The income gap between two groups belonging to the same generation, as evidenced in the rise in top-income shares observed over the last decades, may affect lower income groups preferences over different types of goods and their attitude towards debt. Following John Maynard Keynes in *A Treatise on Money* (1930), the needs of human beings fall into two classes: “those needs which are absolute in the sense that we feel them whatever the situation of our fellow human beings may be, and those which are relative in the sense that we feel them only if their satisfaction makes us feel superior to our fellows”. The observed boom in consumption in periods of increasing inequalities may be partly explained by individuals keeping up with the Joneses on visible consumption, which also tend to be more durable. I set up a simple two-periods life-cycle/permanent income model with credit and income heterogeneity between a reference and a reference-dependent group. I show under which conditions a “borrowing for status” effect exists in partial and general equilibrium. Financial innovations, modeled as an exogenous fall in interest rate, will have an ambiguous impact depending on the possibility to substitute between relative and absolute needs.
# Contents

1 Introduction 3

2 Literature Review 5

3 Stylized Facts 10

4 The Model 15
   4.1 Preferences and technology 15
   4.2 Costly Financial Intermediation 18
   4.3 Borrowing for Status in the Single-Good Case 21
   4.4 Substitution Between Absolute and Relative Needs 28

5 Econometric Analysis 32
   5.1 The Data 32
   5.2 Econometric Methodology 34
   5.3 Results 35

6 Conclusion 37

7 Annexes 42
1 Introduction

“A house may be large or small; as long as the neighboring houses are likewise small, it satisfies all social requirement for a residence. But let there arise next to the little house a palace, and the little house shrinks to a hut.”

Karl Marx, Wage, Labor and Capital, 1847

“Our standard of decency in expenditure, as in other ends of emulation, is set by the usage of those next above us in reputability; until, in this way, (...) all canons of reputation and decency, and all standards of consumption, are traced back by insensible gradations to the usages and habits of thought of the highest social and pecuniary class: the wealthy leisure class.”

Thorstein Veblen, The Theory of the Leisure Class, 1937

“The political response to rising inequality whether carefully planned or an unpremeditated reaction to constituent demands was to expand lending to households, especially low-income ones (...) Cynical as it may seem, easy credit has been used as a palliative throughout history by governments that are unable to address the deeper anxieties of the middle class directly.”

Raghuram G. Rajan, Fault Lines, 2010

The 2008 financial crisis preceded a period of almost three decades of increasing leverage of the financial sector and households, mostly driven by a rise in mortgage debt. This period also saw a rapid development of financial innovations seriously widening the access to credit on durable goods for middle and lower income households. As pointed out by Atif Mian and Amir Sufi in a 2009 article, this could also describe the period preceding the Great Depression: “The form of innovation was not subprime mortgages - it was instead installment loans related to automobile purchases and other consumer durables - but the parallels are striking. Household debt for Americans went over 100 percent of GDP only twice in the last century; in 1929 and in 2006.” Paraphrasing Carroll (2000a) “why do the rich save so much?”, one could ask in return “why do the poor borrow so much?”.

Mian and Sufi (2009) do not emphasize that a similar upward trend in income inequalities also characterized both periods. This article provides an interpretative framework to the joint effect of income inequalities and financial innovations on households’ debt dynamics when status considerations are at play. More specifically, it aims at understanding why low-income and middle-income households who did not experience a fall in real income still engaged in high levels of leverage.
When it comes to households’ debt, the impact of financial innovations and income inequalities has often been considered separately. Adding from previous attempts to explain these trends, the article takes from the literature on consumption habits and social preferences in the utility function, in particular Kolm (1995) or Bowles and Park (2005, 2011).

In *The Great Transformation* (1944), Hungarian political economist Karl Polanyi writes: “man only acts so as to safeguard his social standing, his social claims, his social assets. He values material goods only in so far as they serve this end.” Debt should not only be viewed as “insurance” for lower income groups or extra income for higher income groups. It allows middle and low-income households to conform to the more unequal society they are living in and maintain their relative social status (Veblen effect or Duesenberry’s “demonstration effect”). Adam Smith’s notion of “the ability to appear in public without shame” could very well apply to the run towards home ownership for middle-income and low-income households over the years of sustained increase in income inequalities. Quoting Adam Smith in *Wealth of Nations*: “by necessaries, I understand not only which are indispensably necessary for the support of life, but what ever the customs of the country renders it indecent for creditable people, even the lowest order to be without.” An interpretation based on John Rawls’ concept of primary goods extended to social status or Amartya Sen’s “capabilities” may also justify our notion of “debt for status”. In a world with rising between-groups inequalities, extending access to credit through the promotion of financial innovations can be seen as an answer to the fall in relative social standard of those households who do not benefit from the income rise. It may reduces the willingness to borrow for reasons of relative deprivation at the cost of increasing debt for standard consumption smoothing reasons.

We propose a two-periods life-cycle model of heterogeneous agents (low-income versus high-income household groups) allowing for pecuniary emulation as defined by Thorstein Veblen in *Theory of the Leisure Class*. Households consume two kinds of goods: standard and status goods, which also tend to be more durable (visible). In our model, social status externalities are endogeneously determined and interact with financial frictions in the banking sector. To our knowledge, this would be the first attempt to account for the possibility of social (other-regarding) preferences in the modeling of agents utility function when it comes to the interconnections between households’ debt, durability and financial innovations. We then test empirically the intuitions of our model using a cross-country panel data regression with country and year fixed effects. Our dataset covers the period going from 1960 to 2007 for 17 developed countries.

1Namely: Australia, Canada, Denmark, Finland, France, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, United Kingdom, United States
2 Literature Review

This article borrows from three different strands of the economic literature: the literature on income inequality and households’ debt, the literature on social status preferences and the financial frictions literature. The recent and growing literature on the relationship between inequalities and the rise in households’ debt has been grounded on two distinct definitions of inequality: **within-group** and **between-groups** inequality. The vast majority of studies on households’ debt has been focusing on within-group inequality, also called inter-temporal inequality (Krueger and Perri, 2006; Iacoviello, 2008). In these studies, inequalities are modeled as transitory income shocks affecting households over time, or standard deviation of log-wages. These models are in line with the life-cycle/permanent income hypothesis. Krueger and Perri (2006) were the first to clearly evidence that the increasing income inequalities observed in the US did not materialize in higher consumption inequalities precisely because households were also borrowing more. In their model, representative agents maximize a standard neo-classical utility function. Higher volatility of individuals’ base income leads to an increase in debt as agents smooth consumption over time. Debt is seen as insurance. In this context, financial innovations are welfare increasing on the grounds of higher consumption smoothing and insurance against idiosyncratic income shocks. Iacoviello (2008) also considers within-inequality. He assumes an unexpected fall in income relative to past experiences of income growth, but contrary to Krueger and Perri (2006), he accounts for heterogeneity in the household sector. The author uses a dynamic general stochastic equilibrium (DGSE) model to replicate the trend and cyclical behavior of households’ debt. The income shocks are designed to match the observed trend in income inequalities. Contrary to Barnes and Young (2003), who do not specifically account for income inequality, his calibrated model can reproduce the observed trend in households’ debt.

However, the definition of inequality used in these studies may not be appropriate. Following Ranciere and Kumhof (2010), it is unclear to what extent the observed rise in income inequalities over the last decades actually corresponds to within-group inequality. If households have been facing a higher volatility of base income on average, the distribution of income between different income groups has also substantially changed. The significant rise in between-groups (intra-temporal) inequality over the last three decades has been evidenced by the income share rise of the top ten percent richer, an increase mostly driven by the top five percent and top one percent of the income distribution (Atkinson, Piketty and Saez, 2011). At the same time, this sharp increase has been associated with almost stagnant (or falling) real wages and salaries for middle and low-income households. Nonetheless, these households did not consume less as they made a much bigger use of
credit than before. Following Ranciere and Kumhof (2010), Kumhof et al. (2011) but also Rajan (2010) and Reich (2010), this paper contributes to the recent strand of the economic literature on between-group inequality as it questions the effect of a *ceteris paribus* rise in income of the wealthier groups on the demand for credit of the lower income groups from the same generation.

In their model, Ranciere and Kumhof (2010) consider two groups representing the top stratum and the remainder of the income distribution. The first group of agents corresponds to investors, whose share represents five percent of the population. They derive utility from consumption (with a group specific subsistence level of consumption) and wealth, as in Carroll (2000a). Their income rises with the supply of loans they provide to the 95 percent workers in the economy. Workers’ utility is also a function of consumption and a subsistence level of consumption. The key transmission channel from inequality to households’ debt has to do with the lenders capacity to lend more when their bargaining power increases. Investors use part of their higher income to purchase additional financial assets backed by loans to workers. Workers’ reduced bargaining power drives down real wages. To match their subsistence level of consumption, workers only option is to increase borrowings. In Ranciere and Kumhof (2010), a critical role is thus attributed to an exogenous change in bargaining power and the “sharing of the pie” between two groups: when the rich becomes richer, the poor becomes poorer and vice-versa.

We propose another transmission channel than Ranciere and Kumhof (2010): rising inequalities leads to higher debt ratios for lower-income households due to relative social status externalities, i.e. even in the absence of shocks on households’ own permanent income. As recalled by Clark and al. (2008), income may be evaluated relative to others (social comparison) or to oneself in the past (habituation). While within-groups inequality may correspond to habituation as in Iacoviello (2008), we believe social comparison better accounts for between-groups inequalities. It remains hard to understand why the 95 percent workers would be willing to consume and borrow so much if their income remains steady over time or if they cannot expect their future income to rise. A saving shock and the following fall in interest rates may explain this apparent paradox. Financial innovations in the banking sector should therefore be considered. We can think of falling interest rates and financial innovations as “supply side effects”. If we account for these effects in our model, they can hardly explain the long-run sustainability and social consensus - at least until the recent financial crisis - necessary to justify the extension of credit to low-income households (“demand side effects”). In Carroll (2000a), a case is made against the standard Life Cycle model of savings and consumption for the upper tail of the wealth distribution. The proposed model (called “Spirit of Capitalism”) assumes consumers “regard the accumulation of wealth as an end in itself”, meaning “unspent wealth may also yield a flow of services (such
as power or social status). The “wealth in the utility function” generates higher saving rates for the rich than in standard Life-Cycle models. In this article, the proposed utility function generates higher borrowings for the poor. Paraphrasing Carroll’s 2000 article “why do the rich save so much?”, we ask in return “why do the poor borrow so much?”

This article thus borrows from the literature on consumption externalities and social status preferences. The theoretical literature on these questions is large. Clark and al. (2008) theoretically discussed the Easterlin “paradox” with the inclusion of relative income terms in the utility function. They also review various types of social status based utility functions used in this literature. In recent years, there has been a growing number of studies dealing precisely with the modeling of social preferences and how it may affect the optimal saving (or borrowing) choices of agents: Rayo and Becker (2006), Alonso-Carrera and al. (2008), Badarinza (2011), Roussanov (2011) or Gruber (2012). Considerations for social status relate to some extent to envy, a social sentiment extensively studied in Kolm (1995). However, to the notable exception of Bowles and Park (2005), Alonso-Carrera and al. (2008) or Seung-Yun and al. (2012), this literature does not directly account for income inequalities and the reference level of consumption is often assumed to be exogenous. One contribution of our model is to endogenize the consumption level of reference as it directly results from the wealthier income groups level of consumption and savings. While in Badarinza (2011) the income distribution does not affect the social status externality as the reference levels are symmetric between groups, in our model, the saving decisions of the high-income groups and the equilibrium level of interest rate is ultimately influenced by the consumption externality. In Abel (2005), the reference level is made endogenous but the model assumes representative agents and the impact of income inequality is not addressed. Knell (1999) shows how relative standing in the utility function aggravates the negative impact of inequality on saving rates and growth. Using a two-periods OLG model, he shows that if individuals have a higher concern for present than for future relative standing and if their reference group corresponds to people wealthier than themselves, higher inequalities lead to lower growth. However, Knell (1999) does not allow for negative asset holdings and the definition of the reference levels remain exogenous. Besides, in his article as in most articles featuring positional or consumption externalities in a multi-period model, the key assumption to get an effect on savings rely on assumed differences in the intensity of the Veblen effects across generations. It is shown in this paper that one does not need to assume such differences if the Veblen goods are also more durable or in the presence of a wedge between the interest rate of the reference and of the reference-dependent group.

Rayo and Becker (2006) model a utility bias in favor of conspicuous goods in
terms of durable (visible) goods, with an explicit reference to social comparison: “The purchase of many visible goods such as cars, boats, home appliances, jewelry, and electronic equipment appears to be motivated, at least in part, by a desire to advance in the social ranking.” In their model, the mechanism linking social status to excessive borrowing also assumes more visible goods tend to be more durable. The “status race” leads to an increase in durable goods over non-durable goods and consumption smoothing implies higher borrowing. However, Rayo and Becker (2006) do not model the effect of rising inequalities, i.e. the effect of a ceteris paribus increase of wealth for some on the consumption behavior of others. Their approach is close to ours as it directly refers to Veblen goods but the authors completely neglect the “leisure class” aspect of Veblen’s argument - yet at the root of Veblen effects and conspicuous consumption - i.e. the fact that it is through the constitution of such a group ex ante that the conditions for social status competition materialize. Furthermore, this model is unlikely to explain the rapid rise in households’ debt ratio in most developed countries over the last decades. First because it predicts that a higher level of borrowing is generated by a general increase in wealth. This general increase did not materialize over the period studied. Quite on the contrary, developed economies experienced a lower average growth rate than during previous periods and the growth was mostly captured by high-income groups. Second, because it implies that the durable goods channel suddenly played a much bigger role than before, and for mysterious reasons.

Accounting for these criticisms, our approach proposes a mix between the literature on social comparison (with an endogenously determined consumption level of reference) and IMF Chief Economist R. Rajan’s claim that “an important political response to inequality was credit expansion, which allowed people the consumption possibilities that their stagnant income otherwise would not support.” (Fault Lines, 2010). There is recent micro data evidence on the link between the political argument in favor of financial deregulation, in particular the “financialization” of the household sector, and income inequalities. Using detailed ZIP code data, Mian and Sufi (2009) show that income and financial innovations in the form of mortgage credit growth were negatively correlated in the period preceding the crisis. In particular, subprime mortgages, which allowed low-income households to borrow at lower interest rates than what should have been the case, occured in counties were the relative income growth was declining the most. Their results tend to confirm the relationship between income inequalities and financial innovations in the years preceding the crisis. A political economy argument is tested in Mian and

\[2\text{Atkinson, Piketty and Saez (2011) evidenced that from 1978 to 2007, the average growth of real income for the bottom 99 percent in the US reached 0.6 percent only, and 1.2 percent including the top 1 percent. And as recalled by Saez (2012), top 1 percent incomes captured slightly more than half of the overall economic growth of real incomes per family over the period 1993-2010.}\]
al. (2010). They show that subprime mortgage lenders and borrowers greatly influenced government policy toward housing finance during the subprime mortgage credit expansion. This is also Rajan’s argument in *Fault Lines*: rising inequalities forced the government to extend credit rather than to address the inequality issue directly. In modeling the inter-connections between financial innovations and social status preferences, this article provides a formal rationale to the claim that financial innovations (and economic policy more generally) may crowd out social preferences (Bowles and Polania-Reyes, 2012).

The sharp rise in households leverage, mostly driven by consumption of durables (especially housing) was made possible by the development of mortgage-backed securities and other innovative lending products offering higher returns but presenting higher risks. A quasi-simultaneous rise has therefore been observed between the unregulated shadow banking system evidenced by Poznar et alii (2010) and the surge in households’ debt. Our model therefore accounts for the role of financial intermediaries between high-income investors and low-income households played by the banking sector since the late 1990s. We borrow from the literature on costly state verification and asymmetric information, in particular Bernanke and Gertler (1989). Borrowers must be monitored by a bank as they may lie about their true financial conditions. This generates a gap between the borrowing and saving interest rates and an external finance premium increasing in credit demand. Financial innovations correspond to an exogenous fall in the bank’s monitoring cost, as the development of new products allow the bank to shift default risk towards other agents (governments, insurance corporations...) and to be less rigorous on the monitoring side. The role played by careless brokers prior to the subprime crisis illustrates this argument. Using a different model but accounting for households’ heterogeneity, Mehra, Piguillem and Prescott (2011) justify the difference between lending and saving interest rates in the same fashion as we do, except that they assume an exogenous intermediation cost, proportional to the amount of borrowing and lending between households, while we derive it from a simple costly state verification problem. In their model, households’ heterogeneity (besides endowments) comes from differences in the strength of preferences for bequests rather than social status preferences. Badarinza (2011) is probably closer to our own approach as he also studies the joint effect of the relaxation of agent’s collateral constraints and social status externality on the steady state level of the loan-to-value ratio. However, while he assumes a collateral constraint which depends on labor income and a real stock of durable goods, in the proposed model, the inter-connections between social status and credit constraint come from an (exogenous) systemic crisis risk and agent’s positive probability of default.
3 Stylized Facts

In this section, we present some important stylized facts on households’ debt, income inequalities and consumption habits that justify our simplifying assumptions in the modeling section.

Empirical evidence on the link between increasing between-group inequality and aggregate households’ debt can be found in Ranciere and Kumhold (2010) and Badarinza (2011). They calibrate their model for American data. However, they do not test their results econometrically. Our own cross country sample of developed economies seem to confirm these previous results. As figure 1 illustrates, there is a positive cross-country correlation (of almost 0.50) between changes in top income shares and changes in private debt among OECD countries between 1980 and 2000. The countries which experienced the highest increase in top 1% and top 5% percent income shares are also those for which private debt rose the most. Since the late 1990’s, several Northern or Continental European countries, traditionally more equalitarian than others, are also experiencing an increasing level of income inequality driven by the higher percentile of the income distribution, even though they have comparatively lower absolute levels of income concentration for top-income shares than Anglo-Saxon countries. These are also countries that experienced a major rise in private debt, mostly driven by home mortgages (in particular Portugal, Finland, Norway or Denmark).

The credit booms of these countries were mostly driven by housing booms, i.e. the kind of visible (Veblen) goods which Rayo and Becker (2006) refer to as an explanation for higher borrowings. Frank (2003, 2008) also refers to housing as a typical positional good and provides evidence for the link between housing prices and positional externalities. The influence of durable goods on life-cycle consumption behaviors has been studied, for instance in Fernandez-Villaverde and Krueger (2011), but no argument has been made on the status component of durable goods. Figure 2 shows shows that the variation in median housing size in the US between 1974 and 2007 follows the same trend as the variation in the five percent top-income share, with a lag of one or two years. Controlling for variations in median income, home price index and access to credit, the regression coefficient on top five percent income share remains positive and highly significant.

Precise cross-country data on household leverage and saving rates across the income distribution is not easily available. However, a few studies confirm that

---

3 See also OECD 2011 report “Divided We Stand: Why Inequality Keeps Rising?”: “The latest trends in the 2000’s showed a widening gap between rich and poor not only in some of the already high inequality countries like Israel and the United States, but also for the first time in traditionally low-inequality countries, such as Germany, Denmark, and Sweden (and other Nordic countries), where inequality grew more than anywhere else in the 2000’s.”
the higher levels of households’ debt observed in developed countries have mostly been driven by lower-income groups. In contrast to Maki and Palumbo (2001), who show that the fall in American saving rate was driven by the top 20% of the income distribution, Crossley and O’Dea (2010) has shown that from 1975 to 2007, the top quintile median saving rate in the United Kingdom increased while the bottom quintile decreased. Bibow (2010) reports new evidence for the top 5% richest personal saving rates in the United States too. It is shown to have increased dramatically between 2001 and 2007: from an average rate of 12.5% before 2000 to 20% of disposable income in 2007. In comparison, the bottom 40% households of the income distribution experienced a constant fall in their saving rate since the early 1990’s, with an average level of 5% in the 1990’s and reaching negative values between 2000 and 2007.

Based on the US Survey of Consumer Finance, figure 3 shows the evolution between 1989 and 2007 of the debt ratio for various income percentile groups. The debt ratio of the ten percent richer remained stable while the middle-class and twenty percent poorer households’ debt ratio skyrocketed. In Figure 4, we regress the share of total income for five income percentile groups\(^4\) to the debt ration of each of these household group between 1989 and 2007. This figure illustrates the negative effect on household debt of a decrease in one’s relative income. The correlation is negative with a coefficient of -0.20: a 1% decrease in one’s relative income share corresponds to a 0.2% percent increase in one’s debt ratio. If we trust this figure, a fall in the top 90% income share should generate higher domestic borrowings on average, as the bottom 90% households gather an overwhelming share of total domestic households’ debt.

---

\(^4\)As referenced in the US Survey of Consumer Finance: the second decile, between the second and fourth decile, between the fourth and sixth decile, between the sixth and eighth decile, between the ninth and tenth decile and the tenth decile
Top-income households are essentially savers while lower-income ones spend the major part of their disposable income. Low-income households also tend to borrow more in their first periods of life. Based on the Survey of Consumer Finances (SCF), Carroll (2000a, 2000b) compare the top 1% wealth over permanent income ratio to the median household’s ratio. He shows that the richest SCF households own enormously more wealth in relation to their permanent income: the ratio for the top 1% is 40 at age 60 versus a small 6 for the median household at same age. Atkinson, Piketty and Saez (2011) also argue that contrary to a previous study by Piketty and Saez (2003), the literature has recently shown that the increase in top income shares observed since the 1980’s is not only due to a surge in top wage incomes (the “working rich”), but came from an increase in capital income too. In some countries, top-income capital returns became relatively more important than labor returns relative to the post-WWII period, namely Finland, Australia or the United Kingdom. Besides, data on inheritance also show inherited income has increased substantially over the last decades in countries like the US of France, as evidenced by Piketty (2011). These stylized facts justify our choice for the budget constraints in section 4 and our restriction to the study of heterogeneity within generations and not between.

The empirical evidence on how relative positioning in terms of income may affect people’s consumption and utility has been growing. Easterlin (1995) is the probably the benchmark paper in this literature as it first provided evidence for social status positioning in terms of income, pointing out one of the most widely

**Figure 3:** Aggregated Household Debt for Different Income Percentile Groups (in percent of disposable income), American Survey Data (1989-2007)

cited and discussed paradox in happiness economics: “raising the incomes of all does not increase the happiness of all”. More recent and notable contributions include Luttmer (2005) whoidentifies a negative correlation between happiness and the income of neighbours, or Dynan and Ravina (2007) who find that people’s happiness “appears to depend positively on how well their group is doing relative to the average in their geographic area, even after controlling for the level of their own income.” Oishi and al. (2011) show using General Social Survey data from 1972 to 2008 that the negative association between income inequality and happiness held for lower-income respondents, but not for higher-income respondents which indicates that the richest groups are their own reference. More recent econometric studies have identified relative income effects on consumption and debt based on survey data, namely Carr and Jayadev (2012) or Bertrand and Morse (2013). The latter study asks whether rising consumption among (increasingly richer) rich households induces the non-rich to consume more. They clearly identify trickle down consumption effects that account for up to a quarter of the decline in the savings rate over the last three decades. To our knowledge, no cross-country analysis has been performed on this issue, though the importance of social status considerations may vary well vary across countries. I perform such a regression in the last section of the article and the order of magnitude of the effects (top income shares explaining 10% to 20% of the rise in private debt since 1980) seem to be in line with existing survey and calibrated evidence.

Finally, the rise in households debt cannot be disconnected from the deep changes that took place within the banking sector itself. The relationship between
financial intermediaries and the household sector is quantitatively addressed by Mehra, Piguillem and Prescott (2011) who writes: “a large amount of borrowing and lending takes place between households; in the United States in 2007 the number was 1.7 times GDP. Much of this borrowing and lending is intermediated by financial institutions”. Pozsar et al (2010) present the rapid development of shadow banking in the United States and its progressive decoupling from traditional banking at the end of the 1990’s. Two facts are striking enough to be mentioned here: the general increase in the size of the banking sector starting in the early 1990’s (it doubled in size between 1990 and 2007) and the surge in shadow banking in the second half of the 1990’s as it more than tripled between 1995 (5 trillions liabilities) and 2007 (more than 15 trillions). If financial globalization and foreign savings played an important role in this expansion, Bibow (2010) notice its correspondence in time with the boom in home mortgages and consumer credit. Our model accounts for this stylized fact as it introduces a decoupling between the household sector and financial intermediaries, the latter keeping the returns on their monitoring activities.
4 The Model

The model studies the impact of a rise in top-income shares on low-income households debt (“debt for status”). We try to keep it as simple as possible to make it easily tractable. We do not consider the impact on debt of inter-temporal income shocks within households (i.e. within-group inequality), which has already been extensively studied in the literature (“debt as insurance) and restrict our study to the case of inequality between households belonging to the same generation.

In section 4.1 we define the models environment and the agents preferences and technology. Section 4.2 borrows from the literature on costly state verification, namely Bernanke and Gertler (1989), to justify the wedge between borrowing and saving rates of interest. In section 4.3 we derive the optimal savings and borrowings choice of households in the one-good case. Finally, section 4.4 discusses how allowing for substitution between absolute and relative needs may affect our results.

4.1 Preferences and technology

The economy is populated by financial intermediaries and two representative household groups: a reference group and a reference-dependent group. Each individual household in each group is a representative agent of its own group. We should think of financial intermediaries (or banks) as a saving technology: they receive no endowment but get an external finance premium which covers their monitoring cost and insure them against default risk. Their are three sources of heterogeneity between household groups: their endowment, preferences for social status and access to credit. The reference point is derived endogenously from the optimal behavior of the reference group.

The per-period utility $u(c_t, d_t)$ takes a (logarithmic) Cobb-Douglass functional form, as in Hintermaier and Koeniger (2010) or Fernandez-Villaverde and Krueger (2011). This is in line with empirical micro-level evidence on the intra-temporal rate of substitution between durables and non-durables. We introduce a social status externality on visible (durable) goods in both periods. The quest for status can be understood as investing in more visible goods. This is in line with Alpizar and al. (2005) or Rayo and Becker (2006) regarding the relative importance of social status considerations for the consumption of more durable goods. There are at least two ways of introducing status in a utility function. We can follow Abel (1990) or Abel and al. (2005) and define utility of visible goods as the ratio between own consumption and a power function of reference consumption. In that case, the social status externality disappears when the elasticity of substitution between visible and the standard consumption (non visible) goods is one so the functional
form has to be generalized to a CES function. This makes the computation of a closed form solution tedious and not very tractable because it adds an additional source of risk, which is what Piazzesi and al. (2007) call “compositional risk”. Another way is to follow Bowles and Park (2005), Alonso-Carrera and al. (2008) or Seung-Yun and al. (2011) and introduce the externality as the difference between own consumption and reference consumption. This is what we do here:

\[ u(c_t, d_t) = \ln \left[ c_t^\theta (d_t - v\bar{d}_t)^{1-\theta} \right] \]

\( c_t \) and \( d_t \) correspond respectively to standard consumption (non visible) and durable (visible) consumption at date \( t \). Standard consumption goods are used as a numeraire. Non separability implies that the social status externality on visible goods also indirectly affects the marginal utility of non visible goods. The over line letter corresponds to the reference group consumption level of visible goods. In our specification, the intra-temporal marginal utility of visible over standard consumption goods is increasing with the reference level of visible consumption. The “Veblen” coefficient \( v \in [0, 1] \) simply measures the intensity and nature of the social comparison. Rising top-income shares should deprive the social position of those households who do not benefit from the income rise. But in societies where social preferences are more pregnant than elsewhere, the intensity of the Veblen effects \( v \) should be more stringent too. It is important to keep in mind that when they optimize consumption over time, lower-income households are influenced by the present and future consumption habits of the reference group. Therefore, future social status considerations should induce lower and not higher borrowings as households will be incited to save in order to consume more in the future. We also assume social comparison is strictly intra-generational. We can think of the young generation as students or recent graduates. Their consumption choices (university tuition fees, clothes, entertainment activities...) are unlikely to depend on the working age consumers habits (buying a house, paying for a retirement home). Consumption smoothing also implies the reference level when young already results from the inter-temporal optimization of high-income groups.

This is a pure exchange economy: there is no production and each household group is endowed with some units of goods that can be freely traded. For reasons of simplicity and tractability, we restrict attention to a two periods model with exogenous default risk and default penalties\(^5\). The effects evidenced in the two-periods model should not be sensibly different in a continuous time framework. The model asks the following question: what is the borrowing behavior of households in an economy where they care about their present and future relative standing?

\(^5\)This latter assumption will allow us to focus on the role of the agents income in mitigating agency costs rather than on issues of risk-sharing.
within their own generation.

We define the income shares $\alpha$ and $1 - \alpha$ of the two groups (for instance top 5% and bottom 95%):

$$\alpha_t = \frac{y_t}{y_t + \bar{y}_t}$$

Reference dependent households receive some income when young $y_y \leq \bar{y}_y$. They also receive a stochastic labor income when old $y_{o,s} \leq \bar{y}_{o,s}$ and can borrow to finance consumption. In this closed economy, the supply of assets corresponds to the savings of high-income groups and must equal the asset demand of lower-income households.

There can be two states of the world, a good state that happens with probability $\pi$ where there is no crisis and households do not default, and a bad state where households lose their income and must default on their loans. We may think of $\pi$ as a coefficient accounting for systemic crisis risk affecting the economy as a whole but whose effects on the interest rate still differs between groups depending on their initial endowment (collateral), as will be seen in section 4.2. As the discount factor is augmented by the probability of default, restricting the analysis to systemic risk allows us to neglect an additional source of heterogeneity between households, namely idiosyncratic risk, that would result in a difference in discount factors. When the economy is hit by a systemic crisis, low-income individuals do not get any income and must default on their loans when old. If this is the case, their utility when old equals 0. This happens with probability $1 - \pi$. With probability $\pi$, low-income households do not default. Due to the risk of default, lower income households must borrow at a gross interest rate $R$ that is higher than the bank deposit saving rate $\bar{R}$ of the economy. They maximize the following problem:

$$\max_{(c_y, c_o, d_y, d_o)} \ u(c_y, d_y) + \beta \pi u(c_o, d_o)$$
subject to
$$c_y + p_y d_y + a = y_y$$
$$c_o + p_o d_o = y_o + aR + p_o (1 - \delta) d_y$$

The coefficient $\delta$ is the depreciation rate of good $d$. Note that it can also be seen as the level of visibility of the status good: a lower $\delta$ corresponds to a higher level of durability and visibility so the status good is valued more when young than when old: its relative price when young is lower, everything else equal. Status also functions as collateral and we often call this type of status “reputation”. Of course when status is not strictly speaking a good, this collateral cannot be transferred to the creditor if the borrower defaults. But the borrower’s status can be destroyed or ruined. A lower reputation or status implies that the one asking for a favor (or
a loan) will pay a higher interest rate. For a bigger favor (a bigger loan), more status needs to be put as collateral.

Higher income households are also the reference-income group, so their behavior does not depend on any Veblen effect ($v = 0$): following Veblen, the richest define the reference level of consumption, they cannot envy the situation of any other group. They inherit some income $\bar{y}_y$ when young. When old, they also receive the stochastic endowment $\bar{y}_o$. They also consume both types of goods and can save at the economy’s interest rate $\bar{R}$ when young. A financial intermediary intermediates their savings to lower-income groups. With probability $1 - \pi$, higher-income groups receive no income when old and lose their intermediated savings as creditors cannot pay back. As for the reference-dependent households, the loss is such that it is assumed they get no utility when old. The problem of high-income households therefore reduces to this simple maximization:

$$\max_{(\bar{c}_y, \bar{d}_y, \bar{c}_o, \bar{d}_o)} \bar{u}(\bar{c}_y, \bar{d}_y) + \beta \pi \bar{u}(\bar{c}_o, \bar{d}_o)$$

subject to

$$\bar{c}_y + p_y \bar{d}_y + \bar{a} = \bar{y}_y$$

$$\bar{c}_o + p_o \bar{d}_o = \bar{y}_o + \bar{a} \bar{R} + p_o (1 - \delta) \bar{d}_y$$

In this model, we only consider two groups of households. In reality, the individuals belonging to the bottom 20 percent of the income distribution may not compare themselves to the top 1 or top 10 percent richest groups. Still, they compare to those right above them, who themselves compare to the group above. Assuming two groups for the sake of tracability is a simplification that does not affect the logic of the reasoning or the general results I get from the model. An extension of this model with many income groups taking the next richest group as its reference group should generate a downward cascade of Veblen effects and strengthen the magnitude of our results, as argued in Bowles and Park (2005). Besides, in developed economies, lower-income households may not need to observe directly the consumption patterns of higher-income groups to be sensitive to such patterns. Indeed, it has been argued television and advertising itself may target predominantly higher-income groups and contribute to an increase in desired spending for lower-income groups (Cynamon and Fazzari, 2008). It has been shown television is indeed associated with higher debt levels for durable goods, and not with total non-mortgage debt (Baker and Georges, 2009).

4.2 Costly Financial Intermediation

We assume households cannot lend directly to each other. They only have access to a storage technology (bank deposit) which delivers an interest rate $\bar{R}$
corresponding to the economy’s equilibrium market interest rate. Finance in this model is both a service to savers, as it allows them to store their savings more efficiently than keeping it under a mattress, and a way to intermediate funds to borrowers, accounting for the risk of default. We therefore introduce costly financial intermediation, as in Bernanke and Gertler (1989). Introducing a borrowing constraint should not change fundamentally the logic of the argument. Jeske (2005) shows that in life cycle models with durables and heterogeneous agents, a binding borrowing constraint has the same effect on the user cost of durables as a higher interest rate. The bank is risk neutral and intermediates savings to lend to low-income households. It charges a higher interest rate that results from the risk of default of low-income households and the presence of a monitoring cost ("external finance premium").

Households may have an incentive to lie about their true income when old and announce default despite being in a good state. Thus, they must be monitored by a bank to have access to credit. The bank incites borrowers to tell the truth as it charges a cost to borrowers in case they lied.

With probability $\pi$ households receive their income when old and banks get $Rb$. We can see this from the budget constraint of households when old. With probability $1 - \pi$, households default and the bank gets a zero payoff. If the borrowers default, the bank audits the borrowers with a probability $p \in [0, 1]$ at a cost $\gamma \geq 0$. If it turns out the borrower had lied, the bank seizes all his income and he gets 0 utility when old.

We start from the truth telling condition for households. This condition requires that the contract be structured so that the borrower has no incentive to mis-report his income when old. They must be at least better-off not lying than lying. It is assumed the stock of status good when old $(1 - \delta)p_o d_y$ cannot be transferred to the creditor if the borrower defaults, so it cannot be seized by the bank$^6$:

$$y_o - Rb \geq (1 - p)y_o$$

The second-best efficiency means borrowers should be indifferent between both, so we have $Rb = py_o$. Banks must also be indifferent between intermediating deposit to households at the interest $R$ and simply "storing" savings at the economy’s interest rate $\bar{R}$ (no-arbitrage condition). Bernanke and Gertler (1989) show that under the optimal contract, no auditing occurs when state $\pi$ (no default) is announced. Thus, the bank only audits when borrowers declare default. If default is announced but the bank does not audit (with probability $1 - p$), the bank gets 0. When default is declared there is a probability $p$ that the bank audits and pays the monitoring cost even though borrowers did not lie. The no-arbitrage condition thus implies:

$^6$In the case where the stock of durables can be used as collateral, the external finance premium will be endogenous to the choice of durables when young.
\[ \pi(Rb) + (1 - \pi)(-p\gamma) = \bar{R}b \]

Substituting in the truth telling condition, we find the equilibrium level of \( p \) (with \( \pi y_o > (1 - \pi)\gamma \)):

\[ p^* = \frac{(1 + \bar{R})b}{\pi y_o - (1 - \pi)\gamma} \]

Plugging the equilibrium level of \( p \) back in the truth-telling condition, we get:

\[ y_o - \bar{R}b = y_o - \left( \frac{y_o}{\pi y_o - (1 - \pi)\gamma} \right) \bar{R}b \equiv y_o - \lambda \bar{R}b \]

Therefore, \( R \) equals \( \bar{R} \) times a coefficient \( \lambda \geq 1 \). The coefficient \( \lambda \) captures the risk premium due to imperfect information and monitoring cost. It decreases with the borrowers' income as when \( y_o \) increases, the future collateral value of households is higher.

Financial innovations correspond to a fall in the monitoring cost \( \gamma \). Indeed, banks can afford to spend less on monitoring, either because the technology itself is very performing or because they can now shift the risk of default towards other agents (Credit Default Swaps) and better insure against the risk of default. The former explanation may appear to be more in line with the model as we do not model credit insurance companies and other financial brokers. However, a way to reconcile the latter assumption with this single country model would be to assume such entities correspond mostly to a transfer of credit risk towards the rest of the world. In any case, a reduction of \( \gamma \) reduces \( \lambda \) so that \( R \) gets closer to \( \bar{R} \). Finally, it should be noted that financial innovations do not affect the supply of assets and should therefore be distinguished from financial liberalization.

We call \( \omega \) the external finance premium of the financial intermediary sector when there is no default. It simply corresponds to the difference between \( R \) and \( \bar{R} \) times the amount borrowed \( b \), as the bank entirely captures the proceeds of its monitoring activity to compensate for the probability of default:

\[ \omega = (\lambda - 1)\bar{R}b \]

If there is no uncertainty so that borrowers never default (i.e. \( \pi = 1 \)), then \( \lambda = 1 \) and \( \omega = 0 \).
4.3 Borrowing for Status in the Single-Good Case

When $\theta = 0$, there is no trade-off between standard and status consumption goods in households’ consumption choices. The utility function takes the following form:

$$u(d_y, d_o) = \ln(d_y - v\bar{d}_y) + \beta\pi\ln(d_o - v\bar{d}_o)$$

This single good $d$ has a status component captured by coefficient $v$ (when $v = 0$ the good is a standard consumption good) and a visibility (or durability) component $\delta$ (when $\delta = 1$, the good is non durable). We assume an exogenous growth rate $g$ of the economy such that $\bar{y}_o = g\bar{y}_y$ and $y_o = gy_y$. It is assumed growth is equally shared across income groups as we want to abstract from alternative motives for savings and borrowings, namely differences in future income growth and Alfred Hirschman’s famous “tunnel effect”.

From the maximization problem of the reference household group and the intertemporal budget constraint, we derive the reference levels of consumption in both periods as a constant share of permanent income $\bar{Y} = (1 + \frac{g}{R})\bar{y}_y$:

$$\bar{d}_y = \frac{1}{\bar{\phi}} \frac{1}{1 + \pi \beta} \bar{Y} \quad \bar{d}_o = \pi \beta \bar{R} \frac{1}{1 + \pi \beta} \bar{Y}$$

$\bar{\phi} = 1 - \left(1 - \frac{\delta}{R}\right)$ is the user cost of visible goods and lies between 0 and 1. Indeed, for $\bar{\phi}$ to be positive, $R \geq (1 - \delta)$, which is always true$^7$. A more durable good has a higher visibility and so its user cost is lower: it is consumed more when young. Note that an exogenous rise in $\bar{Y}$ does not affect the share of reference income that is spent on durables over time, which is in line with permanent income theory. The reference income group assets when old is defined as:

$$\bar{a} = \left[1 - \frac{g + \bar{R}}{(1 + \pi \beta)\bar{\phi} \bar{R}}\right] \bar{y}_y$$

(1)

It will be shown under which conditions reference-group assets are positive in general equilibrium, which means reference households are indeed savers. We can then think of $\frac{\bar{a}}{\bar{y}_y + \bar{y}_y}$ as the saving rate of the economy. Following the same steps for reference-dependent households’ group, which gives us the following levels of consumption in both periods, with $Y = (1 + \frac{g}{R})y_y$:

$^7$The user cost of visible goods for lower-income group also lies between 0 and 1
\[
\begin{align*}
\bar{d}_y &= \frac{1}{1 + \pi \beta \phi} Y + v \frac{\pi \beta}{(1 + \pi \beta)^2} \left[ \phi - \frac{1}{\phi \lambda} \right] \bar{Y} \\
\bar{d}_o &= \pi \beta R \frac{1}{1 + \pi \beta} Y - v \pi \beta R \frac{1}{(1 + \pi \beta)^2} \left[ \phi - \frac{1}{\phi \lambda} \right] \bar{Y}
\end{align*}
\] (2) (3)

**Proposition 1:** In the presence of credit frictions, between groups inequality raises consumption when young but make it fall when old. A higher durability of consumption amplifies these two effects.

The analysis of the Veblen externality reveals the presence of two opposite forces. A rise in the permanent income of the reference group will increase reference-consumption when young and when old. The rise in \(\bar{d}_y\) positively affects reference-dependent group’s willingness to consume when young but the rise in \(\bar{d}_o\), i.e. the prospect of living in a society where the old will also be richer, has the opposite effect. The relative importance of these two effects depends on the heterogeneity between the two groups when it comes to the access of credit. This can be better understood looking at the modified inter temporal Euler equation of the reference-dependent group:

\[
d_y = \frac{1}{\pi \beta \phi R} \bar{d}_o + \frac{v}{1 + \pi \beta} \left[ \bar{d}_y - \frac{1}{\pi \beta \phi R} \bar{d}_o \right]
\]

The first part is the standard Euler equation which tells us about the consumer optimal consumption plan: consumption today must equal the present value of future consumption. The second part of the equation is the social status externality: it will be positive or negative depending on whether present status is valued more or less than future status. Since \(\lambda \geq 1\), the present value of future consumption is lower for the reference-dependent group than it is for the reference group. For the latter, its optimal consumption plan implies a higher consumption of \(\bar{d}_y\) than what would be optimal for the reference group to consume if he was in the other group’s shoes. The social status motive for consumption essentially depends on how the reference-dependent group smooth consumption relative to the reference group. Financially constrained household group should put more weight on consumption when old than on consumption when young due to higher borrowing costs. This is the reverse for the reference group. Therefore, reference-dependent group will put an additional weight on present consumption to keep up with the Joneses: this gives rise to an inter-temporal Veblen effect which raises consumption when young. The effect is stronger for more visible status goods. Indeed, the more visible the social status good is, the higher will be the incentive for reference-dependent groups to compensate for a higher level of reference consumption when young.
In the absence of any credit heterogeneity, households from different groups smooth consumption in the same way: lower-income households can fill the status gap simply by borrowing until their marginal utility of status consumption today equals the discounted marginal cost of loans in terms of tomorrow’s status consumption. The benefit of higher status when young is exactly offset by the expected loss of status when old: the social status motive for consumption disappears. Financial innovations therefore have the paradoxical effect of reducing the influence of top income shares on consumption. In the absence of any frictions, i.e. when \( \lambda = 1 \), the externality disappears. The following proposition can thus be derived:

**Proposition 2:** In the presence of credit frictions, between groups inequality generates a borrowing bias for the reference-dependent group which increases with the durability of the good. Financial innovations crowd out social preferences: it reduces the willingness to borrow for reasons of relative deprivation at the cost of increasing debt for standard consumption smoothing reasons.

The reference group assets between young age and old age are defined as:

\[
a = \left[ 1 - \frac{g + R}{(1 + \pi \beta)R} \right] y_y \left[ \frac{\lambda}{1 - \frac{1}{\phi \lambda}} \right] \left[ (1 + g) \bar{R} \right] y_y \]

(4)

For reasons developed above, the externality on “borrowings for status” is always positive and it unambiguously falls with financial innovations \( \gamma \). Indeed, a fall in the monitoring cost of financial intermediaries reduces the lower-income group borrowing rate, increasing the possibility to borrow for standard consumption smoothing reasons. Since the present value of income goes up, the consumption of social status goods rises when young. As lower-income group gets closer to the reference level when young, financial innovations reduces the Veblen externality. Again, what really matters here is the heterogeneity between the two groups when it comes to the access to credit. To see this more clearly, when status goods have no long term visibility in the sense that they cannot be used when old to finance consumption \( (\delta = 1) \), the reference-group savings simplifies to:

\[
a = \left[ 1 - \frac{g + R}{(1 + \pi \beta)R} \right] y_y \left[ \frac{\lambda}{1 - \frac{1}{\lambda}} \right] \left[ (1 + g) \bar{R} \right] y_y \]

(5)

The “borrowing for status” term therefore only depends on the wedge between the borrowing and the saving rate \( \lambda \). The wedge between the interest rates of the two groups prevents the lower-income group to borrow so as to keep up with the higher-income group consumption levels and match his marginal utility loss of relative deprivation when young. This intuition would not change in a setup
where both groups can borrow when young and where the borrowing interest rates are determined in the same fashion as the one described in section 4.2. Indeed, if households have different income the borrowing rates will differ. The effect of financial innovations on the fall in interest rate will be higher for lower-income group than for the higher-income group so that as $\gamma$ falls, both rates get closer to each other. In the absence of credit frictions ($\pi = 1$ and $\lambda = 1$), i.e. when households cannot default on their debt so that interest rates are strictly the same across households’ groups, the externality term disappears, regardless of the visibility of the status good. Reference-group savings therefore reduce to the standard case:

$$a = \left[1 - \frac{g + R}{(1 + \beta)\phi R}\right] y_y$$

(6)

The magnitude of the partial equilibrium effects described and the existence of a “borrowing for status” solution will depend on the equilibrium level of the interest rate. We thus solve for the general equilibrium. The equilibrium interest rate $\bar{R}$ must be such that the total value of net expected assets for financial intermediaries equals 0. There are only two extreme states of the world (full default and no default) and when default is expected there is no intermediation whatsoever since households only maximize utility when young. This makes the balance sheet of financial intermediaries very straightforward: the amount of net intermediated assets ($\bar{R}a + Ra$) plus the external finance premium $\omega = (\lambda - 1)\bar{R}a$ must equal 0. Rearranging, it gives this simple equality condition:

$$a + \bar{a} = 0$$

Notice that in the proposed setup, would financial intermediaries redistribute the proceeds of their monitoring activities to higher-income households through their budget constraint, there would be no wedge in general equilibrium between the saving rate and the borrowing rate as higher-income groups would internalize the above condition so that $\bar{R}a + \omega = Ra$. In general equilibrium, the result would be equivalent to the no default case, i.e. when there is no default risk ($\pi = 1, \lambda = 1$) in the sense that interest rates are identical for both income groups. In both cases, the social status externality disappears, despite households’ heterogeneity in social status preferences. We find the following equilibrium condition for $R^*$ when there are no credit frictions:

$$\bar{R}_{NF}^* = \left[\frac{1 + (1 + \beta)(1 - \delta)}{\beta}\right] g$$

(7)
This is the standard equilibrium condition when consumption is durable. At this equilibrium, there is no borrowings and no savings in the economy. Indeed, since there is no heterogeneity in the consumption of durable goods and both income groups experience the same increase in income, they discount the future at the same rate.

In the presence of frictions, but when status is not visible next period ($\delta = 1$), the equilibrium condition for $R^*$ is the following:

$$ R^*_P = \left[ \frac{\alpha + \lambda \tilde{\alpha} + v \frac{\pi \beta}{1+\pi \beta} (\lambda - 1) \tilde{\alpha}}{\lambda \pi \beta - v \frac{\pi \beta}{1+\pi \beta} (\lambda - 1) \tilde{\alpha}} \right] g $$

(8)

This allow us to derive the following proposition:

**Proposition 3:** In general equilibrium, a “borrowing for status” solution emerges when $v \tilde{\alpha} > \alpha$, i.e. when the reference income group’s share weighted by the status share of consumption is higher than the reference dependent group’s income share. When this condition is met, financial innovations always reduce the “borrowing for status” motive.

In other words, if half of what people consume corresponds to conspicuous consumption, the reference group must be at least twice richer than the reference-dependent good for status to influence savings. This is irrespective of the growth rate of the economy, assuming income growth follows the same trend. This condition always verifies when $v = 1$, i.e. for pure status consumption, unless the two groups have the same share of total income. In this case, we are back to the no intermediation equilibrium. More generally, it means that the social status externality, captured by the product of $v$ and $\tilde{\alpha}$, must be sufficiently large to offset the negative impact of financial frictions on the reference dependent group’s borrowings. Indeed, in general equilibrium, financial frictions creates a saving motive for reference-dependent households who face a higher interest rate than the other households. Financial innovations reduces the saving motive but also lowers the “borrowing for status” motive. When $v \tilde{\alpha} > \alpha$, the second effect dominates the first effect so that when $\lambda = 1$, $a = \tilde{a} = 0$. All these results still hold when we allow for durability of the status good, as shown in the calibration exercise.

In the more general case where both durability and credit frictions are at play, the equilibrium interest rate must be derived from the following quadratic

---

8For non durable goods, i.e. $\delta = 1$, the interest rate follows the standard condition as it strictly equals the discount factor $\frac{1}{\beta}$ times the growth rate of the economy.
equation:

\[
\left[\pi \beta \lambda + v \frac{\pi \beta}{1 + \pi \beta} (\lambda - 1) \bar{\alpha}\right] R_F^2 - \left[\alpha + \lambda \bar{\alpha} + v \frac{\pi \beta}{1 + \pi \beta} (\lambda - 1) \bar{\alpha}\right] g R_F^* \\
= (1 - \delta) \left[\lambda (\bar{\alpha} + \pi \beta) + \alpha + \pi \beta\right] R_F^* - (1 - \delta) [g + (1 + \pi \beta)(1 - \delta)] \tag{9}
\]

We solve for the general equilibrium for consistent values of our parameters. Table 1 presents the benchmark calibration of model parameters based on the existing literature. In particular, following Alpizar and al. (2005) we fix a value of 0.5 for the veblen coefficient \(v\), as they show with survey-experimental methods that the median degree of positionality is between 0.25 and 0.5, and between 0.5 and 0.75 for cars and housing. The saving and borrowing rates derived from this very simple model provides an indication regarding the level of borrowing and saving a closed economy with shared income growth would face in the presence of social status externalities on consumption. The figures below illustrate the propositions developed in the one-good case.

When \(v = 0.5\), proposition 3 requires the reference group’s income share to be higher than two third for a “debt for status” general equilibrium to exist. A more unequal society will experience a rise in its level of borrowing for status, as shown in figure 5: the reference households increase their savings so the red curve shifts to the left and borrowings for status increases so that the blue curve shifts to the right. The borrowing for status rate (and resulting saving rate) evolve between 0 and 6% of national income for a range of credible values of our parameters.

Figure 6 shows the effect of financial innovations. This negative effect of financial innovations on debt only verifies when \(\alpha < v \bar{\alpha}\), otherwise the consumption smoothing effect dominates and the effect is positive, as can be seen in the extreme case where \(\alpha = v \bar{\alpha}\).

Figure 7 shows what happens when the durability of status consumption increases. In the presence of credit frictions, equation (6) implies durability now increases the Veblen externality on borrowings. A more durable status good corresponds to a lower user cost of status for both household groups, which will lead to a fall in reference group savings (the red curve shifts to the right) and a rise in low-income borrowings for standard consumption smoothing motives. The rise in borrowings will be lower than the fall in savings since low-income households face a higher interest rate, but this lower rise is exactly compensated by a rise in borrowing for status (the blue curve shifts to the right). Overall, in general equilibrium, durability will increase the equilibrium interest rate of the economy but “borrowing for status” will remain unchanged.
Figure 5: Effect of rising between-group inequality on “debt for status”

Figure 6: Effect of financial innovations on “debt for status” when

Figure 7: Effect of an increase in durability on “debt for status”
4.4 Substitution Between Absolute and Relative Needs

In the previous section, the importance of absolute needs compared to relative needs in households’ consumption basket could not be assessed, along with their respective contribution to the rise in household debt (we can think of consumer credit versus mortgage debt). We therefore consider an economy where households can choose between standard and status (durable) consumption, i.e. $0 \leq \theta \leq 1$. The utility function now takes the following Cobb-Douglass form:

$$u(c_y, c_o, d_y, d_o) = \ln(c_y^\theta (d_y - v d_y)^{1-\theta}) + \beta \pi \ln(c_o^\theta (d_o - v d_o)^{1-\theta})$$

It is quite intuitive to argue that all visible (durable) consumption must also have a status component (captured by coefficient $v$ in our model). On the contrary, it is hard to think of any perishable or invisible consumption good which would also be status-related. Though living in a conspicuous house may increase in return your marginal utility of standard consumption, food or energy consumption cannot be considered as status goods per se. Standard consumption goods are used as a numeraire and we introduce relative prices of status goods when young $p_y$ and when old $p_o$. Lower-income groups are endowed with standard consumption goods $y^c$ (used as a numeraire) and higher-income groups are endowed with (durable) goods $y^d$ expressed in terms of standard consumption (non visible) goods. This does not affect the main results of the article and simplifies a bit the computation. It only means an increase in the reference group income also corresponds to an increase in the supply of conspicuous goods, which will have an impact in general equilibrium. We therefore have:

$$y_y = y_y^c, \quad y_o = y_y^c, \quad \bar{y}_y = p_y y_y^d, \quad \bar{y}_o = p_o y_y^d$$

From the maximization problem of the high-income households and the intertemporal budget constraint, we derive the reference levels of standard and status consumption when young as a constant share of permanent income $Y = y_y + \frac{1}{R} y_o$ and $\bar{Y} = \bar{y}_y + \frac{\bar{y}_o}{R}$:

$$\bar{c}_y = \frac{\theta}{1 + \pi \beta} \bar{Y} \quad p_y \bar{d}_y = \frac{1}{\phi} \frac{1 - \theta}{1 + \pi \beta} \bar{Y}$$

$$\bar{c}_o = \pi \beta R \frac{\theta}{1 + \pi \beta} \bar{Y} \quad p_o \bar{d}_o = \pi \beta R \frac{1 - \theta}{1 + \pi \beta} \bar{Y}$$

The user cost of visible goods is now $\bar{\phi} = 1 - \frac{(1-\delta)}{R} p$, where $p = \frac{p_o}{p_y}$. An expected rise in social status relative prices over time (a quest for status “bubble”) will reduce the user cost and increase the consumption of visible goods when young.
Permanently changing all prices to the same level will have no effect on the ratio of visible over non visible consumption. For it to lie between 0 and 1, it must be that 
\[ \bar{R} \geq (1 - \delta)p \], which is the case in general equilibrium. High-income households assets are now defined as:

\[
\bar{a} = \left[ 1 - \frac{\delta p + \bar{R}}{(1 + \pi \beta)\bar{R}} \left( \frac{1 - \theta}{\phi} \right) \right] p_y d_y^{\bar{y}} \quad (10)
\]

From the low-income households maximization problem, the inter-temporal budget constraint, and the reference levels of status, we get the optimal levels of reference dependent consumption groups in both periods as a function of \( Y \) and \( \bar{Y} \):

\[
c_y = \frac{\theta}{1 + \pi \beta} Y - v \theta(1 - \theta) \left[ \frac{\phi}{\lambda} + \frac{\pi \beta}{\lambda} \right] \bar{Y} \quad (11)
\]

\[
p_y d_y = \frac{1 - \theta}{1 + \pi \beta} \frac{1}{\phi} Y + v(1 - \theta) \frac{\pi \beta}{(1 + \pi \beta)^2} \left[ \frac{1}{\phi} - \frac{1}{\phi \lambda} + \theta \left( \frac{1}{\pi \beta \phi} + \frac{1}{\phi \lambda} \right) \right] \bar{Y} \quad (12)
\]

\[
c_o = \pi \beta R \frac{\theta}{1 + \pi \beta} Y - v \theta \pi \beta R \frac{(1 - \theta)}{(1 + \pi \beta)^2} \left[ \frac{\phi}{\lambda} + \frac{\pi \beta}{\lambda} \right] \bar{Y} \quad (13)
\]

\[
p_o d_o = \pi \beta R \frac{1 - \theta}{1 + \pi \beta} Y - v(1 - \theta) \frac{\pi \beta R}{(1 + \pi \beta)^2} \left[ \frac{\phi}{\lambda} - \frac{1}{\lambda \phi} \right] \bar{Y} \quad (14)
\]

**Proposition 4:** An increase in between groups inequality leads to a more than proportional substitution effect from standard consumption to status consumption when young. This effect is amplified the more durable the social status good is and the amplification only verifies in the presence of financial frictions.

Because of their higher borrowing interest rate, low income households face a higher user cost of social status than high income households: \( \phi \geq \bar{\phi} \). In equations (11) and (13), we can see that an increase in the reference group’s income \( \bar{Y} \) leads to a substitution effect from standard consumption to status consumption in both periods as it increases the marginal utility of social status consumption for reference dependent households.

The ratio of user costs \( \frac{\phi}{\bar{\phi}} \) increases with visibility \( 1 - \delta \). However, visibility has an ambiguous effect on standard consumption. First, by increasing \( \bar{\phi} \) it increases the reference level of status when young \( d_1 \) so it reinforces the negative effect of reference income \( \bar{Y} \) on standard consumption \( c_y \) and \( c_o \). However, lower-income households keep up on the Joneses not only on the stock of the reference level of status goods but also on the subjective value of this stock. A lower user cost corresponds to a cheaper status good when young so the consumption of \( d_y \) increases. It
therefore reduces the relative value that lower-income groups attach to the status consumption level of higher-income groups when young $\bar{d}_y$. Said differently, the higher consumption of status when young reduces the importance of social comparison bias when young too. There is therefore a negative effect of $\phi$ that comes from this valuation effect. Financial frictions increases the user cost of status for lower-income groups so the second effect is dominated by the first effect. In the absence of financial frictions, the two effects offset each other and $c_y$ and $c_o$ do not depend on visibility in partial equilibrium. Obviously, this substitution effect is a decreasing function of $\theta$.

The optimal borrowing level of the reference-dependent group is now:

$$a = \left[1 - \frac{g + R}{(1 + \pi \beta)R} \left(\theta + \frac{1 - \theta}{\phi}\right)\right] y_y^e$$

$$- v(1 - \theta) \frac{\pi \beta}{(1 + \pi \beta)^2} \left[\frac{1}{\phi} - \frac{1}{\phi \lambda} + \theta(1 - \phi)(\frac{1}{\phi \pi \beta} + \frac{1}{\phi \lambda})\right] (1 + \frac{gp}{R})p_y y_y^d$$

Proposition 5: When households can substitute between their absolute and relative needs, the durability of the status good creates a borrowing bias that increases with top income shares even in the absence of financial frictions. Financial innovations now have an ambiguous effect on “debt for status” as it amplifies the substitution effect through a reduction in user cost $\phi$.

Proposition 2 still verifies, though the extent to which financial innovations will increase or decrease debt for status now depends on the relative importance of the crowding out effect versus the substitution effect. The latter is captured by the additional “$\theta$ term” in the externality part and affects borrowing negatively: an increase in $d_1$ and $d_2$ leads to a fall in the optimal consumption level of $c_1$. The higher is the difference in interest rates (and user costs) between the two groups, the more this effect will reduce the level of “debt for status”. Financial innovations now also have a positive impact on “debt for status”: the fall in $\phi$ makes it easier for lower-income groups to substitute standard consumption for status consumption. In the absence of financial frictions, i.e when $\lambda = 1$ and $\phi = \bar{\phi}$, the level of assets for lower-income households becomes:

$$a = \left[1 - \frac{g + R}{(1 + \pi \beta)R} \left(\theta + \frac{1 - \theta}{\bar{\phi}}\right)\right] y_y^e - v \theta \frac{1 - \theta}{1 + \pi \beta} (1 - 1)(1 + \frac{gp}{R}) p_y y_y^d$$

The sign of the social status externality is always positive as $\bar{\phi}$ lies between 0 and 1. The rise in top income shares increases lower-income households consumption of visible goods when young more than it decreases their consumption of
standard consumption goods, despite the unit elasticity of substitution between both goods. When \( \theta = 0 \), i.e. in the case where households only consume status consumption goods, there is no externality anymore as the effect of a rise in \( \bar{Y} \) on present and future marginal utility of status consumption offset each other (see part 4.3). When \( \delta = 1 \), the Veblen externality disappears for the same reason. Veblen good cannot be used to keep up with the Joneses in the following period so there is no present consumption bias. In other words, the higher incentive to borrow when young is exactly offset by a higher incentive to save for next period’s conspicuous consumption.

Going back to the financial friction case, let’s assume full depreciation of social status goods (\( \delta = 1 \)). As in equation (5), there remains only the effect of the wedge between the borrowing rate of the two groups:

\[
a = \left[ 1 - \frac{g + \lambda R}{(1 + \pi \beta) \lambda R} \right] y^c_y - v(1 - \theta) \frac{\pi \beta}{(1 + \pi \beta)^2} (1 - \frac{1}{\lambda})(1 + \frac{g p}{R}) p_y \bar{d}_y
\]

(17)

Financial innovations reduces the effect of between-groups inequality on “debt for status” for the reasons described in proposition 2.

We can now solve for the general equilibrium. The capital market clearing condition is the same as in section 4.2. but the relative prices of status goods must now be derived from the good-market clearing condition. This is an endowment economy: in both periods, the aggregate supply of goods must equal the aggregate demand. In the case of durable goods, the supply must also include what remains after depreciation. Rearranging, it must be that:

\[
\frac{d_o + \bar{d}_o}{d_y + \bar{d}_y} = g + (1 - \delta) \frac{d_y + \bar{d}_y}{y^d_y}
\]
5 Econometric Analysis

In this section, we attempt to test the intuitions of the model regressing domestic credit to the private sector as a share of GDP and between-groups inequality measured by the top 1% and 5% income shares. To our knowledge, this is the first cross-country econometric analysis of such a relationship. We use an unbalanced panel of 17 developed countries over the period 1960 to 2007. The choice of a cross-country analysis may also be justified under the ground that the kinds of Veblen effects we are capturing in the model are macroeconomic effects. The empirical analysis will also try to account for some of the interactions effects which were evidenced in the model, keeping in mind the limitations proper to cross-country panel regressions. Our analysis suggests the Veblen effects are significant and may account for between 10 to 20 percent of the rise in private debt observed since 1980.

5.1 The Data

There is only limited cross-country data available for lower income households’ debt. Besides, except for a few countries (among them Australia, New Zealand or the United Kingdom), cross country households’ debt as a share of disposable income is not available for long runs of years. We thus use private debt (domestic credit to private sector) as a proxy for households’ debt. The World Bank Development Indicators measure of private debt has the advantage of spanning a wide period of time, between 1960 and 2010. The fact that it includes corporate debt is not seen as an issue providing that corporate debt levels remained quite stable over the period studied. To check the validity of our proxy, we collected data for household debt as a share of disposable income from fourteen Central Banks. The trend comparison confirms the validity of our proxy. Table 3 (in Annexes) shows the correlation coefficients between Central Banks data on households’ debt as a share of disposable income when data is available and private debt measured by the World Bank. It can be seen that for the developed countries considered in this study, the coefficients are high and ranges above 0.9 in most countries.

We borrow our measure of between-groups income inequality from the top-income share series constructed by Atkinson, Piketty and Saez and available in

\footnote{Our sample is constrained by the availability of data on top income shares. Top 1 percent income shares are only available the Australia, Canada, Denmark, Finland, France, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, United Kingdom, United States. Top 5 percent income shares are not available for United Kingdom and Ireland.}
the PSE World Top Income Database. These series are based on income tax ev-
idence, which contrary to household surveys are available annually over a long
period and for a wide range of countries. Burkhauser et al. (2009) reconciles
the Piketty and Saez top income share series, estimated with tax statistics, with
top income shares measured in survey data. Both follow the same trends even
though the top shares measured in the US Current Population Survey (CPS) tend
to be lower than the ones derived from tax data. Here, we focus on two “reference
income” groups: the top 1% and the top 5% of the income distribution.

To measure social comparison at a macro level, it is important to include both
“own income” and “reference income” in the regression. Indeed, following Barba
and Pivetti (2009), we can think of two other channels than Veblen effects as
for why observed inequality may be correlated with rising indebtedness for low
and middle-income households. First, the fact that consumption does not merely
depend on the absolute level of current income, but also on current income relative
to past income (Duesenberry, 1949) and that there is an inelasticity of consumption
with respect to reductions in households’ real income. A sudden stop in households’
increase in real wages may be associated with higher levels of debt simply because
of the unanticipated shock. Second - and this is linked to the first channel - a
tendency of real wages not to keep pace with productivity growth. The average
growth rate of GDP used in the regression is unlikely to precisely capture workers’
own income changes. In addition, we therefore control for cross-country data on
manufacturing workers’ compensation costs (Bureau of Labor Statistics) over the
period 1975-2007. Year fixed effects should also account for the possibility of
unanticipated shocks on households’ expected income.

The model developed in section 4 shows that financial innovations and the fall in
low-income households’ borrowing rate can be endogenous to income inequalities:
expending the access to credit lowers the negative impact of rising inequality on the
lower-income households’ utility. To our knowledge, no good instrument allows us
to capture low-income households’ borrowing rates with cross-country data. This
could be a topic for further empirical research. Still, to account for the more
general effect of lending rates on private debt, we control for the lending interest
rate charged by banks on loans to prime customers. Measures of financial innovations may correspond to de jure or de facto defini-
tions of financial liberalization. To the extent that our notion of financial in-
novations has to do with an environment where the monitoring cost of financial
intermediary is reduced, a de jure indicator seems more appropriate. A dummy
variable identifying the years of financial liberalization whether “borrowing for sta-

10The role played by the Fed and its expansionary policy of low interest rates is often pointed
out as an explanation for the surge in private leverage in the US, though the argument is
often used by opponents of so-called “Big Government”.

33
“tus” plays a smaller role in such an environment. We therefore introduce a dummy for the years of financial liberalization to check whether top income shares do have a lower influence on private debt in such years (proposition 5). We do observe that the Veblen effects have a lower influence on private debt following the deregulation of financial and mortgage markets in the early 1980’s. (IN PROGRESS...).

We also control for country fixed effects, inflation, population growth, and the level of government debt, as some countries (typically in continental Europe) may choose to increase social benefits to tackle an increase in income inequalities. Table 1 (Annexes) summarizes the variables used in the regressions.

5.2 Econometric Methodology

We first implement a simple OLS regression with country and year fixed effects. The OLS fixed effects specification is:

\[ D_{i,t} = \alpha + \beta I_{i,t} + \gamma X_{i,t} + \eta_i + \delta_t + \epsilon_{i,t} \]  

where \( D_{i,t} \) is the private debt ratio in country \( i \) at time \( t \), \( I_{i,t} \) is our measure of inequality, \( X_{i,t} \) is a vector of other control variables we think may affect private debt, \( \eta_i \) is a country fixed effect, \( \delta_t \) is a year fixed effect, and \( \epsilon_{i,t} \) is an error term. The country fixed effects take account of cultural and institutional differences and other country-specific unobserved influences on private debt. The year fixed effects capture the possible influences of changes in social status preferences over time or other determinants of private debt (unexpected income shocks) that the regressors may not capture. It should be noted that the reverse causality between households’ debt and income inequality is unlikely to hold: there is no reason to believe that a higher aggregate level of private debt would bring about an increase in top-income shares.

In addition to the fixed effects OLS estimation, we implement a dynamic panel GMM estimation. Indeed, the process generating private debt within each country is likely to be dynamic, with current realizations of the dependent variable influenced by past ones. We therefore introduce a lagged dependent variable on the right hand side of the equation. Dynamic panel GMM accounts for country fixed effects by first-differencing the regressors. It also reduces auto-correlation between the dependent variable \( D_{i,t} \) and its lagged value \( D_{i,t-1} \) as the first-differenced lagged dependent variable is instrumented with its past levels. The general specification for the difference equation is the following:

\[ D_{i,t} = \alpha + \beta I_{i,t} + \gamma X_{i,t} + \eta_i + \delta_t + \epsilon_{i,t} \]  

34
\[ D_{i,t} - D_{i,t-1} = \beta(I_{i,t-1} - I_{i,t-2}) + \gamma(X_{i,t} - X_{i,t-1}) + \epsilon_{i,t} - \epsilon_{i,t-1} \] (19)

where we keep the same variables as in equation (14), plus the first lagged value of private debt. We perform an Im-Pesaran-Shin (IPS) panel unit root test to check the presence or not of a unit root for private debt. One of the advantage of this test is that it allows for heterogeneous panels. The test confirms the presence of a unit-root (see table 2 in Annexes). We therefore use the system GMM estimator of Arellano-Bover and Blundell-Bond. Indeed, there are two different ways of estimating panel dynamic GMM: difference GMM (Arellano-Bond) and system GMM (Blundell-Bond). Blundell and Bond (1998) demonstrate that if the dependent variable is close to a random walk, then the Arellano-Bond difference estimator performs poorly because past levels of private debt conveys little information about future changes. Contrary to Arellano-Bond which instruments differences (or orthogonal deviations) of private debt with levels, Blundell-Bond instruments levels with differences. For random walk variables, past changes may actually be more predictive of current levels than past levels. In this estimation, we only use the second lags of the endogenous variables as internal instruments. Indeed, due to the small number of countries in the samples (17 and 15), a large number of instruments causes the cluster-robust standard errors to be unreliable. However, we include time dummies, which makes robust standard errors more likely to hold: year fixed effects should reduce the correlation in idiosyncratic disturbances across individuals.

5.3 Results

Tables 4 (Annexes) reports the results from the OLS fixed effects estimation. Regressions 1 and 2 study the impact of a change in top 1% income share while regressions 3 and 4 focus on the top 5% income share. Regressions 2 and 4 use a slightly different panel as we control for manufacturing workers’ compensation costs\textsuperscript{11}. The OLS country fixed effects estimation tells us that a 1 percentage point rise in top 1% income share increases aggregate households’ debt by 1.9 percentage points, or 2.6 points when we control for compensation costs. Between 1980 and 2007, American private debt increased by 116 percentage points when the top 1% income share was increasing by a bit more than 10 points. These Veblen effects thus explain around 20% of the rise in households’ debt over the period preceding the financial crisis. These results are similar in magnitude to Badarinza (2011) who suggests that the debt-to-income ratio is 10 to 30 percent higher in an economy

\textsuperscript{11} Compensation costs in the manufacturing sector are only available for the period 1975-2007.
in which the quest for social status is pervasive. The effects are lower for top 5% income share but remains significant. The impact of top-income shares on private leverage should be compared to the influence of the borrowing rate of interest: as expected, the coefficient is always negative as a higher rate should lead to a lower level of private debt. The regression tells us that a 1 percentage point fall in the lending rate increases private debt by at most 2 percentage points. The lending interest rate decreased by 7 points between 1980 and 2007. At best, the official lending rate channel explains a similar fraction of the rise in private debt than top-income shares. As expected, public debt change is negatively correlated to private debt as a possible answer to between-groups inequality may be to extend the size of the welfare state. Population growth is not significant. Finally, accounting for workers’ actual income level does not seriously affect the size and significance of the Veblen effects. If anything, controlling for workers’ compensation actually increases the explanatory power of top income shares.

Table 5 reports the estimation results using the dynamic panel system GMM estimator. Unsurprisingly, we find a significant positive coefficient of 0.82 to 0.89 on the once lagged private debt to GDP ratio. The coefficients on top income shares are positive in all cases but not significant in regressions 2 and 4, i.e. when we control for compensation costs. After controlling for the influence of past levels of debt on private debt changes, the relative importance of workers’ own income levels reemerges. The effect of (manufacturing) workers’ wages are large, significant in regression 2 and close to the 10% level of significance for regression 4. As we might expect, the sign is negative: a lower absolute level of income leads to higher borrowings to compensate for the income loss, as in Ranciere and Kumhof (2010). These coefficients on compensation costs versus top-income shares can lead to different interpretations as for the relative importance of absolute and relative income. One interpretation would be to argue that households’ absolute income level is actually what matters. However, top-income shares remain highly significant when we do not account for compensation costs and the coefficients are positive for the country fixed effect OLS regression. An other interpretation would be to argue that both are somehow endogenous to each other when it comes to their impact on households’ debt, as the effect of a stagnation or a fall in one’s absolute income may be even stronger in a period of rising top-income shares. These results should not be taken for granted as there may be potential endogeneity issues between the different covariates. To our knowledge, no good instrument has been used in cross-country analysis to clearly separate between both effects. This could be a topic for further research. Finally, public debt still has as negative effect on private debt and the lending rate is still negative, though not significantly in regressions 2 and 3.
6 Conclusion

This paper has investigated how other-regarding preferences might interact with income inequalities, debt and financial innovations, in line with some important stylized facts. We set up a simple closed economy two-periods life cycle model where low-income households are influenced by high-income households when taking their optimal consumption decisions. A rise in top-income shares may lead to higher borrowings of low-income households under certain conditions of durability for the status goods and heterogeneity between agents in the access to credit. We also see how an exogenous fall in low-income households borrowing interest rate (financial innovations) crowds out social preferences. The link between households debt and between-groups income inequality is supported by empirical evidence. Our data seems to indicate that higher inequalities between income groups in the US can explain 10% to 20% of the rise in households debt over the last three decades. However, the simultaneous importance of peoples absolute income levels may be underestimated. The empirical analysis may therefore be completed with the existing micro evidence on inequalities and consumption behavior based on survey data.
References


39


7 Annexes

Table 1: Benchmark calibration of model parameters

<table>
<thead>
<tr>
<th>Variables</th>
<th>Value/Range</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full (systemic) default probability</td>
<td>$0 \leq 1 - \pi \leq 0.05$</td>
<td>Ranciere and Kumhof (2010)</td>
</tr>
<tr>
<td>Depreciation rate of the status (durable) good, annual basis</td>
<td>$0 \leq \delta \leq 1$</td>
<td></td>
</tr>
<tr>
<td>Discount factor, annual basis</td>
<td>0.955</td>
<td></td>
</tr>
<tr>
<td>GDP growth rate, annual basis</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>Monitoring cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Veblen coefficient</td>
<td>$0.25 \leq v \leq 0.5$</td>
<td>Alpizar and al. (2005)</td>
</tr>
</tbody>
</table>

Table 2: Variable Definitions and Sources

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition and construction</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private debt</td>
<td>Domestic credit to the private sector, percent of GDP</td>
<td>World Bank Development Indicators</td>
</tr>
<tr>
<td>Top 1% and 5%</td>
<td>Share of the top 1% and 5% of the income distribution</td>
<td>The World Top Incomes Database</td>
</tr>
<tr>
<td>Lending rate</td>
<td>Lending interest rate is the rate charged by banks on loans to prime customers</td>
<td>International Monetary Fund, International Financial Statistics and data files</td>
</tr>
<tr>
<td>GDP Growth</td>
<td>Gross GDP growth rate</td>
<td>Angus Maddison Historical Statistics</td>
</tr>
<tr>
<td>Inflation</td>
<td>Inflation, annual percent change</td>
<td>Reinhart and Rogoff</td>
</tr>
<tr>
<td>Population growth</td>
<td>Population growth, annual percent change</td>
<td>Angus Maddison Historical Statistics</td>
</tr>
<tr>
<td>Public Debt</td>
<td>Total (domestic plus external) gross central government debt/GDP</td>
<td>Reinhart and Rogoff</td>
</tr>
</tbody>
</table>
### Table 3: Im-Pesaran-Shin (IPS) Test for Cross-Sectionally Demeaned Private Debt

<table>
<thead>
<tr>
<th></th>
<th>Lags(8)</th>
<th>Lags(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>t-bar</td>
<td>-1.206</td>
<td>-1.178</td>
</tr>
<tr>
<td>W[t-bar]</td>
<td>0.752</td>
<td>1.277</td>
</tr>
<tr>
<td>p-value</td>
<td>0.774</td>
<td>0.899</td>
</tr>
</tbody>
</table>

N,T = (18,49); Obs = 828

### Table 4: Correlation coefficients between private debt and household debt (as a percentage of disposable income) in a few developed countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Period</th>
<th>Correlation coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>1977-2009</td>
<td>0.958</td>
</tr>
<tr>
<td>Canada</td>
<td>1995-2007</td>
<td>0.960</td>
</tr>
<tr>
<td>Finland</td>
<td>1999-2009</td>
<td>0.972</td>
</tr>
<tr>
<td>France</td>
<td>1995-2007</td>
<td>0.908</td>
</tr>
<tr>
<td>Germany</td>
<td>1995-2010</td>
<td>0.826</td>
</tr>
<tr>
<td>Ireland</td>
<td>2002-2010</td>
<td>0.972</td>
</tr>
<tr>
<td>Italy</td>
<td>1995-2007</td>
<td>0.979</td>
</tr>
<tr>
<td>Netherland</td>
<td>1999-2010</td>
<td>0.967</td>
</tr>
<tr>
<td>New Zealand</td>
<td>1978-2009</td>
<td>0.916</td>
</tr>
<tr>
<td>Portugal</td>
<td>1999-2010</td>
<td>0.907</td>
</tr>
<tr>
<td>Spain</td>
<td>2000-2010</td>
<td>0.946</td>
</tr>
<tr>
<td>Sweden</td>
<td>1999-2010</td>
<td>0.822</td>
</tr>
<tr>
<td>UK</td>
<td>1987-2010</td>
<td>0.925</td>
</tr>
<tr>
<td>USA</td>
<td>1995-2007</td>
<td>0.930</td>
</tr>
</tbody>
</table>

Sources: OECD, ECB, United Kingdom Economic Accounts, Central Bank of New Zealand, Central Bank of Australia, World Bank Development Indicators
Table 5: OLS Estimation with Country and Year Fixed Effects (Dependent Variable: Private Debt (% of GDP))

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Regression 1</th>
<th>Regression 2</th>
<th>Regression 3</th>
<th>Regression 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top 1%</td>
<td>1.922**</td>
<td>2.674***</td>
<td>-</td>
<td>1.017*</td>
</tr>
<tr>
<td></td>
<td>(0.827)</td>
<td>(0.721)</td>
<td>(0.484)</td>
<td>(0.538)</td>
</tr>
<tr>
<td>Top 5%</td>
<td>-</td>
<td>-</td>
<td>0.902*</td>
<td>1.017*</td>
</tr>
<tr>
<td></td>
<td>(0.484)</td>
<td>(0.538)</td>
<td>(0.412)</td>
<td>(0.412)</td>
</tr>
<tr>
<td>Lending rate</td>
<td>-1.976***</td>
<td>-0.605</td>
<td>-2.041***</td>
<td>-0.841**</td>
</tr>
<tr>
<td></td>
<td>(0.437)</td>
<td>(0.460)</td>
<td>(0.441)</td>
<td>(0.412)</td>
</tr>
<tr>
<td>GDP growth</td>
<td>-2.913***</td>
<td>-1.808***</td>
<td>-3.104***</td>
<td>-2.155***</td>
</tr>
<tr>
<td></td>
<td>(0.437)</td>
<td>(0.479)</td>
<td>(0.459)</td>
<td>(0.415)</td>
</tr>
<tr>
<td>Compensation cost</td>
<td>-</td>
<td>0.686*</td>
<td>-</td>
<td>0.592</td>
</tr>
<tr>
<td></td>
<td>(0.414)</td>
<td>(0.436)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inflation</td>
<td>0.955**</td>
<td>1.502***</td>
<td>1.625***</td>
<td>2.178***</td>
</tr>
<tr>
<td></td>
<td>(0.378)</td>
<td>(0.384)</td>
<td>(0.412)</td>
<td>(0.360)</td>
</tr>
<tr>
<td>Population growth</td>
<td>3.151*</td>
<td>1.230</td>
<td>0.685</td>
<td>-0.516</td>
</tr>
<tr>
<td></td>
<td>(1.744)</td>
<td>(2.263)</td>
<td>(2.093)</td>
<td>(1.954)</td>
</tr>
<tr>
<td>Public debt</td>
<td>-0.287***</td>
<td>-0.378***</td>
<td>-0.127**</td>
<td>-0.267***</td>
</tr>
<tr>
<td></td>
<td>(0.0560)</td>
<td>(0.0569)</td>
<td>(0.0622)</td>
<td>(AAA)</td>
</tr>
<tr>
<td>Constant</td>
<td>41.64***</td>
<td>132.8***</td>
<td>163.8***</td>
<td>-1.329</td>
</tr>
<tr>
<td></td>
<td>(10.86)</td>
<td>(23.81)</td>
<td>(15.00)</td>
<td>(14.24)</td>
</tr>
<tr>
<td>Observations</td>
<td>503</td>
<td>430</td>
<td>437</td>
<td>372</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.861</td>
<td>0.879</td>
<td>0.869</td>
<td>0.886</td>
</tr>
<tr>
<td>Country FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Year FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Number of countries</td>
<td>17</td>
<td>17</td>
<td>15</td>
<td>15</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Table 6: System GMM Estimation (Dependent Variable: Private Debt (% of GDP))

<table>
<thead>
<tr>
<th>Regressor</th>
<th>Regression 1</th>
<th>Regression 2</th>
<th>Regression 3</th>
<th>Regression 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lag of private debt</td>
<td>0.879***</td>
<td>0.820***</td>
<td>0.891***</td>
<td>0.842***</td>
</tr>
<tr>
<td></td>
<td>(0.0919)</td>
<td>(0.132)</td>
<td>(0.0816)</td>
<td>(0.114)</td>
</tr>
<tr>
<td>Top 1%</td>
<td>1.495*</td>
<td>0.668</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>(0.849)</td>
<td>(1.407)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top 5%</td>
<td>-</td>
<td>-</td>
<td>0.891**</td>
<td>0.344</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.438)</td>
<td>(0.850)</td>
</tr>
<tr>
<td>Lending rate</td>
<td>-0.714*</td>
<td>-0.796</td>
<td>-0.498</td>
<td>-0.766*</td>
</tr>
<tr>
<td></td>
<td>(0.404)</td>
<td>(0.535)</td>
<td>(0.325)</td>
<td>(0.460)</td>
</tr>
<tr>
<td>GDP growth</td>
<td>-0.270</td>
<td>-0.745**</td>
<td>-0.348</td>
<td>-0.918***</td>
</tr>
<tr>
<td></td>
<td>(0.375)</td>
<td>(0.377)</td>
<td>(0.382)</td>
<td>(0.334)</td>
</tr>
<tr>
<td>Compensation cost</td>
<td>-</td>
<td>-1.364**</td>
<td>-</td>
<td>-1.233</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.678)</td>
<td>(0.751)</td>
</tr>
<tr>
<td>Inflation</td>
<td>0.245</td>
<td>0.438</td>
<td>0.0876</td>
<td>0.313</td>
</tr>
<tr>
<td></td>
<td>(0.276)</td>
<td>(0.463)</td>
<td>(0.199)</td>
<td>(0.301)</td>
</tr>
<tr>
<td>Population growth</td>
<td>2.058</td>
<td>1.052</td>
<td>2.156</td>
<td>1.219</td>
</tr>
<tr>
<td></td>
<td>(2.215)</td>
<td>(1.849)</td>
<td>(2.070)</td>
<td>(1.843)</td>
</tr>
<tr>
<td>Public debt</td>
<td>-0.137*</td>
<td>-0.220*</td>
<td>-0.153**</td>
<td>-0.213**</td>
</tr>
<tr>
<td></td>
<td>(0.0701)</td>
<td>(0.115)</td>
<td>(0.0641)</td>
<td>(0.108)</td>
</tr>
<tr>
<td>Constant</td>
<td>-10.25</td>
<td>55.91</td>
<td>-10.93</td>
<td>46.36</td>
</tr>
<tr>
<td></td>
<td>(18.38)</td>
<td>(39.46)</td>
<td>(16.30)</td>
<td>(45.46)</td>
</tr>
<tr>
<td>Observations</td>
<td>476</td>
<td>403</td>
<td>413</td>
<td>348</td>
</tr>
<tr>
<td>Number of countries</td>
<td>17</td>
<td>17</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Country FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Year FE</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1