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Authors: Linnea Englund Davidsson & Niclas Hvalgren
Supervisor: Stefan Eriksson

Income Inequality and Household Debt

A panel data study of 17 OECD-countries from 1995-2015
Abstract
This study explores the relationship between income inequality and household indebtedness using panel data on 17 OECD-countries over the time period 1995-2015. Motivated by relative income theory of consumption and previous empirical research we anticipate a non-monotonic relationship between changes in household debt and income inequality (measured by the Gini-coefficient), as dynamics between different groups of households in the income spread is expected to vary at different levels of inequality. Carrying out the empirical analysis we find notable indications of an inverse U-shape relationship between inequality levels and household borrowing. We locate an estimated turning point at a Gini-value of 28.84, which indicates a positive marginal effect on household borrowing as inequality grows from levels below this point, turning negative as inequality increases further. This suggests that as income inequality grows from relatively low levels households increase their rate of borrowing, while at higher levels of inequality households decrease their borrowing rate in response to growing income disparities. Results hold under a random effects model and a pooled OLS model, but fail to prove significant in the stricter fixed effects model, why we can not draw any definitive conclusions about the magnitude of the effect. Nevertheless, the findings of further complimentary estimations lend credence to our hypothesis. Benefits and limitations of our data and empirical methods are comprehensively discussed, as well as the theoretical mechanisms explaining the relationship. Indicative but in the end inconclusive results leaves ample opportunity for further investigations with more advanced empirical methods.

Keywords: Household debt, Income inequality, Reference consumption, Relative income hypothesis of consumption, Panel data analysis, OECD, Advanced economies

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1 Introduction

Since the early 1980’s, there has been a widespread trend across developed countries of rising income inequality. In many economies this development was accompanied by a substantial rise of consumer indebtedness. This parallel pattern (while rather obvious in national accounts data) did not gain much attention until recent years and especially following the Great Recession. The economic meltdown of 2008, at the time unforeseen by most in both academia and in business, spurred some economists to look beyond traditional theory on household behavior and seek explanations in the immense structural changes of unprecedented growth in income disparities in advanced economies the past decades (e.g. van Treeck, 2014; or Stockhammer, 2012). Hence, a growing body of literature exploring the relationship between growing income inequality and macroeconomic outcomes emerged. Several economists have focused on income inequality’s impact on growth (e.g. Lucchino and Morelli, 2012), aggregate saving and consumption (Kim et al., 2014), consumption inequality (e.g. Krueger and Perri, 2006) and financial instability (e.g. Wisman, 2013; Russo et al., 2016), and a few have specifically focused on uncovering its impact on household debt levels (e.g. Cynamon and Fazzari, 2013 or Klein, 2015).

Nevertheless, there are still blank spots to be filled, and we believe that there is ample merit in further study. In an attempt to contribute to this growing body of research and bring further clarity to the field of study, this paper will use empirical analysis methods to explore to what extent the long-term rise of income inequality have impacted the coincidental rise of household indebtedness. The empirical analysis approach is also the main contribution and merit of this paper, given that many studies on the same topic have focused primarily on descriptive data analysis. Specifically, in this thesis we will ask and attempt to answer the following research question: What has been the effect of rising income inequality on household indebtedness in OECD countries over the time period 1995-2015?

Empirical research on the relationship between income inequality and household debt is arguably highly relevant for several reasons. Previously unmatched increases in debt preceded the 2008 recession (Cynamon and Fazzari, 2008) and the subprime mortgage crisis that set the events of the recession in motion was caused by an overextension of credit to households (Demyanyk and van Hemert, 2011). Understanding the contributing factors to debt is therefore critical to understanding macroeconomic risks and instability. The link between debt and inequality also carries real implications for the fields of macroeconomics and political economy (e.g. growth and aggregate consumption) and for testing microeconomic theorems and hypotheses.
An empirical link between income inequality and households’ propensity to consume (and save/borrow) would have important implications for the dominating neoclassical theories explaining household consumption, saving and borrowing decisions. In particular, this would inevitably call the conventional life-cycle and permanent income theory of consumption into question (see for example Kim et al., 2014 and Frank et al., 2014). Given that neoclassical theory has been rejected in several studies due to its insufficient ability to describe household behavior in the past decade (e.g. Kim et al., 2014; Cynamon and Fazzari, 2013; Barba and Pivetti, 2009), this paper continues in the same path of this existing body of research and relies on alternative theoretical explanations.

Such a theoretical framework can be found in the relative income theory of consumption (Duesenberry, 1949), which has experienced a renaissance after having received empirical support in several recent studies (see Frank et al., 2014; König and Größl, 2014; van Treeck, 2014; Carr and Jayadev, 2015; Bertrand and Morse, 2016). Duesenberry’s model acknowledges that households’ consumption and savings decisions is based not only on a rational consideration of the current and future economic situation, but also on a relative perceived social standard (a “keeping up with the Joneses”-effect) and historical levels of living standards. Under this approach, household consumption is expected to be relatively more inelastic in regards to changes in inequality than income - that is, as relative income falls, relative consumption does not fall to match the decrease in income. Notably, these theoretical predictions have found convincing support in empirical studies (Krueger and Perri, 2006; Boushey and Weller, 2006).

Hence we find ourselves, in line with what has been proposed by other prominent studies on the subject (e.g. see Barba and Pivetti, 2009; Stockhammer, 2012; Fazzari and Cynamon, 2013; Kim et al., 2014; Carr and Jayadev, 2015), arriving at the hypothesis that the rise of household debt has developed at least partially as a result of low- and middle-income households (in an effort to maintain their relative standard of consumption) compensating for stagnating wages and growing inequality by incurring debt. Naturally, economists are not in full consensus on the issue. Some economist are more prone to rely on supply-side explanations of the rising household debt, leaving the rise of income inequality out of the equation. Examples include Debelle (2004), who identify low interest rates and increased credit accessibility as key factors, and Dynan and Kohn (2007), who ascribe the development mainly to demographic shift, increases in house prices and financial innovation. While these studies are not theoretically relevant given the relative income theory approach that will be employed in this paper, they can provide valuable guidance to what other factors may be key drivers of household debt, for which we need to control.
In this paper we conduct a panel data study employing the Gini-coefficient (Solt, 2016) and OECD-data (2017) on household debt-to-income ratios to investigate their relationship in 17 advanced economies over a time period from 1995-2015. In our empirical analysis we find indications of a non-monotonic relationship between the Gini-coefficient and the change in the debt-to-income ratio ($\Delta Debt$), suggesting that households, on average, tend to increase their rate of borrowing when inequality increases from lower levels while decreasing their rate of borrowing at higher levels of inequality. The relationship holds under the random effects and the pooled OLS model, but fails to be significant in the fixed effects specifications, which deters us from drawing any definitive conclusions based on the empirical findings. Nevertheless, the results give some clues about the impact of income inequality on household debt, which are interesting both for the discussion of theoretical mechanisms and implications as well as for topics for future research. Furthermore, we also conduct alternative specifications using data on net household financial transactions and the household savings rate respectively, as an additional heterogeneity control to our main analysis.

The following part of this thesis is organized as follows: In section 2 we provide a theoretical background followed by a more thorough review of previous empirical literature in this field of research in section 3. This leads up to an introduction of methodology in section 4, in which we discuss the limitations and properties of the data at hand as well as of the models employed. We arrive at a baseline specification for regressing inequality on change in household debt-to-income ratios, and present the corresponding baseline specification of our alternative dependent variables. The result section, number 5, summarizes key findings and various tests of robustness. Lastly, in section 6 we discuss the implications and limitations of the results of our empirical analysis followed by some recommendations for future research. Section 7, conclusions, provides a summary of the central findings of this thesis.
2 Theoretical framework

The theoretical link between income inequality, household consumption and debt behavior is neither clear cut nor inconclusive. Inequality has in the last few decades quickly emerged from the periphery of economic research to having become a prioritized research topic; however, literature on debt behavior and inequality is still somewhat scarce. In existing economic research borrowing is often treated more or less as equivalent to negative saving: implications of theories regarding savings, as well as consumption, are often considered and utilized interchangeably when studying debt behavior and inequality (e.g. Barba and Pivetti, 2009; Cynamon and Fazzari, 2013 or Kim et al. 2014). It is important to acknowledge, however, that household savings is not the perfect mirror-image of household debt: households may borrow and save simultaneously, and increasing savings may necessarily not lead to decreasing levels of debt, or vice-versa. Still, due to the lack of comprehensive empirical research on household debt, going forward we will consider theoretical implications of household saving behavior as applicable also to household debt behavior, nevertheless, keeping the distinction between (negative) savings and debt in mind.

Conventionally, Friedman’s (1957) permanent income theory followed by the life-cycle hypothesis (put forward by Modigliani 1970), have dominated theoretical frameworks regarding individual consumption behavior in much of modern economic analysis. According to such neoclassical models, economic agents (households) are rational and forward-looking, basing their consumption and saving decisions independently of other factors than changes in their own permanent income. Incurring debt, under these assumptions, is simply a mechanism for households to ‘smooth out’ consumption and maximize their utility over the life cycle - in response to temporary changes in income. Accordingly, in this view, households would not borrow in response to any permanent changes in their income. Furthermore, income distribution, social standards and relative consumption levels would affect neither consumption and savings nor the borrowing decisions of households. Consequently, in such orthodox lines of reasoning, the rise in household debt over the past 35 years would first and foremost be explained by supply-side changes in credit-accessibility, financial liberalization and easing of liquidity constraints having simply extended the opportunity of households to borrow in order to achieve a smoother consumption path over the life-cycle (Barba and Pivetti, 2009).

The permanent income and life-cycle theories have doubtlessly been employed successfully in much economic research. Over the past two decades, however, it has proven rather toothless in its ability to explain households’ behavior in advanced economies, with skyrocketing debt levels. Several recent studies on the evolution of household saving, consumption and borrowing behavior have subsequently rejected the permanent income/life
cycle framework in favor of alternative models, which allow for relative income factors and social positioning to influence household behavior (see e.g. Krueger and Perri, 2006; Kumhof and Rancière, 2010; Barba and Pivetti, 2009; Frank et al., 2014; van Treeck, 2014; Scheuermeyer and Bofinger, 2016). This paper will continue in the spirit of such researchers and employ alternative theoretical approaches in exploring the key drivers behind growing household indebtedness.

Hence, in exploring the link between income inequality and household indebtedness, we rely on the key idea that relative standards of income and positional consumption play a part in economic agents’ (households’) decision making. This is an idea that can be traced all the way back to the end of the 19th century (see Veblen, 1899). Duesenberry (1949) developed and formalized a theoretical framework of a relative income theory of consumption, which ever since has been a pivotal work of reference for all researchers that have sought to include relative positioning in economic models. In the simplest terms, the model maintains that the relative position of an individual in the income distribution is a greater determinant of one’s attitude to consumption and saving than the absolute level of one’s income and abstract standard of living, i.e. households strive to preserve not only an absolute, but also a relative consumption standard. Indeed, Duesenberry found support for his theory in his study of consumption behavior during the Great Depression. Families that struggled to keep up with both their past level of consumption, and with the consumption of their peers, were found to have reduced savings and even incurred debt in order not to fall behind (Barba and Pivetti, 2009).

Moreover, Duesenberry identified two key dynamics in this process, on which we will expand a little bit further upon. On the one hand, the “demonstration effect”, stating that the frequency of interaction with people with relatively higher income and consumption levels than one’s own (and higher social position) positively impacts the impulse to increase spending. This is the fundamental idea behind the emulation motive, the continuous strive for a higher standard of living to keep up with peers and maintain social recognition, today often referred to as to “keep up with the Joneses”. On the other hand, he stressed the impact of the relative relation between present and past incomes on current consumption, a “habit formation effect”. Consumption habits formed over time are relatively rigid as individuals become accustomed to a certain standard and generally seek to avoid retrenchments of the level of consumption they have attained (Barba and Pivetti, 2009).

On the topic of habits’ influence on consumption, it is also relevant to highlight the habit persistence theory (Brown, 1952). In line with Duesenberry, he theorized a lag in household’s consumption behavior when real incomes deteriorate, as they seek to maintain the level of consumption they are accustomed to. This would be achieved by a decline in savings. If
households are used to continuous improvements in living standards, the theory of habit persistence could also imply lower saving rates in response to stagnating income growth.

A recently developed descendant of Duesenberry’s relative income theory of consumption is the expenditure cascades hypothesis, put forward in a paper by Frank et al. (2014). This model incorporates the link between context and evaluation, i.e. the idea that relative income and social positioning matters to households, which has been well-documented and widely recognized by behavioral economists, although often neglected in neoclassical frameworks. In the words of the authors: “In its simplest form, the expenditure cascade hypothesis is that increasing income inequality within any reference groups leads to a reduction in the average savings rate for that group.” (Frank et al., 2014, p. 62). According to this view, it was the growth of inequality [in the United States] that catalyzed the decline in savings by spawning a chain reaction of expenditures as the increase in consumption by top-income household led to an increase in spending by households just below them on the income scale, followed by an increase below them, and so on.

Notably, there is another theoretical mechanism through which income inequality could impact household debt. Krueger and Perri (2006), building on a calibrated general equilibrium model, showed that an increase in the variance of idiosyncratic labor income fluctuations (which they viewed as a rise in within-group inequality) would generate a rise in demand from households for insurance through credit markets. Essentially, the idea is that as steady incomes become more uncertain and volatile, in the wake of growing inequality, people take on debt as an insurance for their consumption standard. Although this view of the mechanism on how inequality drives household debt is slightly different, its main predictions remain in line with the hypotheses proposed from relative income theories.

Keynes (1936, 1939) suggested, as he introduced the idea of the marginal propensity to save [and consume], that richer households would have a higher propensity to save than those in the lower end of the income distribution. Keynes hypothesized that an increase in income inequality, shifting more income to higher income households, should increase the aggregate propensity to save and cause a drag on aggregate demand and a surge in the aggregate savings rate. On the contrary, if the effect of lower-and middle-households engaging in upward-looking comparison - increasing their consumption and lowering their savings in order to keep up with the Joneses - dominates as income inequality rise, the aggregate saving rate may in fact decline (Frank, et al., 2014). Given these two potential opposing effects, the link between income distribution and aggregate household savings is inconclusive. This has implications for household borrow as well, assuming that debt behavior more or less can be explained by corresponding mechanisms. As it is unclear which effects dominates at different levels of inequality, we predict
that an ambiguous and possibly non-linear relationship could exist between income distribution and household debt.

For the theoretical framework of this thesis, we will draw on the simple relative income consumption model as proposed by Frank et al. (2014).

\[ C_i = k(1 - a)Y_i + aC_{i+1} \]  

In this simple but intuitive model, \( C_i \) and \( Y_i \) denote current consumption and permanent income levels of the \( i \)th individual respectively. \( C_{i+1} \) denotes the current level of consumption for the individual who ranks just above the \( i \)th individual in the income distribution, hence introducing a relative income factor into the model. The parameter \( a (0 \leq a \leq 1) \) captures the extent to which an individual's consumption is influenced by that of the individual one step up on the income ladder. Hence, \( a = 0 \) is the same as the permanent income hypothesis, the spending of others having no influence at all on the consumption of the \( i \)th individual, whereas \( a = 1 \) is the other extreme, when an individual's consumption is entirely determined by the standard of the individual whose income outranks his or her own. Accordingly, the model captures two of the most recognized findings from the field of behavioral economics: firstly, that the closer the subject of comparison are to an individual in space and time, the more influence such comparisons exerts; and secondly, people in general compare themselves to those above them on the income ladder rather than those below (Frank et al., 2014).

In summary, the theoretical approach laid out in this section acknowledges that households' consumption, saving and consequently borrowing decisions are based not only on rational considerations of the current and future economic situation, but also on perceived relative social standards (the 'keeping up with the Joneses'-effect) and historical standards of living. Furthermore, it suggests that as inequality rises, households in different income groups may well engage in consumption, saving and debt behavior with effects in opposite directions. Subsequently the aggregate effect of income inequality on debt cannot be clearly predicted by theory, however, it does suggest a relationship that is likely to be nonlinear and unstable, changing in direction and magnitude depending on the level of inequality.
3 Survey of empirical literature

A number of previous studies have focused on the effect of income inequality on household consumption and saving behavior, but fewer have explicitly investigated the link between inequality and debt. As household debt behavior is undeniably related to both savings and consumption (as discussed in the previous section), although not perfectly predicted by either, empirical findings from studies of these elements of household behavior should provide valuable insights to our understanding of household borrowing. Hence, the following survey of the empirical literature presents a comprehensive overview not only of the link between income inequality and debt, but related findings on inequality and savings and consumption too.

A highly cited study by Dynan et al. (2004), employing US panel data, finds strong evidence in support that household income has a positive impact on saving rates, suggesting that relatively richer households indeed have a higher marginal propensity to save. This supports the theory that saving behavior is dependent on households’ relative position on the income ladder, and allows for the possibility that savings behavior across different income groups may move directions. A potential dynamic of such opposing effects is explored by Cynamon and Fazzari (2013), who investigate income inequality as an underlying driver of the substantial decline in the US household aggregate savings since the early 1980’s. Decomposing household groups across the income distribution they find that, although the savings rate among the top 5 percent in the income distribution rose, it plummeted among the bottom 95 percent, which came to dominate the aggregate rate. Furthermore, Cynamon and Fazzari note that this development coincided with an unprecedented increase in household demand, greater than the corresponding fall in savings. They find the explanation in a historic surge in household debt of the bottom 95 percent of the income distribution, who went on an “extended borrowing binge” to finance increasing consumption in response to stagnating incomes.

While Cynamon and Fazzari do not focus on the theoretical mechanism behind this development, several recent studies have put the relative income theory of consumption to the test. Bertrand and Morse (2016) find robust evidence that exposure to relatively higher income households’ consumption and living standards generates an increase in consumption in relatively lower income households. In particular, they show that a 10 percent increase in consumption in the 80th percentile is associated with a 3 percent increase in the consumption of households below this reference group in the income distribution, holding income and other factors of the lower income household constant. Correspondingly, Drechsel-Grau and Schmid (2014) address the same issue in a German setting, and provide evidence that this effect is not restricted to one side of the Atlantic. In fact, they find strikingly similar results, estimating that a 1 percent rise in spending by the reference group, with relatively high income, leads to a 0.3
percent rise in household consumption. The key finding in this study is the upward-looking comparisons effect, labeled “keeping-up-with-richer-Joneses” in their paper, which establishes the hypothesized link between income inequality, household consumption and saving behavior.

Carr and Jayadev (2015) conduct a panel data study in the same spirit examining the patterns of household indebtedness in the US in the period leading up to the Great Recession and its immediate aftermath (1999-2009), with a theoretical framework based on relative income theory. They find that while debt leveraging increased across all households it increased most extensively in lower income groups. Furthermore, they find evidence for “Veblen effects” - traditionally meaning that consumers have desire for conspicuous consumption, it suggests that an economic agent’s spending and savings decisions are influenced by a reference group. In the case of Carr and Jayadev, leverage grew at a faster pace for households with lower income compared to others within their state or demographic group.

Other noteworthy studies that have rejected the permanent income and life-cycle hypothesis but found empirical results congruent with relative income theories are for example Kim et al. (2014), who investigate household debt accumulation, and Ryoo et al. (2014), who investigate how income inequality affect workers’ debt accumulation. Ryoo et al. combine the fundamental assumption of the Kaldorian theory of income distribution, that the propensity to save out of profits is greater than that of wages, with the Veblenian idea of consumption emulation, and find that workers rely on debt financing to maintain desired consumption levels. Their analysis identifies such debt-consumption dynamics as a source of instability and present evidence that this effect is more likely to occur when banks’ credit restrictions are more lenient.

In this context, Frank et al., (2014) should also be mentioned for their contribution in the empirical field as well through their test of the “Expenditure Cascades” hypothesis (discussed in section 2). Using data from all 50 of the US states and the 100 most populous counties, they find evidence for positional externalities of consumption, which suggests that a visible rise in consumption by a reference group triggers an “expenditure cascade” in the group directly below them on the income ladder.

Barba and Pivetti (2009) extend the perspective and explore the long-term causes and macroeconomic implications of rising household debt, focusing on the US economy. Essentially, they suggest that the rise of household debt should be viewed as a substitute for both higher wages (as wages have generally not kept up with productivity growth) and public debt levels, amplified by financial deregulation. Hence, the growth of borrowing in the US economy from the early 1980’s can be largely interpreted as debt-financing of consumption for households that have seen their incomes relatively deteriorate. They stress the idea of household consumption levels being relatively more inelastic than incomes, which can be attributed to the “keeping up with the Joneses” effect as households strive to maintain a relative standard of living. In fact, the
relative inelasticity of consumption inequality through the rise of income inequality has empirically been proven by Krueger and Perri (2006), who show that the rise of income inequality in the US has not been accompanied by a proportional increase in consumption inequality.

Barba and Pivetti (2009) explain the rationale behind understanding household debt by comparing its dynamics to those of public debt in relation to GDP. Hence, they argue that the crucial determinant is the difference between the interest rate \( i \) and the rate of income growth \( w \). For an indebted household, the debt-to-income ratio will continue to rise as long as \( i > w \), given their level of consumption remains stable. Hence, households will not lower their debt-to-income ratios unless they decrease consumption relative to their disposable income. This implies that reducing debt-to-income ratios will require a larger reduction in consumption (in relation to disposable income) the larger the difference between \( i \) and \( w \) and the larger the current debt-to-income level. It suggests that indebted households’ ability to service debt will eventually reach an upper bound, and that a substitution of debt for wages cannot go on indefinitely. Indebtedness will therefore eventually reach some kind of breaking point.

While Barba and Pivetti (2009) mainly relies on analysis of descriptive data from the United States solely, Klein (2015) conducts an empirical analysis employing an unbalanced panel data set covering nine industrialized countries over the time period 1953-2008.\(^1\) Using panel data cointegration techniques and testing different measures of inequality, the author finds that there is a robust long-run relationship between income inequality and household debt. He estimates that a 1 percentage point increase in inequality corresponds to an increase in household debt by 2-6 percent, depending on inequality measure employed.

Schuermeyer and Bofinger (2016) conduct a panel data study analyzing the experience of 29 OECD countries over a time period stretching from 1961 to 2013 (although with a very unbalanced panel), exploring the relationship between the income distribution and household saving. Testing various econometric approaches, they identify a statistically significant inverted U- or hump-shaped relationship between the income Gini coefficient and the household savings rate with a turning point around a Gini coefficient of 0.28-0.30. This suggests that at a low level of income inequality a rise in inequality corresponds with a higher aggregate household savings rate, whereas an increase in income inequality starting from a higher inequality level is associated with a fall in aggregate savings.

The theoretical rationale behind this is that the aggregate savings rate would initially be dominated by the increasing income share of richer households with a higher propensity to save (in line with ideas of Keynes), but when income disparities become larger and more visible, relative income theory of consumption and “Veblen effects” suggest that lower- and middle-

\(^1\) Australia, Canada, France, Italy, Japan, Norway, Sweden, United Kingdom and the United States.
income households would lower their savings in order to keep up with the rising consumption levels of households above them. The turning point located by the writers would be the point where this downward effect on aggregate savings from lower-income households overtakes the upward one from higher-income households. Furthermore, the study finds that the relationship between income inequality and savings is dependent on the level of financial market deregulation and credit availability, with more market liberalization increasing the impact on savings from rising inequality, and more restrictions having the opposite effect.

Altogether, while acknowledging supply-side explanations’ and conventional life-cycle theory’s meaningful (although not comprehensive) contributions to explaining the rise of household debt, the empirical body of literature presented provides evidence that the full picture can only be explained by taking into consideration relative income theory and the structural shifts in the income distribution of the past few decades. While empirical findings support the predictions of relative income theory, one of the drawbacks is that it does not provide any conclusive implications for how income inequality should affect aggregate debt levels, as it is indeed relative and will depend on historical and current contexts. Furthermore, one of the limitations of the existing literature is that many studies have focused on one or a few countries. With this paper, we aim to contribute to this field of research by bringing clarity to the relationship between inequality and debt drawing on the experience of 17 countries.
4 Data and empirical method

In order to explore the link between income inequality and household debt, we estimate a model with the change in the household debt-to-income ratio ($\Delta Debt$) each year as our dependent variable and the Gini-coefficient, our measure of inequality, as the explanatory variable. Estimating the relationship, we draw on theory and empirical findings that have both direct and indirect implications for our subject of study. This section is organized as follows: first we give a thorough description of the data, discuss each variable individually, followed by a motivation of the empirical methods employed in this study and finally we explain our baseline and alternative specifications.

4.1 Data

Since the parallel rise in income inequality and household debt is primarily a dynamic experienced by advanced economies in the late 20th century and forward, our paper is limited to the study of such countries. This is in line with previous studies in this field (including all papers referenced throughout this thesis). Furthermore there are a few other compelling reasons to focus solely on developed countries. There is an undeniable practical advantage in the fact that statistical agencies and international organizations publish comprehensive and reliable statistical data on most of them. Secondly, as the ability of households to incur debt depends on the economy’s capability of consistently providing households with credit, the analysis should arguably be limited to economies with banks and credit markets solid enough to consistently provide such loans.

The empirical analysis in this paper is based on data from a limited number of countries in the OECD-club of developed economies. Specifically, we have constructed a dataset of 357 observations from 17 countries over a time period stretching from 1995-2015, the selection of which we will discuss shortly. Regarding the time period, a longer panel, stretching back to the 1980’s when both the rise of income inequality and household debt started taking off, would have been preferable. Unfortunately, household debt-to-income data (our dependent variable) for most countries is only available from 1995. Given our ambition to have a balanced dataset, this is a practical limitation which we believe to be, although not ideal, still acceptable.

Out of the 35 OECD-member countries half have been excluded in the final dataset, due to various reasons. Some have been dropped due to divergent economic characteristics, such as Mexico, Chile, Hungary and Turkey, whom although part of the OECD does not share the economic fundamentals of most developed countries (e.g. levels of education, income and GDP per capita) and thus may potentially have distorted the analysis. Other countries have been
excluded as they were found to lack data for large periods of time or to have substantial gaps in the data available.²

In a few other cases, we had missing data for some variables for one or a few years in the very beginning or end of our data set. This was the case of Spain and Switzerland, which both had a lack of data on debt-to-income ratios for 1995-1999, however, we decide to keep these countries as the remaining 16 years with complete observations should still provide some valuable insight. In the case of missing control variable observations, of which there is little, we have circumvented the issue either by manually filling in the gap by extrapolating a trend estimate or by allowing the data program (STATA) to do so.³ All in all, we have a highly balanced final data set consisting of 17 nations: Australia (AUS), Austria (AUT), Belgium (BEL), Canada (CAN), Finland (FIN), France (FRA), Germany (DEU), Greece (GRC), Italy (ITA), Japan (JPN), Netherlands (NLD), Norway (NOR), Spain (ESP), Sweden (SWE), Switzerland (CHE), the United Kingdom (GBR) and the United States (USA). In the following sections we present the data we have employed to conduct the statistical analysis and discuss the properties and limitations of each individual variable.

4.1.1 Dependent variable(s)

Household Indebtedness

The dependent variable and target of the study is household indebtedness, or specifically the household debt-to-income ratio which is the statistic we employ in our empirical analysis. The data on household debt-to-income ratios in our countries of study is retrieved from the OECD National Accounts database (2017). It is calculated as average household liabilities (requiring repayment) divided by average net disposable income per country. Liabilities mainly include loans, of which in particular mortgages make up a large part for households, financial securities other than shares, and various other accounts, as defined by the 1993 UN System of National Accounts (OECD 2017). The measure is constructed as an index where 100 points equals a 1:1 ratio of household liabilities to net disposable income. An increase in our variable by one as such implies an increase in the ratio between indebtedness and income by 1 percentage point, for an average household.

The goal of this study is to estimate how household debt behavior changes in response to changes in income inequality. The data provided by the OECD is a straightforward and

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² Czech Republic, Estonia, Latvia, Poland, Slovakia, South Korea and Chile are excluded due to such insufficiencies, as they all have substantial gaps in data, with one or more variables missing for large periods in the late 1990’s and early 2000’s.

³ This is performed only for Greece. We manually extrapolate a trend estimate to replace missing data on real house prices for the years 1995-1997. In the case of Austria, which lacks data on the same variable from 1995-2000, STATA automatically resolves the using the command “mi xtset” panel data command.
presumably suitable measure of debt for this purpose; it captures indebtedness for each country relative to disposable income, meaning that it is generalizable across countries with different levels of income. Dividing debt by income also removes inflation which would affect nominal debt levels, enabling comparisons over time. The division by disposable income is also conducive to the purpose of the study, as it eliminates tax levels as a factor that could otherwise influence results.

The household debt-to-income ratio is a valid measure for the purposes, nonetheless there is some critique and drawbacks that should be kept in mind. The variable does not account for assets, which is the counterpart to debt, and as individuals may have assets that weigh up their liabilities this might give a skewed picture. Consequently it gives no indication on household debt-servicing ability nor information regarding the cost of borrowing. Hypothetically, a high debt-to-income ratio with a low debt-service cost may be less of an issue than a relatively low debt-to-income ratio with high costs. Nevertheless, as debt-services costs are closely correlated to interest rates higher debt-to-income levels should still make households more exposed to risk of default as they will be more affected by changes in interest rates, increasing costs for debt service. Hence there is reason to believe that higher debt-to-income levels, i.e. higher leveraging, makes households more vulnerable to macroeconomic shocks, which has implications for the financial stability of the economy on a macro level (see eg. Stockhammer, 2012; van Treeck, 2014).

Another limitation of the household debt-to-income statistic is that it is an aggregate measure from national accounts, and as such cannot account for any potential differences in levels of indebtedness between high and low-income households. As previously discussed in section 2, theory suggests that the consumption, saving and borrowing patterns of households in different positions on the income ladder may exhibit behaviors that go in opposite directions. It would be desirable to disaggregate household debt data and analyze how borrowing and saving decisions of households change as inequality rises, dependent on their place in the income distribution. Such data, however, is not available to us at the time of performing this study and we can only observe the net changes in aggregate data for all households.

Finally, the fact that the debt-to-income ratio is a statistic that compares a balancing item (accumulated debt) to a flow variable (income) could complicate statistical interpretation and inference, especially considering that absolute levels of the variable vary substantially across countries. As we are interested primarily in the relative effect of income inequality on household borrowing behavior it does not make much sense to analyze the absolute debt-to-income levels at different levels of inequality. We solve this issue by transforming the debt measure, constructing our final form of the dependent variable by differentiating the debt-to-
income ratio for each year. This allows us not only to capture the actual change in household borrowing behavior which we seek to estimate, but also to avoid any risks of spurious regressions as household debt-to-income ratios quite clearly displays an upward trend. The variable of the change in debt-to-income ratio is denoted ‘ΔDebt’.

Figure 1: Household debt-to-income ratios from 1995-2015

Alternative dependent variable - Household financial transactions

In addition to our main measure of household debt behavior, we also employ an alternative measure of the tendency of households to incur debt - Net household financial transactions, which is denoted ‘Transactions’. Data on this variable is collected from and published by the OECD National Accounts Database (OECD 2017) and covers all countries for almost the entire time period, with three countries missing 5 or less observations. Household financial transactions is the difference between net acquisition of financial assets and net increase in liabilities incurred by households over a year, divided by net disposable income. Like the debt-to-income ratio the household financial transactions ratio is indexed on a scale of 0-100, making it appropriate for comparisons across countries and over time.

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4 The new variable is defined as the year-on-year change in household debt-to-income ratio, calculated by subtracting the debt-to-income ratio of the previous year on the current.
For clarification, a negative financial transactions measure implies that households are incurring more debt than they are putting away in savings (i.e. that they have negative net savings that year) and conversely a positive financial transactions measure indicates net positive savings. It is important to note that a net positive household account does not necessarily imply a decrease in absolute debt levels for a household, but merely that savings are greater than the incurrence of debt that given year. Households may thus have a positive household financial transactions statistic while still accumulating more debt (and vice versa).

The benefit of using household financial transactions as a measure of household borrowing behavior is that it, in contrast to the debt-to-income ratio, accounts for the positive flows of households accumulating assets as well, which may give a more balanced picture. As household financial transactions is a measure that is related to household debt-to-income ratio, although as stated not its counterpart, we should expect the pattern of household financial transactions’ response to changes in income inequality to be roughly similar to the inverse relationship between ΔDebt and income inequality.

**Alternative dependent variable - Aggregate household savings**

In order to further test our method and corroborate our main results we use a third dependent variable, aggregate net household savings, simply denoted ‘savings’ in this paper, whose relationship to income inequality has been investigated in the previous literature (e.g. Scheuermeyer and Bofinger, 2016). By replicating earlier investigations (in the sense that we employ the same dependent variable) we aim to gain further understanding for the mechanisms driving household borrowing behavior in the context of rising income inequality. The data is collected from the OECD National Accounts database and covers all countries for the entire time period. The net household savings metric is defined as the subtraction of consumption expenditure from disposable income, together with the net change in household pension funds, divided by household disposable income. Again, the variable is indexed from 0-100 and generalizable across countries and time.

It should be noted that the household net savings measure is neither a perfect counterpart to household debt nor follows the same pattern as household financial transactions (for comparisons see figure 1, A:1 and A:2). While net savings have, in general, been positive for all countries over the time period from 1995-2015, household debt-to-income ratios have simultaneously risen dramatically and financial transactions have fluctuated over time and across countries.
4.1.2 Main independent variable

Income inequality

There is not one but a whole range of methods to measure inequality, each with different strengths and weaknesses, which we discuss below. In this paper we use the Gini-coefficient as our measure of income inequality and employ it as the main independent variable in the empirical analysis. The Gini-coefficient is the most widely collected and referenced statistic of income and wealth inequality. Based on the Lorenz curve, which represents the distribution of income in percent accumulated across percentiles in the population ranked from the poorest to richest, the Gini-coefficient is computed as the ratio of the area between a 45 degree line (representing perfect equality) and the Lorenz curve divided by the whole area beneath the 45-degree line. Ranging on a scale from 0-1, where a higher number indicates less inequality, it provides a simple, useful and comparable measure of inequality (United Nations, 2015).

Nonetheless, there are some limitations to the Gini-coefficient which are necessary to take into consideration. It is not additive nor decomposable, and an often mentioned critique is that it is relatively insensitive to changes at the top and the bottom of the income distribution compared to its response to changes in the middle section. Hence, the Gini gives no information of within-or between group inequality in populations and may underestimate income transfers between high and low earners in the tails of the income distribution (United Nations, 2015).

We have chosen to disregard some alternative measures of inequality due to their complexity, making them difficult to employ and interpret in the context of an empirical regression analysis.\(^5\) Other measures, such as decile dispersion ratios, including the commonly used D9/D1 and the D9/D5 as well as the more recently developed Palma ratio or the 20:20 ratio, would arguably have been relevant alternatives to the Gini coefficient as they more comprehensively capture redistribution of income between key groups, especially at the top and bottom of the income spread\(^6\) (United Nations, 2015). Unfortunately, lack of comprehensive data, both in width and depth, restrains us from using such alternative measures in this paper and thus we employ only the Gini-coefficient for our empirical analysis, keeping in mind its limitations.

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\(^5\) Examples of such measures is the Atkinson’s inequality measure (or index) which builds on a theoretical parameter of the degree of aversion to inequality in a society, making it rather abstract, the Hoover index that captures the share of total income that would have to be redistributed to reach perfect equality, and lastly the Theil index and General Entropy measures, which is rather complex and most useful in situations when you have data that can be disaggregated and compared between groups.

\(^6\) D9/D1 and the D9/D1 simply measure the ratio of the income of the richest 10 percent in the population to that of the bottom 10 percent in the first case and to that of the bottom 50 percent in the latter case. The Palma ratio is the national income share of the top 10 percent of households over that of the bottom 40 percent, it is designed to give more weight to the fact that most of the redistribution of income happens in the tails of the income distribution as inequality grows (Palma, 2011). The 20:20, similarly, is the ratio of the average income of the top 20 percent in the income spread to the bottom 20 percent, and is the measure used in United Nations development reports (United Nations, 2015).
Our Gini-coefficient data is retrieved from the Standardised World Income Inequality Database (Solt, 2016), which compiles and transforms Gini data from the OECD, the Socio-Economic Database for Latin America and the Caribbean, Eurostat, LIS, the World Bank’s PovcalNet, national statistical offices, and various academic studies in order to create a comprehensive data set covering 192 countries from the 1960’s and onwards, and for our period of study the data is complete. In order to facilitate the interpretation of our results, we transform the Gini-coefficient to an index ranging from 0-100. While comprehensive, the lowest observed value for our Gini data is 21.99 and the highest 37.92 (which is a fairly limited interval) and macroeconomic uncertainty restrains us from interpreting implications of results that go beyond our observed data. Below is a figure showing the development of the Gini-index for each country over our time period of study.

*Figure 2: Gini-index from 1995-2015*

Source: Solt (2016)
4.1.3 Other independent variables

In order to isolate the effect of income inequality on household debt levels we need to control for a number of other variables.

**GDP growth**

Economic growth and household debt are inevitably linked. Consumption theory (life cycle models as well as relative consumption models) suggest that debt should rise as economic agents seek to smoothen out temporary dips in income during economic downturns. Nevertheless, the direction of the relationship between the two is not entirely uncomplicated. Following the Great Recession private debt has emerged as a suggested driver of recessions (Mian et al., 2017) unlike the models discussed in this paper which suggest debt levels should rise as a consequence of a recession rather than being a cause of it. Whatever the relationship, it is clear that the relationship between debt and the business cycle is complex and far beyond the scope of this paper. That being said, the level of growth and general state of the economy plausibly affect debt levels on several levels - through wages, asset prices, economic confidence among households and agents etc. - and the variable ‘GDP growth’ is included to take these effects into account.

As a measure of the business cycle, it is possible that ‘GDP growth’ may capture in part the same variation that year-specific time fixed effects would, as such year-specific effects would likely also largely account for the ups and downs in the international economy. Such potential overlapping of effects should be considered when evaluating in regression models in which both controls for the business cycle are employed simultaneously. Growth figures are retrieved from the World Bank Data bank (2017), and contains observations for all countries and years.

**Financial development**

Financial deregulation and greater access to credit and financial services could potentially be a supply-side explanation of the rise of household borrowing, as suggested by e.g. Debelle (2004), reflecting households moving from a constrained, suboptimal level of debt to their preferred level in order to optimize life cycle consumption. We employ the variable ‘Financialdev.’ to control for this effect, retrieving data from the IMF Financial Development Index Database (2015). The index, which assigns each country a score from 0-1, is based on various indicators and is constructed to describe the general ease of accessing financial markets, the development and sophistication of those markets as well as the effectiveness of institutions managing them.

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7 It is of course important to note that the inclusion of a GDP growth variable for each country will capture the country specific effects of business cycle fluctuations, while year dummies would capture only effects of international business cycle movements that affected all countries equally.
(Ratna et al. 2015). As data in the financial development index was one year short (ending in 2014) we extend the set by reproducing the index value of 2014 in 2015 to ensure a balanced data set. We assume that the real-world conditions should not differ substantially between the years, and that this extension should not threaten the validity of the data.

**Old age-dependency ratio**

The life-cycle hypothesis suggests that debt should decrease with age - as people get closer to retirement, they avoid incurring debt that would be unserviceable without future income (Modigliani, 1970). Therefore we expect a negative effect of the share of elderly on household debt. In regards to savings, however, the anticipated effect is a bit more complicated. Individual net savings ought to peak at the moment of retirement, which in many countries is at or around 65. It should then decrease as funds are taken out of pensions to pay for consumption. But since an increase of retirees, who do not save (and instead live off savings), logically ought to be accompanied by an increase in the almost-retired, who save the most, the direction of the final effect on savings is ambiguous.

The old age-dependency ratio is furthermore a demographic factor commonly included as in previous studies on the relationship between income inequality and household saving, spending and borrowing behaviors (e.g. see Kumhof et al., 2012; Drechsel-Grau and Schmid, 2014 and Scheuermeyer and Bofinger, 2016). Hence we employ the variable 'Age-depend', defined as the population share of individuals aged 65 and over, to control for such effects. Data on old age-dependency ratios is retrieved from the World Bank (World Bank, 2017) and is complete for all countries and years.

**Real interest rates**

Standard macroeconomic theory suggests that rising interest rates should increase savings and reduce borrowing as the cost of loans rises, and vice versa. Moreover, some studies have identified low interest rates as a key driver of the previous decades rise in household debt (e.g. Debelle, 2004). Nevertheless the direction of this effect is ambiguous, as borrowing may in fact have a pro-cyclical tendency that correlates with interest rates. In a booming economy households may plausibly extend their borrowing as economic outlook seems promising, even while facing higher rates set by the central bank to 'cool off' the economy. Hence, we cannot assume that empirical estimates will be completely in line with conventional theory in this case, but whichever direction the effect takes controlling for the real interest rate is necessary.

The most relevant interest rate for this paper ought to be the one that best matches the interest rate households face on the credit market. As mortgages make up the majority of household borrowing (OECD, 2017) the average interest rates on mortgages and mortgage
equity withdrawal is likely the best indicator of the interest rate affecting overall household borrowing behavior. Given that mortgages and loans are issued with both fixed and floating rates of varying lengths, a useful control variable ought presumably to reflect mid-length interest rates. Publicly available comprehensive interest rates data (OECD, 2017), however, contain either very short term rates\(^8\) or long term ten year government bond rates. While neither of these interest rate measures can be assumed to perfectly reflect the average interest rate encountered by households on the credit market, we believe that the long term bond rate should be a closer match to household rates. Hence we employ the nominal 10-year bond rate (OECD, 2017) to control for the effect of interest rates in our analysis, and to obtain the real rate, we adjust it for inflation (OECD, 2017). This calculated real rate is henceforth referred to as ‘Real rate’.

**House price-to-income ratio**

For households across the countries included in our data set, mortgages make up much of household borrowing, and house prices have risen quickly in many nations. This suggests that a part of rising debt levels is attributable to increasingly large mortgages to pay for increasingly expensive housing. To control for this effect, we include the *house price-to-income ratio* in our model. (OECD, 2017) This is simply the ratio of the nominal house price over the nominal disposable income in each country. The house price-to-income ratio takes into account household incomes, and is a better indicator of affordability or relative price than simple house price indices. As our dependent variable is the change in the debt-to-income ratio, however, the house price-to-income ratio is transformed in the same way as the debt measure\(^9\). The final variable that we employ in the empirical analysis is denoted ‘Real house’.

Nevertheless, controlling for house price-to-income is not entirely uncomplicated. Housing may in fact be one channel through which a potential "keeping up with the Joneses"-effect exerts itself, as people may borrow more in order to keep up with the housing standards of their peers or withdraw more equity from their house to keep up with consumption standards. Hence, including this variable in our model possibly offsets part of the effect we seek to estimate, which may cause us to underestimate the actual effect of inequality on household debt.

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\(^8\) Short term rates in this case generally consist of average of daily rates based on three month money market rates where available (OECD, 2017), indicating there may be inconsistencies in the data across countries and over time, which is another potential issue that deterred us from using short term rates.

\(^9\) The value of the previous year is subtracted from the current, creating a new variable that measures the change from one year to another.
Budget deficit

Lastly, if we assume that government deficits could be interpreted as an indicator on economic downturns and instability, we should expect it to affect the savings and borrowing behaviors of households. Hence, we include a control variable of general government deficit in our model, which is simply denoted ‘Budget deficit’. Data is retrieved from OECD (2017) National Accounts, and is complete for all countries and years. The indicator is measured as a percentage of national GDP, which is necessary for comparability.

Furthermore, there is theoretical rationale for including this variable as it is likely that forward-looking households (agents) internalize government budget restrictions in their decision making. The idea can be traced back to David Ricardo (1820), but has since then been developed further with a more solid theoretical groundwork by Robert Barro (1974) and others. Such theory would imply that households ought to increase their savings (and decrease borrowing) in response to government deficits, and vice versa when the government runs surpluses (Barro, 1974). However, empirical support for Ricardian equivalence is inconclusive and extremely weak over a long term perspective (Bernheim, 1987). The direction of the variable is therefore subject to ambiguity. It should also be noted that there is a risk that the ‘Budget deficit’ variable partially captures the same effects as our ‘GDP growth’ variable, as fiscal balance should be related to the movements in the business cycle (a correlation of 0.3465 can be noted in table A:1).

Finally, below a table which summarizes the descriptive statistics of all the variables introduced in this data section, 4.1, is presented.

**TABLE I: SUMMARY STATISTICS**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min.</th>
<th>Max.</th>
<th>Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debt</td>
<td>125.7963</td>
<td>51.46059</td>
<td>17.00223</td>
<td>239.839</td>
<td>349</td>
</tr>
<tr>
<td>ΔDebt</td>
<td>2.896033</td>
<td>4.912274</td>
<td>-7.966095</td>
<td>31.8017</td>
<td>332</td>
</tr>
<tr>
<td>Transactions</td>
<td>3.966278</td>
<td>5.519564</td>
<td>-9.23646</td>
<td>19.78008</td>
<td>349</td>
</tr>
<tr>
<td>Savings</td>
<td>6.458399</td>
<td>5.227936</td>
<td>-19.30058</td>
<td>20.09136</td>
<td>353</td>
</tr>
<tr>
<td>Gini</td>
<td>29.75483</td>
<td>3.71728</td>
<td>21.99803</td>
<td>37.92334</td>
<td>357</td>
</tr>
<tr>
<td>GDP growth</td>
<td>1.905319</td>
<td>2.229846</td>
<td>-9.132494</td>
<td>6.251008</td>
<td>357</td>
</tr>
<tr>
<td>Financialdev.</td>
<td>0.753047</td>
<td>0.1238335</td>
<td>0.3712243</td>
<td>1</td>
<td>357</td>
</tr>
<tr>
<td>Age-depend</td>
<td>16.38344</td>
<td>2.440855</td>
<td>11.87148</td>
<td>26.01537</td>
<td>357</td>
</tr>
<tr>
<td>Real rate</td>
<td>2.561088</td>
<td>2.131173</td>
<td>-2.242071</td>
<td>20.99598</td>
<td>357</td>
</tr>
<tr>
<td>Real house</td>
<td>93.0588</td>
<td>17.73473</td>
<td>56.15979</td>
<td>152.5137</td>
<td>350</td>
</tr>
<tr>
<td>ΔReal house</td>
<td>0.9541753</td>
<td>4.359397</td>
<td>-14.02969</td>
<td>16.61238</td>
<td>333</td>
</tr>
<tr>
<td>Budget deficit</td>
<td>-1.878702</td>
<td>4.67664</td>
<td>-15.1414</td>
<td>18.67137</td>
<td>347</td>
</tr>
</tbody>
</table>

10 To whom the commonly used term for such effects “ricardian equivalence” is attributed.
4.2 Empirical Method

When performing regression analysis on panel data, fixed-effects (FE) and random-effects (RE) models are most commonly employed. Each of these models are useful in different circumstances, but as we have aggregate data on a number of variables collected using different methods in different countries it is not immediately clear which model is most appropriate. Thus we perform multiple regression analyses estimating the relationship between our explanatory variable and dependent variable using both models, along with a simple pooled OLS approach. Each model requires assumptions regarding the data, and employing more than one is a fairly common approach by researchers as it gives insight into how changing the data restrictions in each model affects results. The results can be further tested and compared, providing a basis for exploring the structure of the data and discussing potential causal effects (Wooldridge, 2009).

Furthermore, we incorporate year dummies in a number of specifications following our baseline estimations to control for potential time-specific effects, while however keeping in mind that there is reason to believe that other independent variables may sufficiently capture the same effects (as has been noted in section 4.1.3). We also discuss robustness- and heterogeneity tests for our models. The following section treats these issues comprehensively and discusses the suitability and limitations and the interpretations of each model in the context of this study.

4.2.1 Statistical models

The key benefit of panel data\footnote{Also called ‘longitudinal data’, characterized by that it contains several observations from different points in time of one and the same individual or entity.} is that it allows control for entity-specific differences that cannot be observed or measured, and which could be potential sources of omitted variable bias (Wooldridge, 2009). In our case, such differences could include cultural elements or fundamental economic differences that are unique to a specific country and do not change over time. Nevertheless, difficulties arise when analyzing clustered data as it contains multiple levels of analysis, with lower levels (households, in the case of this study) nested within higher levels of analysis (countries containing these households), which can be dealt with using different methods. Which method of analysis is better suited for empirical analysis always depends on the known or assumed properties of the data, and essentially boils down to the judgement of the researcher (Bartels, 2009).

For economists and political scientists the FE model is often the ‘go-to’ choice when analysing panel data. When applied appropriately, the model’s underlying assumptions imply
that any significant estimate captures a causal effect that is valid for all entities. It assumes that all unobserved variation (captured by each entity-specific error term ŭ) is correlated with each explanatory variable in each time period. Hence, in theory, by time-demeaning the variables the FE model effectively eliminates any between-entity variation and time-invariant variable effects and isolates the true effect of the explanatory variable. Unique intercepts for each entity accounts for the estimates entity specific effects in this model. Given its simple approach, straightforward interpretations and strict assumptions it is often considered the most persuasive model when employing panel data. (Wooldridge, 2009)

While the FE model is usually considered most convincing, it has some drawbacks. Only the impact of variables that change over time is captured, meaning that the effect of constant variables will not be estimated correctly\(^{12}\), even if there is a significant effect across entities (Wooldridge, 2009). Similarly, although slowly-changing variables can still be estimated by the FE model it cannot provide a “good estimate” of such a sluggish variable\(^{13}\), and this is one of the particular cases when the restrictive FE model can be inefficient and imprecise (Bartels, 2009). This may have implications for the Gini-coefficient in this paper (as is briefly touched upon in the data description), which has moved less over the time period covered in comparison to alternative inequality measures.

Opposite to the FE model is the pooled OLS model\(^{14}\). This model does not take into account any entity-specific effects, and any estimated effects using this method is likely to contain major bias if there is in fact time-invariant variation in variables between entities. Hence, the pooled OLS analysis is performed to explore the relationship between debt and inequality under more generous restrictions to provide a more nuanced analysis, but interpreting the results of this estimation causally should be avoided (Wooldridge, 2009).

The RE model is similar to the FE model, but it also contains characteristics of OLS and is sometimes described as a “semi-pooled” model. The fundamental required assumption behind the RE model is that any unobserved variation is uncorrelated with the explanatory variables across all time periods. Intuitively, variables are “quasi-demeaned” before the regression is performed, meaning that a fraction of the between-entity variation is eliminated. The size of this fraction is determined by the variance of the entity-specific effects: the larger this variance is, the larger this fraction is.\(^{15}\) One important consequence of this partial demeaning is that it

\(^{12}\)As they will be eliminated along with the entity-specific effects.

\(^{13}\)Indeed, if a variable does not vary greatly in the data available it will always be difficult to retrieve a “good” estimate of it, regardless of model, but the point is that the FE model is relatively less efficient in this sense. Which we will develop on a bit more further ahead.

\(^{14}\)It is ‘pooled’ in the sense that regressions are performed across all observations without making a distinction between entities.

\(^{15}\)As variance increases the fraction approaches 1, and the RE model estimates tends toward the FE model. In contrast, the smaller the variance of the entity-specific effect, the more the RE model tends toward pooled OLS.
allows for including stationary independent variables, whose effects would be lumped together with the entity-specific effects under an FE model. This is often a reason for employing RE. (Wooldridge, 2009)

One rather substantial objection against the RE model is the restrictive and often considered unrealistic assumption that lower level independent variables\(^{16}\) are uncorrelated with the explanatory term \(\text{Cov}(X_{ij}, u_{0j}) = 0\), which is the main reason why the FE model is normally favored (Bartles, 2009). Nevertheless there is no consensus regarding the models: some researchers argue that RE models in general should be preferred to FE model as it provides more reliable predictions for higher-level units (such as countries). For example, Bell and Jones write that “FE models effectively cut out much of what is going on—goings-on that are usually of interest to the researcher… We contend that models that control out, rather than explicitly model, context and heterogeneity offer overly simplistic and impoverished results that can lead to misleading interpretations.” (Bell and Jones, 2015 p. 134).\(^{17}\) Another relevant difference is that while the FE model makes the \textit{a priori} assumption that there is a (one) single true effect that impacts all higher level units alike, the RE model makes no such assumption but provides a framework that allows for explicitly testing it (ibid., 2015).

As explained above, there is no foolproof method for determining which model is preferable under certain circumstances, and there are considerable arguments in favor of employing both the more orthodox FE as well as the RE model even when investigating non-stationary or sluggish variables (Bell and Jones, 2015). In order to help determine model specification, we conduct Durbin-Wu-Hausman tests (Hausman, 1978) for all specifications, testing whether we statistically can reject an RE model in favor of FE or not. The Hausman test, however, does by no means provide an absolute answer. Clark and Linzer (2012) argue that the test is too readily employed and accepted when in fact the choice between either depends on the data and research in question. In addition, it should be noted that the Hausman test is in fact rather a test of the similarity of within-entity and between-entity effects. (Bell and Jones, 2015).

Since neither model can be resoundingly rejected from the outset, we employ both. Although, the stricter and more conventional FE model is considered the first choice, the RE model can arguably provide meaningful economic insights. The efficiency, consistency and interpretations of each model is discussed and evaluated in light of their results. A pooled OLS model is, as mentioned, considered as well although given less weight in the discussion.

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\(^{16}\)Lower level or Level-1 variables represents the variables observed nested within higher level entities, in this case households within countries, in a multilevel data structure.

\(^{17}\)As discussed previously, and which is the rationale behind this reasoning, is that one of the major drawbacks with the FE model in contrast to the RE model is that the former does not account for any time-invariant within-or between entity effects, while the latter does so.
Finally, another consideration to note is that some of our variables increase substantially with the passage of time, and including non-stationary variables such as these could potentially constitute a source of spurious regressions. Statistical tests for non-stationarity would have been a natural starting point for testing this suspicion, but commonly employed unit-root tests are not employable using our data and software. Such tests have subsequently not been performed. Descriptive data provides indications of potential non-stationarity, and we identify the upward-trending household debt-to-income ratio and house-price-to-income ratios as the variables at most risk. Furthermore, in the case of these variables we are more interested in the relative change rather than the absolute values. Hence, to avoid any risk of spurious regressions and to capture the effects we desire to estimate these two variables are transformed into ‘ΔDebt’ and ‘ΔReal house’, by taking the difference between the value of the current year and the previous one, removing additive components. Other variables display a much less pronounced, if at all, upward trend than debt-to-income ratios and house price-to-income ratios, reducing the risk of spurious relationships threatening the validity of estimations. Another consideration we must take into account is heteroskedasticity within our variables, which we allow for by performing all regressions with cluster robust standard errors.

4.2.2 Main specification

Household Debt-to-Income ratio

Based on our theoretical framework and previous literature in the field we suspect that the relationship between income inequality and household indebtedness might be non-monotonic and potentially concave. In order to allow for such nonlinearity we introduce a squared Gini term, ‘GiniGini’ in our baseline specification. As we suspect that there might be substantial unobserved variation between countries the orthodox fixed effects model is the natural starting point for the empirical analysis. Hence, we include country specific fixed effects in our model, however, keeping in mind (as touched upon in section 4.2) that for our relatively long panel data set and sluggish explanatory variable (the Gini index) this model is rather strict, effectively eliminating a great deal of the variation in and between countries. We arrive at the following baseline equation;

\[
\Delta Debt_{it} = \alpha_0 + \beta_1 Gini_{it} + \beta_2 Gini^2_{it} + \delta' X_{it} + \alpha_1 + \lambda_t + \epsilon_{it}
\]

‘ΔDebt_{it}’ is the change in household debt-to-income ratio for country i during year t. ‘Gini’ is the Gini coefficient, and the ‘GiniGini’ form allows for the hypothesized nonlinear relationship. ‘X_{it}’ is a vector including all our control variables, thoroughly presented in section (4.1.3), ‘\epsilon_{it}’ denotes
the error term, and ‘α,’ country-specific fixed effects. Furthermore, we include a variable ‘λt’ to capture any potential time-specific effects we might expect due to fluctuation in the global economy affecting all countries equally, however, we introduce this control variable with a note of caution as there may be reason to believe that the inclusion of ‘GDP growth’ and ‘Budget deficit,’ might sufficiently capture the effects of the ups- and downturns of the global business cycle already.

### 4.2.3 Alternative specifications

In the data section (4.1.1) we introduced two alternative dependent variables, the household financial transactions (‘transactions’) measure of net changes in household assets to liabilities over income and the household savings rate (‘savings’). It should be kept in mind that the analysis of ‘transactions’ and ‘savings’ in this paper is intended primarily as an additional tool in the attempt to deepen understanding for household debt and borrowing behavior in the context of rising income inequality. Neither is meant to replace nor weigh equal to the analysis of household the debt-to-income ratio, our key variable of interest.

**Household Financial Transactions**

As an alternative measure of household borrowing behavior in response to income inequality we employ data on Household Financial Transactions (‘transactions’), which in short captures the net changes in assets and liabilities. As we expect this relationship, given previous empirical findings suggesting nonlinearity, to be non-monotonic as well we arrive at a baseline equation for transactions simply based on the baseline equation for ‘ΔDebt.’ In addition, it should be noted that, as transactions does not accumulate over time and we are in fact interested in the net level of asset/liability change, it has not been modified by detrending (as opposed to the Debt-to-income ratio) as such a transformation would not be useful in this case.

\[
\text{Transactions}_{it} = \alpha_0 + \beta_1 \text{Gini}_{it} + \beta_2 \text{Gini}_{it}^2 + \delta' X_{it} + \alpha_t + \lambda_t + \varepsilon_{it}
\]

**Aggregate Household Savings**

In their 2016 paper ‘Income Distribution and Household Saving: a Non-Monotonic Relationship,’ Scheuermeyer and Bofinger document a hump-shaped relationship between savings and inequality. In an effort to further explore our data we attempt to recreate their findings using the following estimate:

\[
\text{Savings}_{it} = \alpha_0 + \beta_1 \text{Gini}_{it} + \beta_2 \text{Gini}_{it}^2 + \delta' X_{it} + \alpha_t + \lambda_t + \varepsilon_{it}
\]
4.3 Further considerations

Tests of a nonlinear relationship

In order to statistically test the suspected non-linear and inverted U-shape of our model we employ the Sasabuchi-Lind-Mehlum-test (Lind and Mehlum, 2010), which tests the hypothesis of a non-monotonic relationship (U-shape or inverted-U-shape depending on the signs of the coefficients) against the null hypothesis of a monotone relationship. Nevertheless, as most countries in our data are clustered in a relatively narrow Gini-coefficient interval, roughly between an indexed Gini of 21.99-37.92, we realize that finding clear-cut relationships in such narrow data might prove difficult. Hence, to further test the hypothesis that the effect of a rise in the Gini-coefficient on household debt will differ depending on the level of inequality, we also perform a heterogeneity analysis by dividing our observations into groups of low-inequality versus high-inequality countries based on the estimated shape of our preferred specification. If, in fact, a non-monotonic relationship is found in the analysis of the full data set and a turning point can be located, then we should expect to find a linear positive relationship for low-Gini countries and conversely a linear negative relationship for high-Gini countries.
5 Empirical Findings

In this section we present the results of our estimations, beginning with the main findings of our empirical analysis. We begin with our main results. Next, we account for the statistical tests conducted in order to specify the estimated shape of the relationship between inequality and debt, followed by a robustness test for which we divide our data set into two groups of low-versus high inequality countries and analyze them respectively. Finally we consider the results of our investigations using alternative dependent variables and give a short summary of key findings.

5.1 Main results

Based on the estimation outlined in (4.2), our main results are shown in table II, all specifications allowing for a polynomial shape of the relationship as hypothesized. A linear model has also been tested (see appendix table A:II) but do not return any significant or meaningful results, and we exclude it from the central discussion.

<table>
<thead>
<tr>
<th>TABLE II: PANEL DATA REGRESSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable: Difference (Δ) in Household Debt-to-Income ratio</td>
</tr>
<tr>
<td>Regressors</td>
</tr>
<tr>
<td>Gini</td>
</tr>
<tr>
<td>GDP growth</td>
</tr>
<tr>
<td>Financialdev.</td>
</tr>
<tr>
<td>Age-depend</td>
</tr>
<tr>
<td>Real rate</td>
</tr>
<tr>
<td>dReal house</td>
</tr>
<tr>
<td>Budget deficit</td>
</tr>
</tbody>
</table>

Year dummies NO NO NO YES NO NO NO YES
R-squared 0.0891 0.4230 0.4702 0.5357 0.9641 0.2832 0.4373 0.5084
Hausman-test 0.0000 0.0000 0.0000 0.7681

Note: All regressions performed with cluster-robust standard errors, statistical significance is denoted *p<0.1, **p<0.05, ***p<0.01

Column (1) includes no control variables, while column (2) includes control variables that have relatively low correlation with our explanatory variable (see correlation matrix A:I), indicating that these impact the dependent variable more or less exogenously in regards to the Gini index.
Column (3) and (4) both include all control variables, the only difference being the inclusion of individual year dummy variables in specification (4) added to capture international time-specific effects. Apart from a weakly supported relationship, at the 10 percent significance level in specification (2), neither specification employing the FE approach return significant estimates of a relationship between the ‘Gini’ and ‘ΔDebt’.

Columns (5) through (8) display results from our RE specifications, which mirrors the FE specifications (1) through (4). All specifications in column (6) through (8) imply a significant non-monotonic relationship between ‘Gini’ and ‘ΔDebt’, supporting the hypothesized relationship between the variables. The explanation to why the RE model specifications produce significant results, where the FE model does not, is likely found in the model’s more generous treatment of the data and less restrictive constraints on unexplained variation. As discussed in the empirical method section 4.2, the RE model allows for more unobserved variation in and between countries, allows for the effect of the explanatory variable to differ between entities, includes the effects of stationary variables, and generally improves the estimation of sluggish ones - at the cost, however, of potentially increased bias and inconsistency. It is likely that the ‘Gini’ variable is a potential culprit behind the non-significant FE estimates; as the variation between our countries is larger than individual country variation over time, the FE model eliminates much of the variable diversity that should be of interest.

In order to determine whether there is statistical grounds for favoring either model, a Hausman test is conducted for each specification. As can be observed in table II, for specifications (1), (2) and (3) the test rejects the null hypothesis that there is no systematic correlation of the error term with regressors, which indicates an FE model is preferable to an RE model. However, for the specification including time-fixed effects (4) the null hypothesis could not be rejected, indicating that an RE model is equally likely. In general, the results indicate that an FE model should be preferred, but as previously discussed the test is rather simplistic and is at face value not reason enough to categorically reject the RE model, which can still provide economically meaningful insights to the results. Hence, we continue to investigate and consider both models.

Before continuing with the main discussion we consider the results of the pooled OLS model, which can be found in table A:III in appendix. This model produces significant results for all specifications except (1) which includes no control variables, hence is likely highly biased and should not be a focus of this discussion.
beyond a potential source of omitted variable bias, and drawing any substantial conclusions from this result should be avoided.

As estimates across all three models indicate a consistent result, we conclude that all independent variables are meaningful and all variables should therefore be included in a final preferred specification. The only potential variable-specific source of concern is the year dummies, which control for time-specific effects and are included as an additional control for the global business cycle in specification (4) and (8) respectively. The risk, briefly touched upon in section 4.2.1, is that if we believe that the variables ‘GDP growth’ and ‘Budget deficit’ sufficiently capture the effects of the ups and down-turns of the global economy in each country, then the inclusion of year dummies may be an unnecessary addition that eliminate too much variation between countries and impairs the precision of the estimates. In fact, when including year dummies in regressions very few prove to have a significant effect (and those that do are clustered around the time of the financial crisis 2008-2011) suggesting that the inclusion of year-specific effects may be superfluous. Furthermore, if we assume that the effects of the global business cycle may be expressed differently in each country or that local cycles are more impactful, country-specific control variables would likely capture such effects more effectively than year-dummies which estimates one value to be true across all countries. All things considered, columns (3) and (7) contains our preferred specifications in this analysis.

5.2 Alternative specifications
In this section, we present the findings from our alternative specifications, presented in section 4.2.2. These are intended to further illuminate our regression method, data and results, but are not the main focus of the paper. In Table III the preferred specifications of the FE as well as RE models are presented for all dependent variables. The estimates for our main dependent variable, ‘ΔDebt’, in this table corresponds to those presented in Table II. The preferred specifications include all control variables presented in the data section 4.1, and exclude year dummy controls for time-specific effects.

\[^{19}\text{Results for individual time-specific dummies are not included in the final paper due to formatting considerations.}\]
As is depicted in table III, the estimated relationship between ‘transactions’ and income inequality (‘Gini’) is non-monotonic and display a notable similarity to the inverse of the relationship between ΔDebt and income inequality. Again, the FE model (column 3) does not produce any significant results, while the less restrictive RE model (4) implies a non-monotonic U-shaped relationship at the 5 percent significance level. Following the same line of reasoning as in the previous section in regards to our main dependent variable, we note that the estimated coefficients of the RE model are roughly similar to the FE model and statistically significant, which suggest that interpretation is meaningful, although this analysis should be carried out with a certain degree of caution.

In our estimation of the relationship between household savings and inequality, like household ΔDebt and ‘transactions’, we again find that the FE estimation does not return significant results while RE does. Much like Schueermann and Bofinger (2016) we discover an inverted U-shape relationship between the variables, although we fail to do so with the same certainty, and our estimation of the turning point is calculated several Gini index points higher. This is somewhat surprising as we are employing the same household savings and inequality data. A notable difference between our estimation and that of Scheuermann and Bofinger is the

<table>
<thead>
<tr>
<th>TABLE III: PREFERRED SPECIFICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent var.</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Regressors</td>
</tr>
<tr>
<td>Gini</td>
</tr>
<tr>
<td>(4.056314)</td>
</tr>
<tr>
<td>Gini²</td>
</tr>
<tr>
<td>(0.0669362)</td>
</tr>
<tr>
<td>GDP growth</td>
</tr>
<tr>
<td>(0.1008513)</td>
</tr>
<tr>
<td>(5.530404)</td>
</tr>
<tr>
<td>Age- depend</td>
</tr>
<tr>
<td>(0.3505586)</td>
</tr>
<tr>
<td>Real rate</td>
</tr>
<tr>
<td>(0.1387643)</td>
</tr>
<tr>
<td>ΔReal house</td>
</tr>
<tr>
<td>(0.0971912)</td>
</tr>
<tr>
<td>Budget deficit</td>
</tr>
<tr>
<td>(0.0951429)</td>
</tr>
<tr>
<td>Year dummies</td>
</tr>
<tr>
<td>R-squared</td>
</tr>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>Turning point</td>
</tr>
<tr>
<td>Hausman-test</td>
</tr>
<tr>
<td>No. Of obs</td>
</tr>
</tbody>
</table>

Note: All regressions performed with robust standard errors, statistical significance is denoted *p<0.1, **p<0.05, ***p<0.01
length of the panel; while data availability for the main focus of this paper, household debt, force us to limit the size of the study to 20 years, their estimation uses a data set that (while being highly unbalanced) runs from 1961 to 2013 across 23 countries. The larger panel size is the most likely cause of these differing results, which suggests that a longer panel could have benefited our estimates as well.

5.3 Tests of a nonlinear relationship

For statistically testing the estimated non-linearity of our preferred specification (table III (2)) we employ the Sasabuchi-Lind-Mehlum-test (Lind and Mehlum, 2010). With a p-value of 0.0175, the test rejects the null hypothesis of a monotone or U-shape, which implies that we can assume with 95 percent certainty an inverted U-shaped (hump-shaped) relationship. The turning point is identified at an indexed Gini-coefficient of 28.84, suggesting that from levels of inequality lower than that point household debt increases at a growing rate as inequality increases, while at levels of inequality beyond that point household debt-to-income increases at a diminishing rate (until it passes the x-axis). The interval for our data stretches from an indexed Gini-coefficient of 21.99 to 37.92, and the estimates are likely to be economically meaningful only within this interval. Furthermore, the test suggests a somewhat asymmetrical hump-shape, as it estimates an upward slope of 0.91 and a downward slope of -1.21, at the lower and upper bounds respectively.

Correspondingly, in order to statistically test the suggested non-monotonic relationship of our dependent variables we once again employ the SLM-test. For ‘transactions’ we use our preferred specification (table III, column (4)), which is an RE-model implying a significant U-shape, for testing the relationship. With a p-value of 0.028, which corresponds to a 5 percent significance level, the test implies the presence of a U-shape with a turning point at a Gini-index of 30.41. Furthermore, the test estimates the slope to be -1.31 at the lower bound and 1.17 at the upper bound (again, the interval of our indexed Gini-data can be found in table I). This result suggests a negative effect of rising income inequality on household financial transactions at relatively lower levels of inequality, turning positive at relatively higher levels of inequality. Finally, we again conduct an SLM-test for our ‘savings’ variable, which estimates a turning point at 35.34 - a rather high value considering the results of previous studies (see Scheuermeyer and Bofinger, 2016) and the estimates for our other dependent variables. However, this test does not prove significant and we cannot draw any conclusions from it.

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20The RE model is used for this test, as testing the non-significant estimates of the FE-model are neither statistically nor economically meaningful.
High- and low-Gini groups

In order to further test the robustness of the indicated hump-shaped relationship between income inequality and household debt we conduct additional regressions based on the assumption (supported by our SLM tests) that the effect will express different directions depending on the level of inequality of a country (see table A:IV in Appendix). We divide our data set of 17 entities into two subgroups of high and low-inequality countries, based on the turning point identified by the SLM-test of our preferred regression\(^\text{21}\). Countries that consistently have displayed a Gini-coefficient of 29 or above\(^\text{22}\) over the 20 years of observation are considered high-inequality, while countries whose Gini-coefficients have stayed below this value\(^\text{23}\) make up the low-inequality group. As we do not expect our estimated turning point of 28.84 to be a sharp one, we only include observations of low-Gini countries from below 28.

Regressions in this robustness test are performed using both the FE and the RE model. For the high-Gini group of countries we find in the FE specification statistically significant estimates in support of the negative relationship indicated by our preferred specifications (see column (3) table A:IV), with the Hausman-test lending further credence to the result as it favors the FE model\(^\text{24}\). For low-Gini countries on the other hand the estimates are ambiguous; the FE model indicates a positive relationship while the RE model estimates a negative one. However, neither specification proves significant. The more clearly defined, steeper high-gini, and ambiguous low-gini estimate chimes with the SLM-test, which also predicted a much steeper downward slope (than the upward one). In summary, the high vs. low Gini test seems to support the estimated inverted U-shape although results are weak and inconclusive.

\(^{21}\) All countries except for France, which had to be excluded as it's Gini coefficient over the time period circled the turning point (28.84) and could not be right be assigned to neither group.

\(^{22}\) Australia, Canada, Greece, Italy, Japan, Spain, Switzerland, United Kingdom and United States.

\(^{23}\) Austria, Belgium, Finland, Germany, Netherlands, Norway and Sweden.

\(^{24}\) Rejecting the RE model at 1 percent significance level.
5.4 Estimated relationship

The significant ‘Gini’ and ‘Gini²’-coefficients along with the SLM test suggest the existence of an inverted U-shape relationship. Plotting the results from our preferred specification in table III, column (2) returns the following graph:

*Figure 3: Estimated relationship between Gini and ΔDebt: based on preferred RE specification (2) table III (note value at turning point marked at Gini = 28.84).*

As the Gini coefficient increases from a low level, the average change in household debt is positive and accelerating until the turning point located where the Gini coefficient equals 28.84. This implies that for every point of increase in the Gini index, households raise their borrowing, and at an increasing rate. After the turning point the change in debt - while still positive - is diminishing for every point of increase in the Gini, meaning that households still accumulate debt but at a decreasing rate. Furthermore, this model estimates that on average household debt incurrence rates does not turn negative (cross the x-axis), i.e. that households decrease their accumulated debt, until the Gini reaches a value of 36.43. This indicates that household debt levels increase in response to increases income inequality for all levels of the Gini below this point (36.43), at varying rates, whereas after this point accumulated debt levels actually begin to fall as income inequality rises.

The consistency of results across models and specifications allows us to conclude that our preferred estimations are internally valid. However, it should be pointed out that observations of the the Gini index only stretch from 21.99 to 37.92. Even under the best of circumstances interpreting relationships beyond observational limits of the data introduces significant uncertainty, and the results should only be considered meaningful within this
interval. The stricter and perhaps more convincing FE models also fail to produce significant estimates which discourages from interpreting the results and magnitude of coefficients at face value. As discussed earlier, while the risk of the FE model is inefficiency, the risk of the RE model is inconsistency, which may well be a greater weakness. Hence the coinciding results from all models can give meaningful indications of a relationship, but are not evidence enough to draw any definitive conclusions or generalize the relationship externally without exercising caution.
6 Discussion

As concluded in the previous section, our findings imply a non-monotonic concave relationship between income inequality and household debt. This is in line with theory and previous studies, although our estimations of the magnitude of this relationship are not conclusive and should only be interpreted as roughly indicative. In addition, the results from our alternative specifications employing the 'transactions' and 'savings' variables appear to show patterns that go more or less hand in hand with our main findings on household debt and borrowing behavior. Taken together, the empirical analysis results in some substantial implications with regards to theory, which we discuss and develop further in this section.

As discussed in the theoretical framework section 2, Keynes suggested as early as 1936 that the marginal propensity to consume (MPC) varies across the income spectrum, which is supported by several empirical studies (see section 3, e.g. Dynan et al., 2004 and notably Cynamon and Fazzari, 2013, who relate this to borrowing and debt behavior). Keynesian theory can thus explain that saving and borrowing behavior varies depending on the level of inequality as income redistributions will make different groups of households with different marginal propensities to consume, save and borrow, more or less dominating in aggregate data. However, this theoretical line of reasoning by itself cannot comprehensively explain the observed nonlinearity of the relationship between inequality and debt found in the empirical analysis.

This is where the relative income theory of consumption becomes relevant, as it suggests that household propensities for consumption, saving and borrowing (as it has been applied before by e.g. Barba and Pivetti, 2009), is not constant for different household groups but depends on relative social and economical factors, such as upward-looking interpersonal comparison. In this paper we employ the relative income theory of consumption model by Frank et al. (2014), which has two key implications for our analysis. The first is that the closer the reference group (i.e. the 'Joneses', displaying a normative standard) are to an agent in space and time, the more influence it exerts on the agent's behavior. The second is that agents generally seek to emulate the behavior of those above them on the income ladder. Taken together, these proximity and upward comparison effects provide a plausible theoretical explanation for the non-monotonic relationship found throughout all specifications.

Consider an economy with relatively low levels of inequality becoming more unequal, where income is being concentrated with households in the top of the income spectrum. Differences in consumption standards between peers should become more pronounced as income inequality rises, but the 'keeping up with the Joneses'-effect and habit persistence prompt households falling behind in relative income to strive to maintain their consumption
standards. Proximity to, and frequency of interaction with, higher-income reference households will according to this theory amplify the effect. As has been found in several studies (e.g. Cynamon and Fazzari, 2013 and Frank et al., 2014) this gives rise to expenditure cascades and debt-financed consumption among low and middle-income households, which is in line with our findings that indicate a positive relationship between growing income inequality and household borrowing when moving from lower levels of inequality. Income and consumption disparities becoming more visible, but seemingly still within reach to those falling behind, gives rise to a surge in borrowing among relatively poorer households to finance consumption.

Our empirical analysis further indicates that this positive marginal effect continues at an increasing rate until it reaches a turning point, estimated around a Gini of 28.84 (according to our preferred random effects specification). This also makes sense under a relative income theory of consumption approach. As income inequality rises, proximity and Veblen effects diminish, and so demand caused by relative income effects decrease. The rate at which households incur debt to finance such consumption demand would therefore decrease at higher levels of inequality. Correspondingly, assuming that a lower (higher) marginal propensity to consume (save) among relatively richer households also implies a lower marginal propensity to borrow among those households, and in line with Keynesian theory, such a dynamic could potentially also contribute to a negative marginal effect on borrowing at high levels of inequality as these households become more dominating in aggregate data.

Supply-wise it also seems probable that at some point credit constraints rein in the borrowing of poorer households. As pointed out by Barba and Pivetti (2009), indebted households’ ability to service debt eventually reaches an upper bound, and similarly Schuermeyer and Bofinger (2016) argue that low and middle income households’ savings rates eventually bottom out at zero as inequality rises. Fundamentally, credit can only be extended so much.

Both demand and supply effects contribute to explaining the inverted U-shape or ‘hump’ of the estimated relationship, although which effect is more dominant is not possible to determine from our results. To do so we would need disaggregated data on the behaviors of different income groups of households. Nevertheless, the theoretical framework, through its initially intensifying and later diminishing effect on incentives, capability and propensity of households to incur debt, provides a satisfactory explanation of the mechanisms behind the inequality and debt relationship.

25 In other words, as income disparities rise and households of different income standards associate less as the ‘distance’ between them increases, which results in that relatively richer household standard exerts less influence over relatively poorer households.

26 A more thorough explanation can be found in section 3 on empirical literature.

27 And as several studies investigating the mortgage debt origins of the financial crisis of 2008 suggests doing so may come at risk of increased financial instability.
Henceforth, we relate our empirical analysis of the alternative dependent variables, ‘savings’ and ‘transactions’, to our main topic of discussion. Regarding savings it may initially seem counterintuitive that we estimate an inverted U-shaped relationship between household savings and inequality, as at first glance savings ought to hold an opposite relationship to ‘ΔDebt’. Nevertheless this estimation is in line with previous empirical research (see Schuermeyer and Bofinger, 2016 - although our estimates indicate a shift in the marginal effect of inequality at a higher value of the Gini), and can be likely explained by a dominating effect of higher income households’ higher marginal propensity to save at high levels of inequality. We also note (as described in the data section 4.1.1.) that savings rates have remained fairly consistent over the period of study28, which stands apart from the substantial fluctuation of household financial transactions and the upward trend of debt-to-income ratios. Evidently, positive household saving rates can coincide with increased debt levels, which explains why these measures relationship to inequality do not mirror each other. An explanation for this could lie with long-terms savings such as pensions which may be less elastic than consumption and borrowing. It could also point towards a difference in technical construction and measurement or estimation of our variables.

Our third dependent variable, ‘transactions’, in contrast to the saving rate, takes into consideration changes in both assets and liabilities in relation to income and may in fact be a more balanced measure of households’ financial situation (seeing how the saving rates in no way reflect the systematic increase in debt). Hence, it is not surprising that we find a U-shaped relationship between ‘transactions’ and the Gini-index with a turning point located roughly mirroring the relationship of inequality and ‘ΔDebt’. This suggests that moving from lower levels of inequality the ratio between the acquisition of assets and net incurrence of liabilities (more or less; savings and debt) falls, until after a certain turning point29 where households reverse this behavior.30 This is theoretically and empirically consistent to the estimated relationship between inequality and ‘ΔDebt’: household debt first increases at an accelerating rate, and then decelerates after passing the turning point before finally turning negative.

One factor that should be discussed before drawing any final conclusions is the rise of house price-to-income ratios. We expect house affordability to have a large effect on indebtedness through mortgages, and this effect is controlled for in all our specifications (and proves highly significant throughout). Nevertheless, house prices is not a completely unproblematic variable to control for, as housing decisions may be a (partial) channel for debt-

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28With the notable exception of Greece.
29Estimated at a Gini-index value of 30.41.
30In other words, moving from lower levels of inequality households lower the rate at which they acquire more assets (save) relative to the rate at which they incur liabilities (take on more debt), and vice versa for higher levels of inequality.
financed consumption and affected by household's strive to "keep up with the Joneses". Indeed, this does not seem unlikely considering the subprime mortgage-fueled crisis of 2008 in the US. If housing is viewed as another type of consumption subject to households' interpersonal comparisons, then mortgages (to some extent) should be considered an expression of households' attempt to maintain the relative living standards of their peers. Seeing as this is likely, controlling for housing prices in fact eliminates part of the effect of income inequality on household debt that we seek to estimate. Given that an analysis of housing as a channel for interpersonal comparison and "keeping up with the Joneses"-effects is unfortunately out of scope for this paper, we can only note the potential existence of such effects and its possible impact on our estimations. Possibly making us underestimate the relationship.

In summary, although this study does not find conclusive evidence for a precise effect of income inequality on household debt it succeeds in the purpose of bringing further clarity to the shape of such a relationship, as well as providing a rough indication of its magnitude. Furthermore, it sheds light on the direction and behavior of other variables and channels of relevance for empirical studies on the subject. The internal validity of this study should be considered strong. The width, length, and high balance of the panel data indicates we have a good starting point for the estimations, and along with the inclusion of a number of various highly relevant control variables in the regressions, this suggests that the estimations of our explanatory variable are valid. Various robustness tests and heterogeneity controls lends further credence to the internal validity. As for external validity, the results of the study should arguably be generalizable to countries with more or less similar economic characteristics to the countries employed in this study. It is likely the findings would not apply to developing economies, or economies with fundamentally different economic, political or cultural characteristics.

While this study provides new and meaningful insights to our understanding of the relationship between income inequality and household debt, its results also sparks new questions. One of the (previously discussed) drawbacks with this study is the aggregate data which does not allow for analyzing the behaviors of households at different levels of the income distribution. If such data could be obtained from a wide panel such as the one we employ, much deeper exploration of the dynamics behind our results could be conducted, potentially revealing more substantial findings. Even with the data at hand further investigations, using other and more advanced statistical methods (such as for example cointegration techniques) should be of ample merit.

31 We can, as argued before, assume that the estimations from the random effects model and pooled OLS model, which both prove significant, gives some good indications on the relationship we seek to investigate, although the failure of the fixed effect model to produce significant results deter us from interpreting the estimates at face value.

32 i.e. fairly advanced economies with relatively liberal credit access for households.
7 Conclusion

This thesis explores the relationship between the coincidental rise of income inequality and household debt in developed economies, specifically seeking to answer the research question "What has been the effect of rising income inequality on household indebtedness in OECD countries over the time period 1995-2015?". Drawing predominantly on relative income theory of consumption (see Duesenberry, 1949 and Frank, 2014) - which has gained substantial support in recent studies showing that household consumption, saving and borrowing is affected by relative factors such as interpersonal comparison - we hypothesize that relatively lower income households increase their borrowing in order to "keep up with the Joneses" as inequality increases and relative income falls. We do not expect this effect to be static, however, as decreasing economic "proximity' to reference groups eventually reduces their influence. Due to this ambiguity we arrive at the hypothesis that there is a nonlinear relationship between inequality and change in household debt, depending on the level of inequality.

Carrying out the empirical analysis we employ a panel data set consisting of 357 observations from 17 OECD-countries from 1995-2015, and construct a polynomial baseline model to allow for the hypothesized nonlinearity, with change in the household debt-to-income ratio as our dependent variable and the Gini-coefficient as our measure of inequality and explanatory variable. Several independent variables are employed to control for sources of bias. We test the relationship in various specifications using a fixed effects model, a random effects model as well as a pooled OLS model. The empirical analysis returns meaningful indications of an inverted U-shape relationship, suggesting that increasing inequality has an accelerating effect on household debt incurrence up to a Gini of 28.84. After this turning point increasing inequality instead reduces the rate of debt incurrence. Although our empirical findings support the hypothesis, results are not strong enough to draw any definitive conclusions as FE models do not return significant estimates. The weak results using FE models could potentially be caused by a sluggish Gini-coefficient, which has been relatively static over the 20 years covered by our data set. Consequently, the results are interpreted as indications of a causal relationship rather than absolute evidence, but which can still provide meaningful insights.

Weak statistical estimates prevents us from giving any policy recommendations based on the findings of this study, but highlight the importance of further exploring the implications of inequality in advanced economies. Further research into the relationship between household debt and income inequality, and perhaps in particular the debt behavior of different income groups, is warranted before drawing any further political or economic conclusions.

33 Earlier studies of the inequality-savings relationship suggest that a longer data set, stretching back to the 1980’s or farther could likely have produced statistically stronger results.
References


**Data**


**Appendix**

*Figure A:1 Net Household Financial Transactions 1995-2015*

Source: OECD (2017)

*Figure A:2 Household Saving rates 1995-2015*

Source OECD (2017)
### TABLE A.1 CORRELATION MATRIX

<table>
<thead>
<tr>
<th></th>
<th>ΔDebt</th>
<th>Transactions</th>
<th>Savings</th>
<th>Gini</th>
<th>Financial dev.</th>
<th>GDP growth</th>
<th>Age-dep</th>
<th>Real rate</th>
<th>ΔReal house</th>
<th>Budget deficit</th>
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<tr>
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<td>-0.1089</td>
<td>-0.2712</td>
<td>1.000</td>
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<td>-0.0738</td>
<td>0.2002</td>
<td>0.4442</td>
<td>0.0040</td>
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<td>-0.1172</td>
<td>0.0759</td>
<td>-0.0594</td>
<td>0.0127</td>
<td>1.0000</td>
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<td>0.2085</td>
<td>0.0004</td>
<td>-0.1197</td>
<td>-0.1350</td>
<td>-0.3449</td>
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<td>0.1427</td>
<td>-0.3025</td>
<td>0.0262</td>
<td>-0.3295</td>
<td>-0.1505</td>
<td>-0.1410</td>
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<td>-0.1078</td>
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<td>-0.0983</td>
<td>0.0511</td>
<td>0.3656</td>
<td>-0.0967</td>
<td>-0.0400</td>
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<td>-0.2163</td>
<td>0.1245</td>
<td>-0.4930</td>
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<td>-0.2591</td>
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### TABLE A.2 PANEL DATA REGRESSIONS

Dependent variable: Difference (Δ) in Household Debt-to-Income ratio (ΔDebt)

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<thead>
<tr>
<th>Regressors</th>
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<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
<th>(6)</th>
<th>(7)</th>
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</thead>
<tbody>
<tr>
<td>Gini</td>
<td>-1.480142**</td>
<td>-0.6809321</td>
<td>-0.989823</td>
<td>-0.8881637</td>
<td>-0.1548455**</td>
<td>-0.1321129</td>
<td>-0.0435595</td>
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<tr>
<td></td>
<td>(0.7807095)</td>
<td>(0.773047)</td>
<td>(0.5762478)</td>
<td>(0.5833742)</td>
<td>(0.0856378)</td>
<td>(0.1135275)</td>
<td>(0.121777)</td>
</tr>
</tbody>
</table>

| Gini²      | -0.2802858** | -0.4005948*** | -0.526383*** | -0.2508063** | -0.3093801*** | -0.4961801*** |
|            | (0.1239267)  | (0.1015382)  | (0.1577901)  | (0.1071551)  | (0.1138667)  | (0.1883011)  |

| GDP growth | -0.6325874*  | -0.7625812*** | -0.4019092** | -0.5043102*** | -0.4665892*** | -0.2300345 |
|           | (0.3580552)  | (0.3324481)  | (0.6892987)  | (0.1186499)  | (0.1327101)  | (0.1665054)  |

| Financial dev. | 13.72239** | 13.74508 | 4.886482 | 4.313713 |
|                | (1.826148)  | (0.620972) | (0.068289) | (3.550007) |

| Age-dep | -0.052377 | 0.1039451 | -0.0071105 | 0.1960041* | 0.2461123** | 0.1012425 |
|         | (0.1412446) | (0.137565) | (0.137892) | (0.1111264) | (0.1206259) | (0.1388784) |

| Real rate | 0.6697726*** | 0.5647368*** | 0.4489583** | 0.6716158** | 0.6292607*** | 0.5305*** |
|           | (0.1105102)  | (0.0978137)  | (0.1147491) | (0.052774)  | (0.0552480)  | (0.0576638) |

| ΔReal house | 0.3578205** | 0.5867324** | 0.5887324** | 0.1887328** | 0.2819997** |
|             | (0.046482)  | (0.1254152) | (0.0750259) | (0.0846548) | (0.0846548) |

<table>
<thead>
<tr>
<th>Year dummies</th>
<th>NO</th>
<th>NO</th>
<th>NO</th>
<th>YES</th>
<th>NO</th>
<th>NO</th>
<th>YES</th>
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<tbody>
<tr>
<td>R-squared</td>
<td>0.0539</td>
<td>0.3874</td>
<td>0.4565</td>
<td>0.5315</td>
<td>0.3779</td>
<td>0.4184</td>
<td>0.5002</td>
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</table>

| Constant     | 46.88525 | 33.20363 | 34.79726 | 28.76981 | 15.11507 | 10.44295 | 6.23601 |
|             | (0.0002) | (0.0005) | (0.0000) | (0.6787) | (332) | (325) | (316) |

| No. of obs   | 332 | 325 | 316 | 316 | 316 | 316 | 316 |

Note: All regressions performed with cluster-robust standard errors, statistical significance is denoted *p<0.1, **p<0.05, ***p<0.01
<table>
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<th>TABLE A:III OLS REGRESSIONS</th>
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<tr>
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</tr>
<tr>
<td></td>
<td>(1)</td>
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<td>(3)</td>
<td>(4)</td>
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<tr>
<td>Gini</td>
<td>-0.1675453</td>
<td>2.196222**</td>
<td>2.157826**</td>
<td>1.595307*</td>
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<tr>
<td>Gini^{c}</td>
<td>0.0001943</td>
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<td>-0.0372724**</td>
<td>-0.0273349*</td>
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<tr>
<td>(0.0202666)</td>
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<td>(0.0167573)</td>
<td>(0.0148755)</td>
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<td>-0.416193*</td>
<td>-0.2270803*</td>
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<tr>
<td>(0.1333776)</td>
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<tr>
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<td>-0.4295732***</td>
<td>-0.3470243***</td>
<td>-0.4663304***</td>
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<tr>
<td>(0.0999652)</td>
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<td>0.3215556**</td>
<td>0.2533733**</td>
<td>0.3332017**</td>
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<tr>
<td>(0.0877224)</td>
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<td>ΔReal house</td>
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<td>0.6547602***</td>
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<td>0.6657699***</td>
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<td>(0.0719528)</td>
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<td>0.1344442*</td>
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<td>(0.0795285)</td>
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Year dummies: NO, NO, NO, YES, NO
Breusch-Pagan: 0.2832, 0.0000, 0.0000, 0.0000, 0.0000
R-squared: 0.7403, 0.4096, 0.4107, 0.4802, 0.4107
No. of obs: 332, 325, 316, 316, 325

Note: All regressions performed with robust standard errors, statistical significance is denoted
*p<0.1, **p<0.05, ***p<0.01
<table>
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Year dummies NO NO NO NO
R-squared 0.4560 0.4440 0.5583 0.4957
Constant 7.982811 13.26064 67.2601 20.77024
Hausman-test 0.4338 0.0015
No. Of obs 132 132 160 160

Note: All regressions performed with cluster-robust standard errors, statistical significance is denoted *p<0.1, **p<0.05, ***p<0.01