck et al. (2019) compiled data from already existing data sources[10], which was then supplemented and made consistent with data from economic development reports published by the International Monetary Fund (IMF), the World Bank, and national governments. The ending point of the time period studied for this thesis ends with the year 2017, since that is the last year of which the current version of the database contains information. When it comes to

---

[8] Next to the LIS data, it uses data from the OECD Income Distribution Database, the Socio-Economic Database for Latin America and the Caribbean generated by CEDLAS and the World Bank, Eurostat, the World Bank's PovcalNet, the UN Economic Commission for Latin America and the Caribbean, national statistical offices around the world, and academic studies. Additionally, reliance on problematic assumptions is minimized by using as much information as possible from proximate years within the same country (Solt, 2019).

[9] For a detailed methodological description of the SWIID, see Solt (2019).

[10] Beck et al. (2000) provide a non-exhaustive list of sources such as the World Bank's World Development Indicators, the International Monetary Fund's International Financial Statistics and Government Financial Statistics, the United Nation's National Income and Product Accounts, and data sets from the Organization for Economic Co-operation and Development (OECD), the Asian Development Bank, and the Inter-American Development Bank.

the starting year of the studied time period, the year 1990 is chosen, since before then, the data on the various factors that need to be controlled for becomes very scarce.

Table 1: Variable Definitions and Sources

Variable	Definition	Source
Gini	Gini coefficient of disposable income	Standardized World Income Inequality Database (SWIID) (Solt, 2019)
Financial Development		
Bank Credit	Claims on the private sector by deposit money banks as a percentage of GDP	Financial Structure Database (Beck et al., 2019)
Market Capitalization	Stock market capitalization as a percentage of GDP	Financial Structure Database (Beck et al., 2019)
Controls		
GDP per capita	Gross Domestic Product (GDP) per capita in constant 2010 USD	The World Bank Development Indicators (2019)
Inflation Rate	Annual change in the Consumer Price Index (CPI)	The World Bank Development Indicators (2019)
Openness to Trade	The sum of exports and imports of goods and services as a percentage of GDP	The World Bank Development Indicators (2019)
Educational Attainment	Average years of education of the population between 25 and 64 years of age (5-year intervals)	Educational Attainment Database (Barro & Lee, 2013)
Industrial Production	Amount of industrial value added as a percentage of GDP (it comprises value added in mining, manufacturing, construction, electricity, water, and gas)	The World Bank Development Indicators (2019)
Social Security (Welfare State)	The amount of social benefits to households as a percentage of GDP (including social benefits typically in cash as well as transfers in kind)	OECD database (2020)

As can be seen, the variable of Educational Attainment is obtained from the database constructed by Barro and Lee (2013), which provides education data in 5-year intervals for 89 countries. As a source for their database they used, amongst others, information from censuses and surveys as compiled by UNESCO and Eurostat. However, regarding the time period of focus for this thesis, their database only includes the years up to 2015. Hence, some observations are missing at the end of the sample period. Nevertheless, data on these years can still be obtained, since Barro and Lee provide projections up to 2040. Even though the reliability of projections further into the future is questionable, the first 5-year

interval of these projections should still be accurate and should thus not have a negative impact on the reliability of the results.

Due to the fact that several datasets are combined, it is inevitable that for many countries some or all observations of a certain variable are missing during the period of interest, causing the dataset to be unbalanced. When the majority of observations of either the dependent or one of the main independent variables is missing for a country, it is not included in the analysis. Additionally, if all observations on one of the control variables for a country are missing, it is excluded as well[11]. Hence, data availability is the main driver of the selection procedure behind the 72 countries included in the analysis.

4.2 Exploring the Data

Given the 72 countries selected for the analysis, the original 2,774 country-year observations are reduced to a maximum of 576 due to the use of the 5-year averages (see Table 2). Since the variable of Social Security is only available for OECD countries, it has the lowest amount of 163 available observations. All other variables have an observation count that varies between 448 and 576. Looking at the Gini Coefficient, it can be seen that it varies between a minimum of 20 and a maximum of 59.80, with an average of 37.68.

Continuing with the main independent variables of financial development, it can be seen that bank credit to GDP has a minimum of 1.06 % and a maximum of 209.27 %, whereas Market Capitalization to GDP has a minimum of 0.01 % and a maximum of 1,042%. This means that whilst all countries in the sample have some degree of bank-based development of their financial system, the market-based development is almost non-existent for some. Hence, variability regarding financial development is large between countries, especially for the market-based component, which is also shown by the standard deviations. These are 40.19 and 88.84 for the bank-based and market-based components, respectively. In combination with the large range and high variability, the median of both financial development variables indicates a high positive skewness, since it is relatively close to the minimum (42.81 and 30.34 for the bank- and market-based components, respectively). Confirmation of this skewness through a histogram inspection therefore warrants a transformation of these variables to their natural logarithm, making their distribution more normal[12] (Jauch & Watzka, 2012). The same holds for the independent variables of GDP per capita, Inflation, and Openness to Trade[13]. Comparing their original values with those after the log-transformation[14], the median is now situated roughly in the middle between the minimum and maximum, indicating a reduction in skewness (for example, the

---

[11] Any missing values remaining are handled by the statistical package through listwise deletion.
[12] The aggregate Financial Development indicator (denoted as Financial Development in Table 3) is then simply the log-transformed sum of the financial system indicators
[13] Since the Inflation variable contains some negative values, a constant of 100 is added to every observation before taking the natural log (in line with Brei et al., 2018)
[14] The log-transformed variable is displayed below its original in Table 2.

median of bank credit is now 3.76, between a minimum of 0.06 % and a maximum of 5.34 %). The squared terms needed for the analysis are therefore created based on the log-transformed variables.

Table 2: Summary Statistics of Included Variables

Variable	Log	Obs.	Median	Mean	SD	Min	Max
Gini Coefficient	No	547	38.48	37.68	9.04	20.00	59.80
Bank Credit/GDP	No	562	42.81	53.36	40.19	1.06	209.27
Ln(Bank Credit/GDP)	Yes	562	3.76	3.66	0.87	0.06	5.34
Ln(FD)	Yes	448	4.42	4.37	0.85	1.74	7.13
Market Cap/GDP	No	454	30.34	52.61	88.84	0.01	1,042.28
Ln(Market Cap/GDP)	Yes	454	3.41	3.27	1.35	- 4.38	6.95
GDP per Capita	No	566	7410.62	17,038.37	20,060.83	283.01	109,084.40
Ln(GDP per Capita)	Yes	566	8.91	8.91	1.45	5.65	11.60
Inflation (CPI)	No	559	5.33	25.41	150.89	- 2.26	2,414.35
Ln(100 + CPI Inflation)	Yes	559	4.66	4.73	0.30	4.58	7.83
Openness to Trade	No	563	60.64	74.15	50.00	12.88	425.16
Ln(Openness to Trade)	Yes	563	4.11	4.15	0.55	2.56	6.05
Years of Education	No	576	8.16	7.98	3.05	0.68	13.87
Industrial Production	No	519	27.08	27.58	7.99	6.88	61.67
Social Security/GDP	No	163	12.57	12.14	4.76	0.07	19.87

Since the data is expected to show a non-linear relationship, income inequality might be affected differently for countries in different stages of (financial) development. Figures 1a through 2b therefore show examples of how both income inequality and financial development have changed over time for 4 developed countries as well as 4 developing countries[15]. These might provide some insights as to what to expect from the main analysis.

      Figure 1a displays how income inequality has been on the rise in several developed countries. Even Sweden, a country amongst those with the lowest income inequality, has been plagued by a steady increase of the Gini-coefficient. Figure 1b shows that, just like income inequality, both bank- and market-based financial development have been on the rise.

---

[15] Classification is based on the country classifications published by the United Nations (2020).

Figure 1a: Income Inequality in Developed Countries
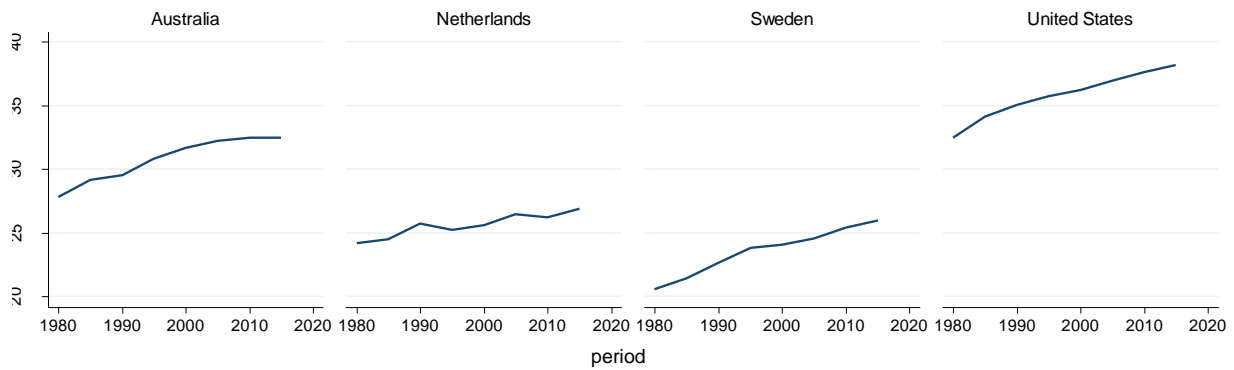
Figure 1b: Financial Development in Developed Countries
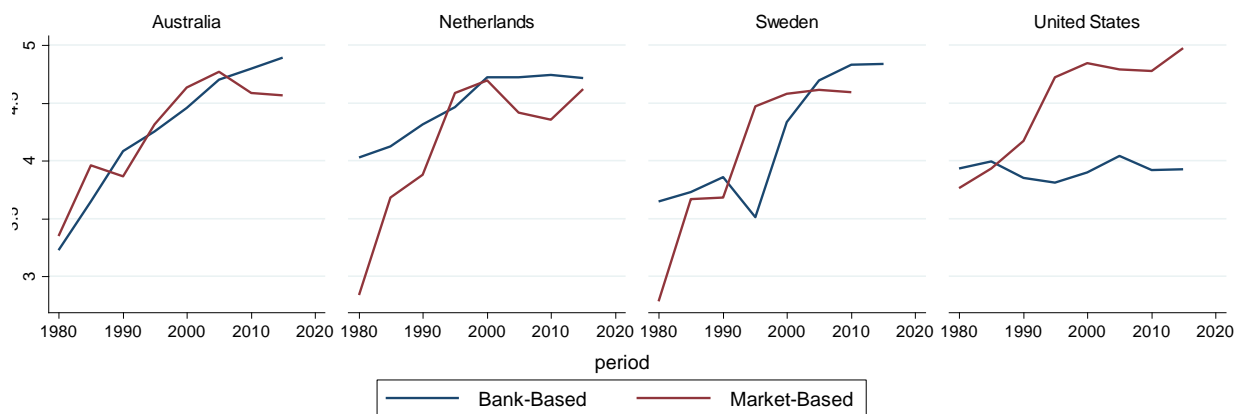
For those countries still in a developing stage, figures 2a and 2b show something different. Similar to most developed countries, financial development has been on the rise within the developing countries. However, with some exceptions, most developing countries have seen a decrease or stagnation in their income inequality trend. Therefore, when putting together these graphs of countries in different stages of development, a U-shape can be distinguished over time. Whilst these graphs provide a good look on the behavior of the main variables of interest, an analysis that controls for any other influential factors is required before any conclusions regarding the finance-inequality relationship can be drawn.

Figure 2a: Income Inequality in Developing Countries
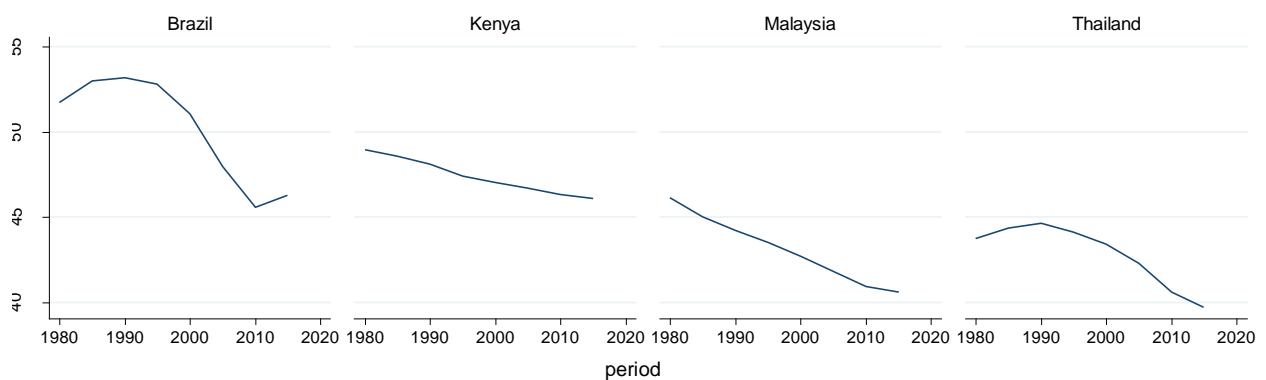
Figure 2b: Financial Development in Developing Countries
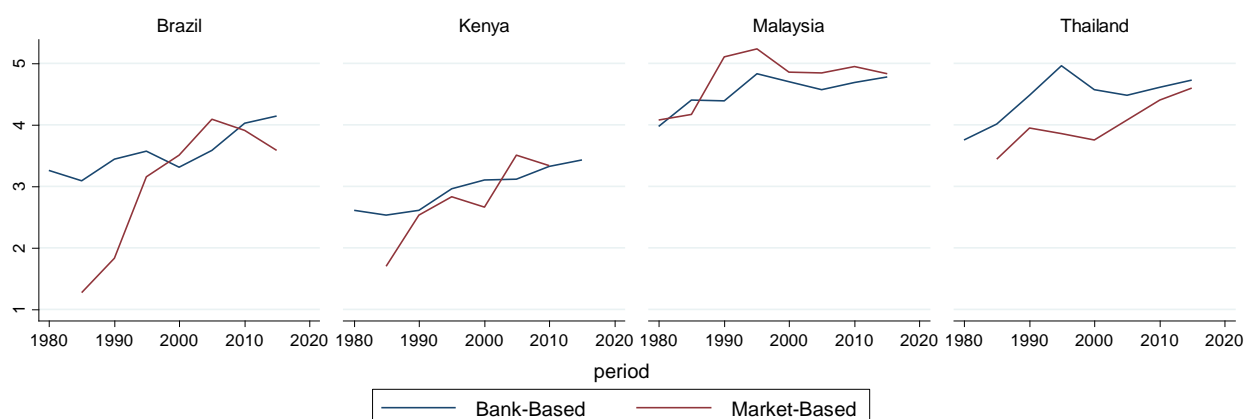
5. Empirical Analysis

5.1 Main Analysis

As was mentioned in the methodological section, the main analysis consists of two phases. Both phases are based on equation 5 with the main difference being that the second phase includes an extra control variable for the welfare state factor which reduces the sample size and time period. In Table 3 on the next page, four fixed effects regression outputs of the first phase are shown[16]. As can be seen in the first estimation outcome, the coefficient of financial development based on the combined financial system components is positive, indicating that financial development has a positive effect on income inequality. However, it fails to reach statistical significance, and the originally hypothesized non-linear relationship does not become apparent either, since its squared term is insignificant as well. Similar results can be observed for both measures of bank-based financial development, thus indicating it has no statistically significant effect on income inequality. The market-based component of financial development, however, does achieve statistical significance at the .01 level either when included on its own or alongside the bank-based component. Its squared term is significant as well at the .05 level, indicating that the relationship between market-based financial development is non-linear. Looking at the last column, the coefficient is positive, meaning the Gini coefficient rises by 0.00737 for every percentage increase in the ratio of market capitalization to GDP (given that the level of market-based financial development is zero). However, since the squared term is negative, the non-linear relationship is convex and thus takes on an inverted U-shape instead of the hypothesized U-shape. For every percentage increase in the ratio of market capitalization to GDP, its effect on the Gini coefficient decreases by

---

[16] Since estimations might suffer from heteroskedasticity, heteroskedasticity-robust standard errors are used. These standard errors have the beneficial property of controlling for any autocorrelation present as well. Additionally, pairwise correlations show that the main variables of interest are not plagued by high collinearity (see appendix B), just as the Variance Inflation Factors (VIFs) of the explanatory variables do not raise any suspicion of problematic multicollinearity (see appendix C).

0.000988. Thus, in lower stages of market-based financial development income inequality increases, whilst in higher stages of market-based financial development income inequality seems to decrease.

Table 3: Income Inequality and Financial Development without Welfare State Control (1990-2017)

	Bank-Based and Market-Based Combined	Bank-Based Only	Market-Based Only	Bank-Based and Market-Based Individually
Financial Development	2.028			
	(1.993)			
Financial Development Squared	-0.188			
	(0.228)			
Bank Credit		0.0849		0.0311
		(1.523)		(1.636)
Bank Credit Squared		-0.0142		0.00668
		(0.213)		(0.210)
Market Capitalization			**0.737***	**0.737***
			(0.188)	**(0.205)**
Market Capitalization Squared			**-0.101***	**-0.0988***
			(0.0415)	**(0.0427)**
GDP per Capita	7.000	5.662	6.694	6.825
	(5.656)	(5.182)	(4.947)	(5.480)
GDP per Capita Squared	-0.357	-0.241	-0.325	-0.335
	(0.309)	(0.293)	(0.274)	(0.301)
Trade Openness	1.242	2.002**	1.378	1.414
	(0.992)	(0.960)	(1.017)	(1.047)
Inflation Rate	**1.597***	**0.960**	**1.883***	**1.895***
	(0.494)	**(0.795)**	**(0.285)**	**(0.274)**
Years of Education	-0.456	-0.413	-0.446	-0.450
	(0.323)	(0.341)	(0.318)	(0.326)
Industrial Production	**-0.121***	**-0.133***	**-0.0988***	**-0.0970***
	(0.0492)	**(0.0547)**	**(0.0462)**	**(0.0474)**
Constant	-6.810	1.165	-5.398	-6.116
	(25.75)	(23.77)	(24.68)	(25.53)
Observations	366	405	370	366
Number of Countries	72	72	72	72
Country Fixed-effects	Yes	Yes	Yes	Yes
Year Fixed-effects	Yes	Yes	Yes	Yes
F-Statistic	3.185	2.402	6.237	6.086
p-value	0.0011	0.0114	0.0000	0.0000
R-squared (within)	0.158	0.136	0.197	0.199

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: The dependent variable is income inequality as measured by the Gini coefficient. All estimations are based on the fixed effects (within) estimator and use 5-year non-overlapping averages.

Continuing with the control variables included in the estimations, it appears that only some reach statistical significance, with industrial production being the only one that manages to do so at the .05 significance level across all four models. Surprisingly, the control for the Kuznets curve (GDP per capita and its squared term), with its coefficients being the correct signs, fails to achieve statistical significance. Additionally, it seems that the R-squared (within) of all four models is on the lower side, with 19.9% for model 4 being the highest. This means that at best, 19.9% of all variations in income inequality can be explained by the model.

Combining the lack of explanatory power of the model with the fact that the main explanatory variables fail to reach statistical significance might mean that their coefficients are underestimated as a result of the previously argued omitted variable bias. This underestimation might be caused by the missing welfare state control being positively correlated with the main explanatory variables, whilst being negatively correlated with the dependent variable[17]. The second phase estimations shown in Table 4 therefore include the additional control for the welfare state (Social Security).

As can be seen, both the total number of observations and the number of countries are lower as a result of the additional welfare state indicator being available only for 36 OECD countries from 1995 onwards. However, the explanatory power of the model has roughly doubled, rising to as much as 42.4% of the variation in income inequality (model 8). Additionally, there are substantial changes in the signs and significance of the coefficients. Looking at the main independent variables, it can be seen that they now have the hypothesized signs. The coefficients of total financial development as well as bank-based and market-based financial development are negative with a squared term that is positive, indicating that their relationship with income inequality is U-shaped. Additionally, their relationship with income inequality is much stronger, especially for bank-based financial development. However, bank-based financial development is now highly significant at the .01 level, whereas that is no longer the case for market-based financial development. Hence, whilst these results show no clear effect of market-based financial development on income inequality, they show that a 1% increase in ratio of bank credit to GDP will cause the Gini coefficient to decrease by 0.1387 (given that the level of bank-based financial development is zero). The squared term, however, indicates that for every percentage increase in the ratio of bank credit to GDP, this effect decreases by 0.01644. Thus, until it reaches a certain threshold, bank-based financial development will narrow the income distribution, after which it causes the income distribution to widen again.

Looking at the control variables, it can be seen that the control for the Kuznets curve (GDP per capita) is positive and its squared term negative across all estimations, indicating the inverse U-shaped relation between economic growth and income inequality as was initially expected. Whereas slightly significant at the .1 level when either the combined financial development indicator or the market-based

---

[17] See pairwise correlations in Appendix B

financial development indicator is included, it is significant at the .05 level when including bank-based financial development only or both measures of financial development alongside each other.

Table 4: Income Inequality and Financial Development with Welfare State Control (1995-2017)

	Bank-Based and Market-Based Combined	Bank-Based Only	Market-Based Only	Bank-Based and Market-Based Individually
Financial Development	-12.17***			
	(4.402)			
Financial Development Squared	1.248**			
	(0.461)			
Bank Credit		-14.16***		-13.87***
		(3.793)		(3.666)
Bank Credit Squared		1.691***		1.644***
		(0.459)		(0.444)
Market Capitalization			-1.190	-1.184
			(1.194)	(1.768)
Market Capitalization Squared			0.164	0.176
			(0.153)	(0.218)
GDP per capita	17.40**	18.57**	16.48*	17.82**
	(8.436)	(7.918)	(9.036)	(7.891)
GDP per capita Squared	-0.977*	-1.055**	-0.928*	-1.001**
	(0.502)	(0.477)	(0.526)	(0.472)
Trade Openness	3.212**	3.568**	2.762*	3.942**
	(1.494)	(1.566)	(1.552)	(1.569)
Inflation Rate	-11.93	-9.344	0.273	-9.920
	(8.435)	(6.840)	(5.962)	(6.885)
Years of Education	-0.279	-0.302	-0.274	-0.266
	(0.224)	(0.247)	(0.229)	(0.237)
Industrial Production	-0.0622	-0.0503	-0.0632	-0.0631
	(0.0619)	(0.0588)	(0.0629)	(0.0597)
Social Security	-0.171*	-0.207**	-0.144	-0.201*
	(0.100)	(0.101)	(0.110)	(0.106)
Constant	34.91	17.66	-43.26	22.47
	(57.43)	(48.36)	(51.48)	(46.26)
Observations	154	160	156	154
Number of Countries	36	36	36	36
Country Fixed-effects	Yes	Yes	Yes	Yes
Year Fixed-effects	Yes	Yes	Yes	Yes
F-Statistic	3.078	4.134	3.090	6.588
p-value	0.0047	0.0005	0.0046	0.0000
R-squared (within)	0.353	0.417	0.285	0.424

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: The dependent variable is income inequality as measured by the Gini coefficient. All estimations are based on the fixed effects (within) estimator and use 5-year non-overlapping averages.

Furthermore, whereas the controls for the inflation rate and the sectoral structure of the economy where previously significant at the .05 level, they no longer are after the inclusion of the welfare state control. The welfare state factor is statistically significant at the .05 level when only bank-based financial development is included whilst reaching the slightly lower .1 level when including either the combined indicator or bank-based and market-based development alongside each other. Hence, for every percentage increase in the ratio of social benefits to GDP, the Gini coefficient decreases by 0.201 (based on the final column), thus having the effect that was expected ex ante. Finally, the control for globalization (Trade Openness) has become significant at the .05 level in all estimations except when including market-based financial development on its own. This would indicate that an increased openness to trade causes income inequality to rise.

5.2 Robustness Checks

Whilst the second phase estimations of the extended model shown in the previous section are basically a robustness check of the baseline model grounded in previous studies, their main purpose is to test whether these previous studies have failed to include a core variable in their model. However, in order to make sure that the differences between the first and second phase estimations can be attributed to the inclusion of the welfare state factor, the baseline model is once again estimated. The sample consists of the same observations of 5-year averages used in the second phase estimations (shown in table 4) to make the results comparable. If these estimations show results that are similar to those of the first phase estimations, they make the importance of the welfare state factor more robust and greatly reduce the probability that the differences between the first and second phase estimations are due to the decrease in sample size and time period.

Looking at the results in table 5, they look similar to those of the second phase estimations. As can be seen, the R-squared (within) indicates that the model is able to explain at most 38,4% of the variation in income inequality when both bank-based and market-based finance are included alongside each other, meaning that the explanatory power of the model is roughly 4% lower when the welfare state factor is excluded. Additionally, there is no change in the signs of the main independent variables, with bank-based financial development and its squared term remaining significant at the .05 level. A 1% increase in ratio of bank credit to GDP will cause the Gini coefficient to decrease by 0.1248 (given that the level of bank-based financial development is zero) with its strength decreasing by 0.01462 for every percentage increase. Next to the main independent variables, the control for globalization (Trade Openness) is still showing a positive effect with no change in its statistical significance, whereas the control for the Kuznets Curve no longer reaches statistical significance. The control for educational attainment becomes statistically significant at the .1 level when only bank-based financial development is included in the model, indicating that income inequality within a country decreases as the average years of education increases.

Table 5: Income Inequality and Financial Development without the welfare state control (1995-2017)

	Bank-Based and Market-Based Combined	Bank-Based Only	Market-Based Only	Bank-Based and Market-Based Individually
Financial Development	**-10.78****			
	(4.294)			
Financial Development Squared	**1.094****			
	(0.452)			
Bank Credit		**-12.65*****		**-12.48*****
		(4.025)		**(3.976)**
Bank Credit Squared		**1.497*****		**1.462*****
		(0.490)		**(0.482)**
Market Capitalization			-0.810	-0.646
			(1.294)	(1.907)
Market Capitalization Squared			0.124	0.118
			(0.163)	(0.233)
GDP per capita	12.27	11.84	11.70	11.34
	(7.371)	(7.162)	(7.787)	(6.986)
GDP per capita Squared	-0.673	-0.656	-0.650	-0.625
	(0.449)	(0.443)	(0.463)	(0.436)
Trade Openness	**3.106****	**3.399****	**2.640***	**3.575****
	(1.488)	**(1.593)**	**(1.552)**	**(1.599)**
Inflation Rate	-10.48	-7.932	0.695	-8.581
	(8.262)	(7.085)	(6.355)	(7.133)
Years of Education	-0.351	**-0.407***	-0.336	-0.347
	(0.215)	**(0.229)**	(0.223)	(0.213)
Industrial Production	-0.0223	-0.00723	-0.0306	-0.0206
	(0.0582)	(0.0577)	(0.0593)	(0.0574)
Constant	43.79	33.49	-27.70	38.19
	(54.60)	(47.45)	(46.18)	(45.33)
Observations	154	160	156	154
Number of Countries	36	36	36	36
Country Fixed-effects	Yes	Yes	Yes	Yes
Year Fixed-effects	Yes	Yes	Yes	Yes
F-statistic	2.617	4.395	2.585	6.345
p-value	0.0150	0.0004	0.0161	0.0000
R-Squared (within)	0.323	0.375	0.263	0.384

Standard errors in parentheses

$^{*} p < 0.10, ^{**} p < 0.05, ^{***} p < 0.01$

Note: The dependent variable is income inequality as measured by the Gini coefficient. All estimations are based on the fixed effects (within) estimator and use 5-year non-overlapping averages.

Thus, whilst still not showing a clear effect of market-based financial development on income inequality, a U-shaped relationship between bank-based financial development and income inequality is apparent even when the welfare state factor is excluded. Therefore, the welfare state factor is not as detrimental in solving an omitted variable bias, but nevertheless increases the statistical power of the model. A possible explanation for the second phase estimations showing different results compared to the first

phase estimations might be that the model is simply not a good fit for countries outside the OECD sphere, thus indicating that the reduced sample is what caused the results to change.

As a second robustness check, following Jauch & Watzka (2012), the second phase estimations are conducted with a one period lag of all independent variables. This additional check addresses arguments of reverse causality and that the explanatory factors need time to influence income inequality, whilst also controlling for any simultaneity bias that might affect the results (Jauch & Watzka, 2012). By lagging the independent variables, the estimations measure their effects on income inequality in five years. Looking at the results in Table 6, it can be seen that the model is able to explain at best 43,2% of the variation in income inequality, which is slightly higher compared to the second phase estimations without the lags. However, it has to be stated that whilst the same sample was used as with the second phase estimations, the one period lag of the independent variables caused a reduction in the amount of observations.

Continuing with the main independent variables, it can be seen that their signs have remained negative, whereas their squared terms have remained positive. Additionally, the magnitude and significance level of the effect of bank-based financial development have decreased when it is either included without or alongside market-based financial development. On the other hand, the effect of market-based financial development is now significant at the .1 level, as well as its squared term, which reaches significance at the .05 level. Hence, both bank-based and market-based financial development seem to have a U-shaped relationship with income inequality. When the ratio of bank credit to GDP increases by 1%, the Gini coefficient decreases by 0.06496 over the next five years. According to the squared term, however, this effect decreases by 0.00853 for every percentage increase. For a 1% increase in the ratio of market capitalization to GDP, the Gini coefficient decreases by 0.02028 over the next five years, with a 0.0031 lower decrease for every percentage increase.

When it comes to the control variables, the effect of globalization (trade openness) on income inequality remains positive whilst reaching the higher significance level of .01 when bank-based and market-based finance are included alongside each other. Additionally, the measure of industrial production is now statistically significant at the .05 level in three of the four estimations, which means that when the ratio of industrial value added to GDP increases, the Gini coefficient goes down over the next five years. However, just as with the previous robustness check, the control for the Kuznets Curve fails to reach statistical significance whilst bearing the expected signs (inverse U-shape). Finally, the control for the welfare state is only slightly less significant when bank-based financial development only is included in the model, still indicating the negative relationship with income inequality. When both bank-based and market-based finance are included alongside each other, the estimation indicates that for every percentage increase in the ratio of social benefits to GDP, the Gini coefficient decreases by 0.0015 over the next five years.

Table 6: Income Inequality and Financial Development with the welfare state control and a one period lag of all independent variables (1995-2017)

	Bank-Based and Market-Based Combined	Bank-Based Only	Market-Based Only	Bank-Based and Market-Based Individually
L.Financial Development	-9.729**			
	(3.607)			
L.Financial Development Squared	1.101***			
	(0.395)			
L.Bank Credit		-6.166*		-6.496**
		(3.475)		(3.152)
L.Bank Credit Squared		0.811*		0.853**
		(0.432)		(0.391)
L.Market Capitalization			-1.930**	-2.028*
			(0.830)	(1.012)
L.Market Capitalization Squared			0.290**	0.310**
			(0.125)	(0.136)
L.GDP per Capita	3.536	4.283	4.154	4.205
	(5.074)	(5.371)	(5.142)	(5.018)
L.GDP per Capita Squared	-0.289	-0.320	-0.330	-0.325
	(0.315)	(0.338)	(0.320)	(0.310)
L.Trade Openness	2.114**	2.407**	1.988*	2.746***
	(0.997)	(1.095)	(1.010)	(0.955)
L.Inflation Rate	-2.333	2.365	6.168	1.276
	(7.557)	(5.087)	(4.320)	(5.518)
L.Years of Education	-0.0931	-0.0924	-0.0936	-0.110
	(0.213)	(0.238)	(0.204)	(0.220)
L.Industrial Production	-0.105**	-0.0949*	-0.115**	-0.107**
	(0.0466)	(0.0476)	(0.0515)	(0.0443)
L.Social Security	-0.138*	-0.139*	-0.107	-0.150*
	(0.0690)	(0.0772)	(0.0704)	(0.0749)
Constant	54.87	17.60	-4.386	26.83
	(41.24)	(30.15)	(25.87)	(31.42)
Observations	125	125	126	125
Number of Countries	36	36	36	36
Country Fixed-effects	Yes	Yes	Yes	Yes
Year Fixed-effects	Yes	Yes	Yes	Yes
F-Statistic	3.791	4.797	2.098	6.392
p-value	0.0012	0.0002	0.0475	0.0000
R-Squared (within)	0.413	0.392	0.350	0.432

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: The dependent variable is income inequality as measured by the Gini coefficient. All estimations are based on the fixed effects (within) estimator and use 5-year non-overlapping averages.

6. Discussion

6.1 Revisiting the Hypotheses

Placing the results in context of the existing literature, it seems the first phase estimations of the baseline model are not in line with any of the theory as proposed by either Banerjee & Newman, Galor & Zeira, Greenwood & Jovanovich, or Thomas Piketty. Only market-based financial development seems to have an effect on income inequality which is positive but diminishing as the ratio of market capitalization to GDP increases. For the sample of 72 countries across the period of 1990 to 2017, no clear effect of bank-based financial development on income inequality could be distinguished. These results are also contradictory to previous empirical studies that did find an effect of bank-based financial development on income inequality, be it positive, negative, or U-shaped (Batuo et al., 2010; Brei et al., 2018; Clarke et al., 2003; Jauch & Watzka, 2012; Maldonado, 2017).

However, when reducing the sample to 36 OECD countries and including an additional control for the welfare state factor, the fit of the model seems to improve and the signs of the coefficients are more in line with theoretical expectations and the findings of previous studies. Whilst showing a negative relationship between financial development and income inequality as theorized by both Banerjee & Newman and Galor & Zeira, the statistically significant squared term indicates that the relationship is U-shaped, meaning that financial development causes income inequality to increase again after a certain threshold is reached. Hence, the results confirm Piketty's claim that the relationship is U-shaped. An estimation of the same sample of OECD countries without the welfare state factor included did not drastically change this relationship, which indicates that the results of the first phase estimations were not caused by the initially expected omitted variable bias. Instead, it appears as though the model is simply not a good fit for the large sample of 72 countries, indicating that perhaps the detrimental factors in determining income inequality might differ between OECD and non-OECD member countries. Additionally, estimating the extended model for the same sample of OECD countries whilst using a one period lag of all independent variables did not change the effect of bank-based financial development on income inequality either. Hence, the estimations seem rather robust. In fact, when using the lag of bank-based and market-based financial development, market-based financial development became significant as well, be it at a mere .1 level when included alongside bank-based financial development. This would suggest financial development, be it bank based or market based, has a delayed impact on income inequality. The reason that market-based development has a significant effect on income inequality only when using its lag might be that credit is available relatively fast whereas the accumulation of capital through the investment in stocks needs multiple years to take off and produce any noteworthy returns.

Based on the estimation results of both the first phase baseline model and the second phase extended model, it appears that there is indeed a non-linear U-shaped relationship between financial development and income inequality. However, the model has shown to be of a good fit for the OECD

countries only. Therefore, the hypothesized non-linear relationship between financial development and income inequality is accepted, but only when it comes to the members of the OECD. As already mentioned in the literature review (see section 2.2), an explanation for the widening of the income distribution would be the increased importance of capital during the last decades (as argued by Piketty). The creation of new financial products has made financial systems increasingly complicated, with the subprime crisis of 2007-2009 and the global recession that followed as its culmination. Afterwards, financial systems have become increasingly regulated. As a result, the importance of collateral, down payments, and a decent steady income have become more important. Whilst the poor often do not meet these criteria, having little capital and a low and/or insecure monthly income with little room for savings, they could have a difficult time in obtaining (bank) loans, even within well-developed financial markets. Therefore, their ability to engage in profitable opportunities (such as higher education) is hampered.

Whereas the hypothesized non-linear effect on income inequality is thus supported by the evidence, the hypothesized stronger positive effect of market-based financial development compared to bank-based financial development is not, and is therefore rejected. Even though market-based financial development seems to have a positive effect on income inequality based on the first phase estimations, this relationship did not hold when the sample size and period were reduced as a result of the inclusion of the welfare state factor. Furthermore, when using the one period lags of all independent variables, the upward effect of market-based financial development was weaker than that of bank-based financial development for the sample of OECD countries.

6.3 Place in the Current State of the Literature

Comparing these results with previous studies, they are similar to those found by Brei et al. (2018), who also found a U-shaped relationship between bank-based financial development and income inequality. However, the empirical analysis of this thesis does not provide convincing evidence for the U-shaped relationship Brei et al. found between market-based financial development and income inequality. Since Batuo et al. (2010) and Clarke et al. (2003) found a negative relationship between financial development and income inequality, the results are in line with their findings as well. However, they did not allow for a non-linear effect and it is questionable if their analysis would have shown an upward trend if they had done so, given that it would be based on older data. When it comes to the results found by Jauch & Watzka (2012), it seems as though their results suffered from the same issue as the first phase estimations of this thesis, since their coefficients had rather strange signs, and their model was rather weak in terms of explanatory power. A possible explanation for this is that they did not include several controls that have been proven to have an effect on income inequality such as globalization and education. Furthermore, their analysis included an even larger amount of countries, most of which the model simply might not have been a good fit for.

6.3 Policy Implications and Limitations

When it comes to policy implications, the results could be beneficial to policy makers within the governments or financial institutions of OECD members in their struggle against income inequality. Additionally, the results of the welfare state factor confirm the 'paradox of redistribution' as named by Korpi & Palme (1998), which means that it would be beneficial to opt for a universal social security system based on principles of equality. This would help to ensure a minimum income and disproportionally benefit the poorest of society, thereby narrowing the gap in the income distribution.

However, it has to be stated that this thesis does not come without its limitations. First of all, the findings are generalizable only to the OECD members, since the explanatory power of the first phase estimations was relatively low and their results contradictory to existing empirical evidence and literature. Nevertheless, the results could be useful to those countries that are affected the most by a worsening income distribution. With income inequality rising at a rapid pace in North America and Asia whilst growing at a moderate rate in Europe, it is primarily the OECD members that are affected. Furthermore, just as with any macroeconomic panel data studies, there is the issue of data availability. Most countries have gaps in their macroeconomic data, especially those with transitional or developing economies. However, even though it decreased the total amount of observations, the number of gaps has been reduced through the 5-year averages used to control for the cyclical effects of the economy. Finally, from a methodological point of view, there are some limitations to the fixed effects estimation method. As is stated by Hill et al. (2020), fixed effect estimations require a sufficient amount of variation in predictor variables. If not, this means that the variable is nearly constant and the estimator will perform poorly in predicting it since the observations are demeaned. As a result, the standard errors of these near constant variables can be inflated and their statistical power reduced. Even though the 5-year averages used in the estimations help to increase the variation between observations, the statistical power of the model might be affected because of this. Additionally, the time-invariant effects that are controlled for when using the fixed-effect estimator remain a 'black box' (Hill et al., 2020). Therefore, any analysis of the context of the finance-inequality relationship is not possible.

7. Conclusion

Over the last three decades, global income inequality between countries has decreased as Western Europe saw its economic growth decline whilst it went up in developing parts of the world. Within many countries, however, income inequality has been on the rise, be it with differences in magnitude. At the same time, there was a trend of growing financial development across the world, which several theories described in this thesis have tried to link to the growing income inequality within countries. Whilst previous empirical studies have found a negative relationship, there are those that have found evidence of a positive or U-shaped relationship. However, there are only a few studies that have distinguished between bank-based and market-based financial development.

Using a fixed effects analysis of panel data on 72 countries, only market-based financial development seems to affect income inequality, increasing the Gini coefficient as market-based financial development increases. Whilst this relationship is non-linear, it does not take on its expected form, since the positive effect of market-based development on income inequality decreases as it gets to higher levels. Additionally, the explanatory power of the model is relatively low when comparing it to the estimations of a reduced sample of 36 OECD countries with an additional control for the welfare state factor included. These reduced sample estimations also showed that the initial results of the larger sample are not robust to alternative measurement, since the effect of market-based financial development disappears. Instead, a non-linear U-shaped relationship is found between bank-based financial development and income inequality, with market-based financial development also showing a U-shaped relationship but not reaching statistical significance. Contrary to the larger sample, the results of this reduced sample of 36 OECD countries proved to be robust to alternative measurements. Thus, it can be concluded that for these 36 OECD countries, bank-based financial development has a U-shaped relationship with income inequality, narrowing the income distribution in the early stages of development whilst widening it after a certain threshold is reached. The additionally included welfare state factor showed a negative relationship with income inequality, indicating that a larger redistributive budget for social benefits to households would reduce income inequality.

If or when additional social security data becomes available, future studies could check the robustness of these results for OECD countries when looking at a longer period of time. Furthermore, they could include the welfare state factor when analyzing the larger sample of countries and see whether it impacts the results. Finally, it could be beneficial to refrain from lumping a large number of countries together and reducing the fit of the model, since the most detrimental factors in influencing income inequality might differ between OECD and non-OECD members.

Bibliography

Alvaredo, F., Chancel, L., Piketty, T., Saez, E., & Zucman, G. (2018). World Inequality Report 2018. In *World Inequality Lab*.

Banerjee, A. V., & Newman, A. F. (1993). Occupational choice and the process of development. *Journal of Political Economy*, *101*(2), 274–298.

Barro, R., & Lee, J.-W. (2013). A New Data Set of Educational Attainment in the World, 1950-2010. *Journal of Development Economics*, *104*, 184–198. http://www.barrolee.com/

Batuo, M. E., Guidi, F., & Mlambo, K. (2010). *Financial Development and Income Inequality: Evidence from African Countries* (No. 25658; MPRA Working Papers).

Beck, T. (2011). The Role of Finance in Economic Development: Benefits, Risks, and Politics. In *CentER Discussion Papers* (2011/141; CentER Discussion Papers).

Beck, T., Demirguc-kunt, A., & Levine, R. (2019). *Financial Structure Database*. The World Bank. https://www.worldbank.org/en/publication/gfdr/data/financial-structure-database

Beck, T., Demirgüç-Kunt, A., & Levine, R. (2000). A new database on the structure and development of the financial sector. *World Bank Economic Review*, *14*(3), 597–605.

Beck, T., Demirgüç-Kunt, A., & Levine, R. (2007). Finance, inequality and the poor. *Journal of Economic Growth*.

Brei, M., Ferri, G., & Gambacorta, L. (2018). Financial Structure and Income Inequality. In *BIS Working Papers* (No. 756; BIS Working Papers).

Clarke, G., Xu, L. C., & Zou, H. (2006). Finance and Income Inequality: What Do the Data Tell Us? *Southern Economic Journal*, *72*(3), 578–596.

Clarke, G., Xu, L. C., & Zou, H. F. (2003). Finance and income inequality: Test of alternative theories. In *Policy Research Working Paper* (No. 2984).

Cournede, B., Denk, O., & Hoeller, P. (2015). Finance and Inclusive Growth. In *OECD Economic Policy Papers* (No. 14; OECD Economic Policy Papers).

de Haan, J., Oosterloo, S., & Schoenmaker, D. (2018). *Financial Markets and Institutions - A European Perspective* (3rd ed.). Cambridge University Press.

Domanski, D., Scatigna, M., & Zabai, A. (2016). Wealth inequality and monetary policy. In *BIS Quarterly Review*.

Galor, O., & Zeira, J. (1993). Income Distribution and Macroeconomics. *The Review of Economic Studies*, *60*(1), 35–52.

Greenwood, J., & Jovanovic, B. (1990). Financial Development, Growth, and the Distribution of Income. *Journal of Political Economy*, *98*(5), 1076–1107.

Guiso, L., Haliassos, M., & Jappelli, T. (2003). Household stockholding in Europe: Where do we stand and where do we go? *Economic Policy*, *18*(36), 123–170.

Hill, T. D., Davis, A. P., Roos, J. M., & French, M. T. (2020). Limitations of Fixed-Effects Models for

Panel Data. *Sociological Perspectives*, *63*(3), 357–369.

İnam, B. (2019). Income Distribution in the World : Yesterday , Today , Tomorrow. *Saudi Journal of Economics and Finance*, *3*(10), 459–465.

Jauch, S., & Watzka, S. (2012). Financial development and income inequality: a panel data approach. In *CESifo Working papers* (No. 3687; CESifo Working Papers).

Kalara, N., & Zhang, L. (2018). *The changing landscape of firm financing in Europe, the United States and Japan* (No. 383; CPB Discussing Papers).

Korpi, W., & Palme, J. (1998). The paradox of redistribution and strategies of equality: welfare state institutions, inequality, and poverty in the Western countries. In *LIS Working Paper Series* (No. 174; LIS Working Paper Series).

Kuznets, S. (1955). Economic Growth and Income Inequality. *American Economic Review*, *45*(1), 1–28.

Levine, R. (1997). Financial Development and Economic Growth: Views and Agenda. *Journal of Economic Literature*, *35*(2), 688–726.

Lyubimov, I. (2017). Income inequality revisited 60 years later: Piketty vs Kuznets. *Russian Journal of Economics*, *3*(1), 42–53.

Maldonado, J. E. (2017). *Financial Systems and Income Inequality* (2017/36; Bruges European Economic Research Papers).

Marx, I., Nolan, B., & Olivera, J. (2014). The welfare state and antipoverty policy in rich countries. In *IZA Discussion Papers* (No. 8154; IZA Discussion Papers).

Obst, T. (2013). *Income inequality and the welfare state: How redistributive is the public sector?* (29/2013; Hochschule Für Wirtschaft Und Recht Working Papers).

OECD. (2020). OECD Data. In *OECD website*. Organisaton for Economic Co-operation and Development. https://data.oecd.org/

Ortiz, I., & Cummins, M. (2012). Global Inequality: Beyond the Bottom Billion – A Rapid Review of Income Distribution in 141 Countries. *SSRN Electronic Journal*.

Piketty, T. (2014). *Capital in the Twenty-First Century*. Harvard University Press.

Rajan, R. G., & Zingales, L. (2003). Banks and Markets: The Changing Character of European Finance. In *NBER working papers* (No. 9595; NBER Working Papers).

Solt, F. (2015). On the assessment and use of cross-national income inequality datasets. *Journal of Economic Inequality*, *13*(4), 683–691.

Solt, F. (2019). The Standardized World Income Inequality Database, Version 8. In *Harvard Dataverse* (Vol. 4, pp. 1183–1199).

Tan, H. B., & Law, S. H. (2012). Nonlinear dynamics of the finance-inequality nexus in developing countries. *Journal of Economic Inequality*, *10*(4), 551–563.

The World Bank. (2019). *World Development Indicators*. World DataBank. http://databank.worldbank.org/data/reports.aspx?source=2&type=metadata&series=SI.POV.GIN

I#advancedDownloadOptions

United Nations. (2020). World Economic Situation and Prospects 2020. In *United Nations.*

UNU-WIDER. (2019). *World Income Inequality Database (WIID)*. United Nations University.

https://www.wider.unu.edu/project/wiid-world-income-inequality-database

Woolridge, J. M. (2013). *Introductory Econometrics: A Modern Approach* (5th ed.). South-Western,

Cengage Learning.

Appendix

A. Hausman Specification Test

A popular alternative to the fixed effects estimator is the random effects estimator, which differs from the fixed effects estimator by making the additional assumption that the unobserved time invariant effects are uncorrelated with the explanatory variables. As mentioned in the methodological section, the fixed effects estimator is used since this additional assumption is expected to be violated. In order to formally check if the fixed effects estimator is preferred over the random effects estimator, the Hausman specification test is used (shown below). The Hausman test checks the null-hypothesis of no systematical difference between the coefficients produced by the fixed effects and random effects estimators. Rejection of this null-hypothesis therefore means that the key assumption of the random effects estimator is violated and the fixed effects estimator is preferred (Woolridge, 2013, p. 496). Since the test reports a Chi-squared value of 746.01 that is significant at the .05 level, the null-hypothesis is rejected and the use of the fixed effects estimator is justified.

```
                  ──── Coefficients ────
                    (b)          (B)          (b-B)      sqrt(diag(V_b-V_B))
                    fe           re          Difference         S.E.

    lnBCRgdp      -.1202815    -1.086607     .9663255             .
    lnBCRgdp2      .0346737     .2158323    -.1811586             .
    lnMKTgdp       .8951079     .8612788     .0338291             .
    lnMKTgdp2     -.0683573    -.0002201    -.0681372             .
    lnGDPcap       3.183285     8.349402    -5.166116             .
    lnGDPcap2     -.1237601    -.5856729     .4619127          .024252
    lntrade        1.312575     1.151229     .1613455             .
  lninflation      2.029751     1.909703     .1200481             .
    EDUCyears     -.4288271    -.2539417    -.1748854             .
    Industry      -.0940012    -.0829306    -.0110706             .

                 b = consistent under Ho and Ha; obtained from xtreg
          B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

            chi2(10) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                     =       746.01
         Prob>chi2 =       0.0000
         (V_b-V_B is not positive definite)
```

B. Pairwise Correlations

Variables	Gini	Private Cr.	Market Cap.	GDP p.c.	Trade Openness	Inflation Rate	Years of Education	Industrial Production	Social Security
Gini	1.000								
Private Cr.	-0.456	1.000							
Market Cap	-0.144	0.614	1.000						
GDP p.c.	-0.633	0.702	0.425	1.000					
Trade Openness	-0.173	0.365	0.280	0.293	1.000				
Inflation Rate	0.195	-0.350	-0.396	-0.175	-0.225	1.000			
Years of Education	-0.566	0.611	0.453	0.812	0.347	-0.194	1.000		
Industrial Production	0.132	0.035	-0.114	-0.021	-0.088	0.162	-0.038	1.000	
Social Security	-0.470	0.247	0.062	0.482	0.146	-0.276	0.228	-0.506	1.000

C. Variance Inflation Factors (VIFs) of independent variables

VIFs without welfare state factor excluded

Variable	VIF	1/VIF
lnGDPcap	3.91	0.255866
EDUCyears	3.14	0.318417
lnBCRgdp	2.62	0.382363
lnMKTgdp	1.79	0.557441
lninflation	1.27	0.785590
lntrade	1.21	0.824788
Industry	1.05	0.949030
Mean VIF	2.14	

VIFs with welfare state factor included

Variable	VIF	1/VIF
lnGDPcap	3.08	0.324719
lninflation	1.95	0.513638
EDUCyears	1.74	0.574975
lnBCRgdp	1.66	0.603991
SSEgdp	1.61	0.620566
Industry	1.51	0.663910
lnMKTgdp	1.39	0.717372
lntrade	1.25	0.803165
Mean VIF	1.77	

D. Country List

1. Australia	2. Austria
3. Bangladesh	4. Barbados
5. Belgium	6. Bolivia
7. Brazil	8. Bulgaria
9. Canada	10. Chile
11. China	12. Colombia
13. Costa Rica	14. Cote d'Ivoire
15. Cyprus	16. Czech Republic
17. Denmark	18. Dominican Republic
19. Ecuador	20. Egypt
21. Finland	22. France
23. Germany	24. Ghana
25. Greece	26. Guatemala
27. Honduras	28. Hong Kong
29. Hungary	30. India
31. Indonesia	32. Iran
33. Ireland	34. Italy
35. Jamaica	36. Japan
37. Jordan	38. Kenya
39. Korea	40. Luxembourg
41. Malawi	42. Malaysia
43. Mauritius	44. Mexico
45. Morocco	46. Nepal
47. Netherlands	48. New Zealand
49. Norway	50. Pakistan
51. Panama	52. Paraguay
53. Peru	54. Philippines
55. Poland	56. Portugal
57. Romania	58. Russia
59. South Africa	60. Spain
61. Sri Lanka	62. Sweden
63. Switzerland	64. Thailand
65. Tunisia	66. Turkey
67. Uganda	68. United Kingdom
69. United States	70. Uruguay
71. Venezuela	72. Zambia