Households’ Debt, Between-Groups Inequality and Financial Innovations:
“Why Do The Poor Borrow So Much?”

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May 22, 2012

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Abstract
When it comes to households’ debt, the impact of financial innovations and income inequalities has often been considered separately. To study these trends, we set up a heterogeneous agents two-periods endowment economy featuring consumption externalities “a la Veblen”. We show that financial frictions in the banking sector along with social status externalities produce a borrowing bias for low-income households increasing with top-income shares, as it affects the sensitivity of the interest rate to changes in the supply of assets. In competitive equilibrium, financial innovations modeled as an exogenous fall in the monitoring cost of the banking sector reduce lower-income households disutility from social standing at the cost of increasing the overall level of debt. Data on private debt in 17 developed countries over the period 1960-2007 show that greater between-groups inequality is indeed associated with higher leverage. These Veblen effects are economically significant and robust to fixed effects and other specifications.
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I am particularly grateful to Edouard Challe and Nicolas Coeurdacier, my two supervisors for this master thesis. I shall also be thankful to Samuel Bowles, Romain Ranciere, and Philippe Weil for their very useful suggestions and comments.

1 Introduction

“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, especially in any community where class distinctions are somewhat vague, all canons of reputability 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. This period also saw a rapid development of financial innovations seriously widening the access to credit 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 in developed
economies. 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

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.” In this
article, debt is therefore not only 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 Smiths
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” could also justify our choice for the utility function. 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.

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*. 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 the agents
utility function when it comes to the inter-connections between households’ debt and
financial innovations. We then test empirically the model’s transmission channel
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 countries1.

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1Namely: Australia, Canada, Denmark, Finland, France, Ireland, Italy, Japan, Netherland, 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 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 explains 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.

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: 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, our 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) recently explained the Easterlin “paradox” with the presence 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). However, this literature does not directly account for income inequalities as the reference level of consumption is often assumed to be exogenous. One contribution to our model it 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 ultimately influence 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. In his model, the key assumption relies on differences in the intensity of the Veblen effects across generations. However, Knell (1999) does not allow for negative asset holdings and the definition of the reference levels remain exogenous.

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.” Their approach may look close to ours at first
sight as it directly refers to Veblen goods; but the authors completely neglect the “leisure class” aspect of Veblen 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. In their model, the mechanism linking social status to excessive borrowing assumes more visible goods also 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. Furthermore, we think this model is unlikely to explain the rapid rise in households’ debt ratio in most developed countries over the last decades. First because the model 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 here. Quite on the contrary, it corresponded to lower average growth rates than previous periods and high-income groups benefited the most from this relative lower growth\(^2\). Second, because the other explanation would be that the durable goods channel suddenly played a much bigger role than before, which is hard to believe.

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 Raghuram Rajan’s claim in *Fault Lines* (2010), which is that “an important political response to inequality was credit expansion, which allowed people the consumption possibilities that their stagnant income otherwise would not support.” Micro evidence on the link between financial deregulation, in particular the “financialization” of the household sector and income inequalities have recently been developed. 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, occurred 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 al. (2010). They show that subprime mortgage lenders and borrowers greatly influenced government policy toward

\(^2\)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.
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 also provides a formal rationale to this claim.

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 an external finance premium decreasing in net worth and a gap between the borrowing and saving interest rates. 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 (see the role played by careless brokers prior to the subprime crisis). 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 standard costly state verification problem. In their model, households’ heterogeneity 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 our model, the inter-connections between social status and credit constraint come from imperfect information between lenders and borrowers 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 approach 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 Badar-inza (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 and 2 illustrate, 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 (in particular Portugal, Finland, Norway or Denmark). It should be noted that the credit booms of these countries were often 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.

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

\[^3\text{See also OECD 2011 report “Divided We Stand: Why Inequality Keeps Rising?”: “The latest trends in the 2000’s showed a widening gap between rich and poor not only in some of the already high inequality countries like Israel and the United States, but also for the first time in traditionally low-inequality countries, such as Germany, Denmark, and Sweden (and other Nordic countries), where inequality grew more than anywhere else in the 2000’s.”} \]
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.

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

\(^4\)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.
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.

The empirical evidence on how relative positioning in terms of income and consumption may affect people’s utility has been growing. Easterlin (1995) is the benchmark paper as it first provided evidence for social status positioning in terms of income, pointing out one of the most widely cited paradox in happiness economics: “raising the incomes of all does not increase the happiness of all”. More recent and notable contributions include Luttmer (2005) who identifies 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.”
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, Pigullem 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 these different stylized facts.
4 A Basic Model

The model studies the impact of a rise in top-income shares on low-income households’ debt. We try to keep the model 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”). The model further analyzes how financial innovations in the household sector may affect the equilibrium level of debt in a world with social status externalities. Financial innovations, modeled as an exogenous fall in the monitoring cost of financial intermediaries, crowd out social status preferences at the cost of increasing private debt. They are associated with a simultaneous rise in the size of the banking sector.

In section 4.1 we define the model’s technology environment and the agents’ preferences. 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 consumption decisions of each income groups, along with households’ optimal savings and borrowings. Finally, section 4.4 solves for the closed-economy competitive equilibrium.
4.1 Preferences and Technology

We consider a simple endowment economy where heterogeneous households live for two periods. There are two classes of households, a low-income group and a high-income group ($i = h, l$). High-income agents receive a deterministic (inherited) income $y^h$ in first period. They save the amount $s$ at the market saving rate $R$ to finance second period consumption. Low-income households receive a stochastic labor income in second period $y^l_t$. They must borrow at rate $R^l \geq R$ from banks to finance consumption in first period. These budget constraints are in line with the stylized facts presented in the previous section. There can be two states of the world, a good state and a bad state ($s = g, b$). When $s = b$, low-income individuals do not get any income and must default on their loans in second period. If this is the case, consumption in period 2 equals 0. This happens with probability $1 - \pi$. With probability $\pi$, $s = g$ and low-income households do not default. Each income group is assumed to be representative of the individual agents composing the group. We may think of endowments $y^h$ and $y^l$ as the income shares of top 5 percent versus bottom 95 percent of the income distribution, $\pi$ being an aggregate probability of default (or crisis probability).

In this closed economy, the supply of assets $s$ corresponds to the savings of high-income groups and must equal the asset demand $b$. A critical assumption is that high-income households cannot lend directly to low-income households. They only have access to a storage technology (bank deposit) which delivers an interest rate $R$ corresponding to the economy’s equilibrium market interest rate. Low-income individuals cannot borrow directly from high-income households either. They must go through a bank which can monitor lending. In this model, the higher borrowing interest rate results from the moral hazard problem between the bank and its borrowers. The “external finance premium” which results from the difference between saving and borrowing interest rates is entirely captured by financial intermediaries.

Each household group has different preferences, and utilities are defined over lifetime consumption. We introduce social status based preferences in the utility function of the lower income households (Veblen effects), as in Bowles and Park (2005), Alonso-Carrera and al. (2008) or Seung-Yun and al. (2011). Other-regarding preferences thus directly enters the agents’ utility function over consumption. Following Veblen, “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”. High-income households thus determine the reference level of consumption. Following Bernanke and Gertler (1989), in second period, consumption is linear and stochastic. Individuals only care about expected consumption, that
is they are risk-neutral in period 1 with respect to period 2. This allows us to focus on the role of the agent’s income in mitigating agency costs rather than on issues of risk-sharing (see part 4.2) and simplifies the analysis of low-income households’ optimal choices preserving all the effects we want to analyze. The problem of low-income households is thus given by:

$$\max_{(c_1^l, c_2^l, s)} \ln(c_1^l - vc_1^h) + \beta E(c_2^l, s)$$

subject to

$$c_1^l = b,$$

$$c_{2,s}^l = y_s^l - b R^l$$

The coefficient $v$ (for “Veblen”) simply measures the intensity and nature of the social comparison. Rising top-income shares should lower the relative social standards of those households who do not benefit from the income rise. When social preferences are more pregnant than elsewhere, the intensity of the Veblen effects $v$ should be more stringent too. When they optimize consumption over time, low-income households are influenced by the consumption habits of the reference group at the time they take their inter-temporal decision, i.e. in first period only. This assumption is in line with Knell (1999) who assumes younger individuals care more about social standing than older ones, at least at the time they take their decisions. Said differently, people might underestimate the strength of future social comparisons. 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 in period 1 already results from the inter-temporal optimization of high-income groups. We can already see that an increase in the reference level of consumption increases the marginal utility of consumption for low-income groups.

Contrary to low-income households, the high-income group does not face any Veblen effect: the richest have no reference group as they belong themselves to the reference group. Consumption in second period is also linear but deterministic as income is known in period 1. The problem of high-income households therefore reduced to this simple maximization:

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5This specification does not consider how social status might affect borrowing choices when included in second period too. Intuitively, the effect should be negative as households want to consume more in second period and must reduce first period borrowings. However, we checked that assuming a higher borrowing rate than saving rate does not affect the main results when Veblen effects are of the same intensity.
\[
\begin{align*}
\max_{(c_1^h,c_2^h)} & \quad \ln(c_1^h) + \beta c_2^h \\
\text{subject to} & \quad c_1^h = y^h - s, \\
& \quad c_2^h = Rs
\end{align*}
\]

In this simplified 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 is a simplification that does not affect the logic of the reasoning or the general results we 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 in Bowles and Park (2005).

### 4.2 Costly Financial Intermediation

To justify the existence of a wedge between the saving rate of the rich and the borrowing rate of the poor, we introduce costly financial intermediation, as in Bernanke and Gertler (1989). We assume high-income households cannot lend directly to low-income households. They only have access to a storage technology (bank deposit) which delivers an interest rate \(R\) corresponding to the economy’s equilibrium market interest rate. The bank intermediates these funds to lend to low-income households. It charges a higher interest rate that results from the risk of default and the presence of a monitoring cost (“external finance premium”). The difference between the higher borrowing rate and the saving rate captures the size of the banking sector.

Low-income households have no collateral and lenders cannot observe their future stochastic income when they propose a loan. Borrowers default on their loans whenever \(c_2^l < 0\). From section 4.1, this happens when \(y^l = 0\), i.e. when state \(b\) is realized and we assumed the probability of bad outcome (default) was \(1 - \pi\). Furthermore, households may have incentive to lie about their true income once in period 2 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 \(\pi\) low-income households are able to pay back their loans and banks get \(R^l b^l\). We see this from the budget constraint of low-income households in period 2. With probability \(1 - \pi\), low-income 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 \( y^l \) and he gets 0 in period 2.

We start from the truth telling condition for low-income households. This condition requires that the contract be structured so that the borrower has no incentive to mis-report his income in period 2. They must be at least better-off not lying than lying:

\[
y^l - R^l b^l \geq (1 - p) y^l
\]  

(1)

The second-best efficiency means low-income borrowers should be indifferent between both, so we have \( R^l b^l = p y^l \). Banks must also be indifferent between intermediating high-income households deposit to low-income households at the interest \( R^l \) and “storing” the savings of high-income households corresponding to the asset demand at the interest rate \( R \) (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:

\[
\pi(R^l b^l) + (1 - \pi)(-p\gamma) = R b^l
\]  

(2)

Substituting in equation (1), we find the equilibrium level of \( p \) (with \( \pi y^l > (1 - \pi)\gamma \)):

\[
p^* = \frac{R b^l}{\pi y^l - (1 - \pi)\gamma}
\]  

(3)

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

\[
y^l - R^l b^l = y^l - \left(\frac{y^l}{\pi y^l - (1 - \pi)\gamma}\right) R b^l \equiv y^l - \delta R b^l
\]  

(4)

Therefore, \( R^l \) equals \( R \) times a coefficient \( \delta \geq 1 \). The coefficient \( \delta \) captures the risk premium due to imperfect information and monitoring cost. It decreases with
the borrowers’ income as when \( y' \) increases, the future collateral value of low income households is higher. If borrowers never default (i.e. \( \pi = 1 \)), then \( R^l = R \).

Financial innovations correspond to a fall in the monitoring cost \( \gamma \). Indeed, banks can afford to spend less on monitoring (see the case for subprime mortgages and careless brokers in the years preceding the 2008 crisis), either because they can now shift the risk of default towards other agents (Credit Default Swaps) or simply because the banking sector can better insure against the risk of default. In any case, financial innovations reduce \( \delta \) and \( R^l \) gets closer to \( R \). In Minskyean terms, these financial innovations should “stretched liquidity”, increasing leverage ratios and credit availability.

Finally, we call \( \phi \) the size of the financial intermediary sector. It simply corresponds to the difference between \( R^l \) and \( R \) times the amount borrowed \( b \), as the bank entirely captures the proceeds of their monitoring activities:

\[
\phi = (\delta - 1)Rb
\]

### 4.3 Optimal Saving and Borrowing Choices

From the maximization problem of the high-income households, we derive the optimal level of consumption in first period and the optimal saving function \( s(.) \) of high-income households:

\[
\begin{align*}
    c^h_1 &= \frac{1}{\beta R} \\
    s(R) &= y^h - \frac{1}{\beta R}
\end{align*}
\]

In this simple model, because preferences are linear in second period, income \( y^h \) does not directly affect households consumption in first period. Of course, this will not be the case anymore in competitive equilibrium as an increase in \( y^h \) will lead to a decrease in \( R \) (section 4.4). Equation (7) shows that high-income savings increase with the interest rate \( R \) (substitution effect) and the initial endowment \( y^h \): high-income households simply save all the excess income above their marginal utility of consumption in first period. The risk-neutrality assumption greatly simplifies the algebra without affecting the more general channels we want to focus on. More importantly, it allows us to establish a direct positive link between savings, income and the interest rate.
Combining the modified Euler equation of low-income households with the equilibrium consumption level of high-income households found in equation (6), we obtain the optimal borrowing level of low-income households $b(\cdot)$ as a function of $R$ and $R^t$:

$$b(R, R^t) = \frac{1}{\pi \beta R^t} + \frac{v}{\beta R}$$ (8)

The first term of equation (8) corresponds to what the optimal borrowing choice of low-income households would be without any Veblen effect: they would simply borrow until their marginal utility of consumption today equals the discounted marginal cost of loans in terms of tomorrow’s consumption. The discount factor is augmented by the probability of default: when the probability of defaulting in first period is higher (lower $\pi$), the marginal utility of consumption in second period decreases so households borrow more in period 1. When the borrowing interest rate decreases, their inter-temporal wealth increases so they borrow more in first period. The second term corresponds to the social status externality on households’ debt. When $R$ decreases, high-income households save less so they consume more today. This raises the Veblen externality on low-income households’ debt, increasing marginal utility of consumption in first period.

We now replace $R^t$ in equation (8) by its value to have an expression of low-income households debt as a function of $R$ only:

$$b(R) = \frac{1}{\delta \pi \beta R} + \frac{v}{\beta R}$$ (9)

Before turning to the competitive equilibrium, we can already see what may be the effect of an exogenous fall in the borrowing rate of low-income households $R^t$ (i.e. “financial innovations”). Of course, it should allow low-income households to increase borrowing, which is a standard result in life cycle theory. But it should also reduce the dis-utility from social status comparison as the gap between their own consumption and the high-income consumption in first period should fall. This second effect appears more clearly in section 4.4, after we derive the equilibrium level of interest rate.

### 4.4 Competitive Equilibrium

Asset supply must equal asset demand. The equilibrium on the capital market in this economy thus implies:
\[ b(R) = s(R) \]  

(10)

From this condition, we can derive the steady state (gross) interest rate \( R^* \) of the economy as a function of \( v, \delta, y^h \) and \( \pi \):

\[ R^* = \left( \frac{1}{\delta \pi + 1 + v} \right) \frac{1}{\beta y^h} \]  

(11)

An increase in high-income households \( y^h \) produces a saving shock. The increase in asset supply leads to a decrease in \( R^* \). A decrease in \( \delta \) allows low-income households to borrow more so the asset demand increases and \( R^* \) must increase. An increase in \( v \) has the same effect on asset demand than a fall in delta so the effect on the economy steady state interest rate is also positive. In this framework, status externality and financial innovations affect the elasticity of the interest rate to changes in asset supply.

Plugging the expression of \( R^* \) back in equation (9), we get the steady state level of low-income households’ debt in this economy as a function of \( v, \delta, y^h \) and \( \pi \):

\[ b^* = \left( \frac{1 + v \delta \pi}{1 + (1 + v) \delta \pi} \right) y^h \]  

(12)

\[ \frac{\partial b^*}{\partial v} = \left( \frac{\pi}{\frac{1}{\delta} + (1 + v) \pi} \right)^2 y^h \geq 0 \]

\[ \frac{\partial b^*}{\partial \delta} = -\frac{\pi}{(1 + (1 + v) \delta \pi)} y^h \leq 0 \]

The steady state level of low-income households’ debt \( b^* \) is increasing with between-groups inequalities, modeled as a permanent rise in top-income shares \( y^h \). The increase is due to the saving shock that results from a permanent income rise of rich households. The parameters \( v \) and \( \delta \) ultimately determines the sensitivity of \( R \) to a change in \( y^h \). Plugging the expression of \( R^* \) back in equation (5), we get the steady state size of the financial intermediary sector as a function of \( v, \delta \) and \( \pi \):

\[ \phi^* = \left( \frac{\delta - 1}{\beta} \right) \left( \frac{1}{\delta \pi} + v \right) \]  

(13)
We can infer three propositions from the model:

**Proposition 1:** *In the presence of social status externalities, the equilibrium level of households’ debt is higher than in an economy without social status externalities.*

The first derivatives of $b^*(y^h)$ with respect to $v$ is positive. The social status externality has two diverging effects on households’ debt: it increases borrowings as low-income agents want to fill the social status gap between their own consumption and the consumption level of higher income groups. However, these over-borrowings impact positively on the equilibrium rate of interest, which should reduce the level of debt. Overall, the first derivative of equation (12) shows the positive effect of the Veblen externality on households’ debt dominates.

**Proposition 2:** *Financial innovations (understood as a lowering in low-income households borrowing rate) reduce the dis-utility in terms of social standing but at the cost of increasing the overall level of debt.*

The first derivatives of $b^*(y^h)$ with respect to $\delta$ is negative. When $\delta$ decreases, households debt increases as they can now borrow money at a lower interest rate. In turn, the rise in borrowings increases the equilibrium level of interest rate, inciting high-income households to consume less in first period. The combination of these two effects reduces the social status gap between low and high income households. The general impact of a fall in $\delta$ on the social status externality is made clear from the expression of the first derivative of $b^*$ with respect to $v$: a fall in $\delta$ lowers the effect of income inequalities on households debt. However, it does so at the cost of increasing the overall level of debt.

**Proposition 3:** *Financial innovations increases the equilibrium size of the banking sector.*

Equation (13) show the effect of a fall in $\delta$ is ambiguous as it decreases the monitoring cost and therefore the premium attached to lower-income borrowings but it increases $R$ and $b$. Overall, the effect of financial innovations increases the size of
the financial sector, which is in line with the stylized facts presented in section 3.

The trade-off mentioned by Rajan in Fault Lines (2010) is made explicit here. Promoting financial innovations, the government may extend access to credit for households who do not see their income rise and thus reduce the social anxieties produced by a more unequal society (“the ability to appear in public without shame”). However, it does so at the cost of a higher aggregate level of private debt.

5 Econometric Analysis

We test our 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 econometric test of such a relationship. We use an unbalanced panel of 17 developed countries over the period 1960 to 2007.

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.

6 Our sample is constrained by the availability of data on top income shares.
We borrow our measure of between-groups income inequality from the top-income share series constructed by Atkinson, Piketty and Saez and available in the PSE World Top Income Database. These series are based on income tax evidence, 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.

We also control for country fixed effects, inflation, population growth, and the

---

7The 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".
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:

$$D_{i,t} = \alpha + \beta I_{i,t} + \gamma X_{i,t} + \eta_i + \delta_t + \epsilon_{i,t}$$ (14)

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 $D_{i,t}$ 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:

$$D_{i,t} - D_{i,t-1} = \beta(I_{i,t-1} - I_{i,t-2}) + \gamma(X_{i,t} - X_{i,t-1}) + \epsilon_{i,t} - \epsilon_{i,t-1}$$ (15)

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 costs⁸. 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 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

⁸Compensation costs in the manufacturing sector are only available for the period 1975-2007.
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 Conclusions

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 model where low-income households are influenced by high-income households when taking their optimal consumption decisions. We show how a rise in top-income shares leads to higher borrowings of low-income households through a higher elasticity of the interest rate to changes in asset supply. 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 seem 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 people’s absolute income levels may be underestimated. The empirical analysis may therefore be completed with micro evidence on inequalities and households’ borrowing behavior based on survey data.

The benchmark could be extended further. The model suggests financial innovations may be partly endogenous to income inequalities: a government caring about the utility of low-income households has a choice between reducing inequalities and easing access to credit. One interesting extension to the model would be to add a political economy component or to formalize this trade-off with a social welfare function. Another possible extension would be to adapt the model to an OLG economy with production, as saving and borrowing choices affect capital accumulation and growth. Assuming three periods and the possibility of borrowing and saving for both groups should not change the main findings of the model. In an OLG framework close to the one used by Jappelli and Pagano (1994), households still borrow in first period to finance consumption. Second period savings may either increase or decrease depending on the relative importance of social comparison across generations. The role of financial innovations in that regards may be worth studying. Finally, the proposed set up corresponds to a closed economy where savings only comes from the high-income households agents. One may want to extend the model to an open economy where the amount of savings include surplus countries’ excess supply of assets.
7 Annexes

Table 1: 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>
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</table>

Table 2: 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 3: 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>Netherlands</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>
<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></td>
<td></td>
</tr>
<tr>
<td>Top 5%</td>
<td>-</td>
<td>-</td>
<td>0.902*</td>
<td>1.017*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.484)</td>
<td>(0.538)</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>
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<tr>
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<td>(0.414)</td>
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<td>(0.436)</td>
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<td>1.502***</td>
<td>1.625***</td>
<td>2.178***</td>
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<td>(0.378)</td>
<td>(0.384)</td>
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<td>1.230</td>
<td>0.685</td>
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<td>(1.744)</td>
<td>(2.263)</td>
<td>(2.093)</td>
<td>(1.954)</td>
</tr>
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<td>-0.287***</td>
<td>-0.378***</td>
<td>-0.127**</td>
<td>-0.267***</td>
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<td>(0.0560)</td>
<td>(0.0569)</td>
<td>(0.0622)</td>
<td>(AAA)</td>
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<td>41.64***</td>
<td>132.8***</td>
<td>163.8***</td>
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<td></td>
<td>(10.86)</td>
<td>(23.81)</td>
<td>(15.00)</td>
<td>(14.24)</td>
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<td>437</td>
<td>372</td>
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<td>R-squared</td>
<td>0.861</td>
<td>0.879</td>
<td>0.869</td>
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<tr>
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<td>YES</td>
<td>YES</td>
<td>YES</td>
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<td>17</td>
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</table>

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Table 5: 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>
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<tr>
<td>Lag of private debt</td>
<td>0.879***</td>
<td>0.820***</td>
<td>0.891***</td>
<td>0.842***</td>
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<td></td>
<td>(0.0919)</td>
<td>(0.132)</td>
<td>(0.0816)</td>
<td>(0.114)</td>
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<td>Top 1%</td>
<td>1.495*</td>
<td>0.668</td>
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<tr>
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<td>(0.849)</td>
<td>(1.407)</td>
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<tr>
<td>Top 5%</td>
<td>-</td>
<td>-</td>
<td>0.891**</td>
<td>0.344</td>
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<td>Lending rate</td>
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<td>-0.796</td>
<td>-0.498</td>
<td>-0.766*</td>
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<td>(0.404)</td>
<td>(0.535)</td>
<td>(0.325)</td>
<td>(0.460)</td>
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<td>-0.745**</td>
<td>-0.348</td>
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<td>(0.375)</td>
<td>(0.377)</td>
<td>(0.382)</td>
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<td>Compensation cost</td>
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<td>-</td>
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<td>0.313</td>
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<td>(2.215)</td>
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<td>-0.220*</td>
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References


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