An Analysis of Consumer Debt Restructuring Policies*

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Abstract

We solve a quantitative dynamic model of borrower behavior, whose income is subject to individual specific and aggregate shocks. Lenders provide loans competitively. Recessions are characterized by lower expected earnings growth and a higher likelihood of a large drop in earnings. The model generates procyclical credit demand and countercyclical default. We analyze alternative debt restructuring policies aimed at reducing default during recessions: (i) interest rate reduction; (ii) maturity extension; and (iii) refinancing. Outcomes are best for the maturity extension policy that allows borrowers to temporarily make interest-only payments on the loan. Not all borrowers exercise the option. The maturity extension policy leads to lower default rates, higher consumer welfare, and a smaller drop in consumption during recessions, without significantly increasing cash-flow risk for lenders.

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1 Introduction

During the last couple of decades there have been large increases in household leverage. Panel A of Figure 1 plots the ratio of total U.S. household debt to gross domestic product (GDP), which has roughly doubled from forty percent in the early eighties to eighty percent at the end of last year.[1] During the same period, the importance of household final consumption expenditure for aggregate output has also increased, and it now represents around two-thirds of GDP.[2]

[Figure 1 here]

At the micro level the large increase in leverage means that the net worth of households and their balance sheets may have become more sensitive to shocks to disposable income and to the value of their assets (Mian, Rao, and Sufi (2013)). When faced with a negative shock, more leveraged households may be forced to cut consumption more and, if shocks are correlated across households, the result may be a significant drop in aggregate household consumption and economic activity. Aggregate shocks are also likely to impact the financial position of banks and other financial institutions, with a decline in the value of their assets and a depletion of capital reserves, as we have witnessed in the financial crisis of 2007-2009. What should be done in such a situation? Should household debt be restructured? And if so, in which way?

Our goal is to provide some answers to these questions. In order to do so we set up a dynamic model, in which household earnings are subject to both economy-wide and individual specific shocks. More specifically, we follow Guvenen, Ozkan, and Song (2014) in our modelling of the agents' earnings process, so that recessions are characterized by lower expected earnings growth and a higher likelihood of a large drop in earnings. In each period, agents must decide how much to consume, whether to borrow using a term loan, and in case of positive outstanding debt, whether to default on the loan.

On the supply side we assume a competitive market for loan providers, that set spreads so as to break-even on the loans (as in for example Livshits, MacGee, and Tertilt (2007)). Our base model (endogenously) generates a number of interesting predictions, such as lower consumption growth during recessions, procyclical credit demand and countercyclical default. Recessions are characterized by lower earnings growth and higher earnings tail risk that reduce the incentives of many individuals to take a new loan. However, those who are hit by the lower earnings realizations arising from the tail risk do want to access credit. This means that those individuals who wish to borrow during recessions have relatively higher credit risk and are not as sensitive to the cost of credit. For those with large amounts of debt outstanding at the onset of the recession, the large drops in earnings that characterize bad times make default more likely.

[1] The increase is similar if we consider instead the ratio of household debt to disposable income. There are structural reasons for this upward trend, including financial market deregulation and innovation that has improved households' access to credit (see for instance Gerardi, Rosen, and Willen (2010)).

[2] In 2013 it was equal to 68.5 percent of U.S. GDP. (Source: The World Bank, at http://data.worldbank.org).

It is in the context of this model that we quantitatively evaluate the effects of alternative consumer debt restructuring policies, that involve some form of concession given to borrowers during recessions, either in the form of interest or principal reduction, or in facilitating a loan restructuring. More specifically, we evaluate the following policies: (i) interest rate reduction; (ii) loan maturity extension, i.e. temporarily allow for interest-only payments on the term loan, with a corresponding increase in its maturity; and (iii) facilitate loan refinancing during recessions, i.e. allowing borrowers to prepay the existing loan and to take out a new one.

Our motivation for studying the effects of debt restructuring during recessions is two fold. First, from an aggregate point of view, leverage and defaults pose particular challenges during bad times (Kiyotaki and Moore (1997)). They may lead to a downward economic spiral, the severity of which may be reduced by the debt restructuring policies that we study. Second, recessions are characterized by lower earnings growth and higher risk, but these aggregate events are far beyond the control of individual borrowers, which should help to mitigate moral hazard concerns.[3]

Another important aspect of our analysis is that we allow *all* borrowers, regardless of their savings or income, to take advantage of the restructuring policies if they wish to do so. In the context of our model with perfect information it would be straightforward to study more complex restructuring policies, for example that depend on savings. We abstract from this since implementing these more complex policies in practice may be difficult, as borrowers are likely to have private information that they may not have an incentive to disclose. Furthermore, a policy that is made available to all has the additional advantage of being less likely to be perceived as a bail out of a specific group of individuals. For government sponsored/subsidized restructuring programs this may be an important consideration, and it may facilitate their political implementation.

We evaluate the restructuring policies along several dimensions, including their impact on borrower welfare, defaults, consumption, and on the properties of lenders' cash-flows. Although there are trade-offs among the policies, the one that leads to better outcomes is loan maturity extension. Compared to the base model without debt restructuring, it generates lower unconditional default rates, lower default rates and a smaller drop in consumption in recessions, and an improvement in borrower welfare (measured in utility terms, from an ex-ante point of view). From the lenders perspective, the losses that arise from the postponing of loan principal repayments are offset by the drop in default rates and by the additional interest payments received. It is also important that not all borrowers decide to exercise the option to extend loan maturity. The lower earnings growth and higher earnings risk that characterize recessions, and the uncertainty regarding how long the recession will take, lead better off precautionary borrowers to keep on making the scheduled loan repayments and in this way reduce their leverage. This mitigates the impact of the policy on lender cash-flows.

[3]Even though the events that trigger the possibility of restructuring are not the result of borrowers' actions, the policies that we study are not immune to moral hazard. As our model results will show, the expectation of debt restructuring in bad times affects agents' consumption and borrowing behaviour also in good times.

The policy of allowing for a reduction in the loan interest rate in bad times is too costly, since all borrowers want to take advantage of it.[4] It implies that the loan interest rate must increase sufficiently in good times to compensate lenders for the significantly lower cash-flows that they will receive in recessions. This reduces the benefits of the policy. On the other hand, not all borrowers decide to refinance their loans in recessions. Only those who are worse off do so. This helps to reduce default rates in recessions. However, the increase in debt outstanding for the refinanced loans means that lender losses on those for which there is default are on average higher. Lenders need to be compensated for this up-front, which reduces the benefits of the policy. But the main disadvantage of this policy is its impact on lender cash-flows: they become significantly more volatile and there is a large number of periods in which lenders need to have significant amounts of capital to extend loans.

Our paper is related to a large literature on debt and default, and their implications for both the macroeconomy and asset prices. Seminal papers include Alvarez and Jermann (2000), Fay, Hurst, and White (2002), and Chatterjee, Corbae, Nakajima, and Rios-Rull (2007). Athreya (2005) and Livshits (2014) provide surveys of the literature on consumer credit and default. Our paper is also related to several others that study default in the context of the recent financial crisis (for example Corbae and Quintin (2015), Adelino, Gerardi, and Willen (2013)). Adelino, Gerardi, and Willen (2013) is particularly relevant since they address the question of why more lenders chose not to renegotiate home mortgages. They do not find evidence to support the notion that renegotiation was hampered by the fact that loans had previously been securitized. Instead they develop a model that points towards the roles of redefault and self-cure risk in reducing the benefits of renegotiation for investors. In our model there is also redefault and self-cure, but we show that the quantitative outcomes depend on the type of restructuring.

Some recent papers have studied the household deleveraging process that takes place during bad times and its aggregate economic implications (see for instance the important contribution of Guerrieri and Lorenzoni (2009)). Due to the characteristics of the earnings process, some of the agents in our model want to (endogenously) deleverage in bad times. And we show that in order for lenders to be able to break-even in recessions, they may need to restrict access to credit to the riskiest borrowers. In this way our paper also contributes to the understanding of the deleveraging process. But its main contribution is to model and quantitatively evaluate alternative forms of debt restructuring. In order to be able to do so we simplify along certain dimensions that have been the focus of the above literature (for example we do not solve endogenously for the equilibrium risk-free rate). In addition, we consider a setting with perfect information and focus on the quantitative implications of the different restructuring policies. Therefore our approach is very different from the theoretical model of Kovrijnykh and Livshits (2013) where debt restructuring arises with a positive probability in an optimal screening mechanism that deals with an adverse selection friction (the lender cannot observe the cost of default of the borrower).

[4]The same would be true for a policy that allows for a loan principal reduction.

Our paper is structured as follows. Section 2 describes the model, which we parameterize in section 3. Section 4 is the main results section. Section 5 extends the main model by introducing the possibility of credit rationing. The final section concludes.

2 The Model

The demand for credit comes from agents who in each period decide how much to consume, borrow, and whether to default on existing debt. Lenders provide loans at a rate such that on average they break-even. In our base model there is no option to restructure the debt. This base model provides a benchmark to which we compare the effects of alternative restructuring policies. In this section we describe in detail the several features of the model. Even though we solve endogenously for the loan premium, our model is in several dimensions partial equilibrium. This allows us to model in more detail the different restructuring policies.

2.1 Aggregate state

In each period the economy may either be in an expansion or in a recession. An exogenous transition probability matrix governs the evolution between these states. We define the indicator function I_t^{cycle} to be equal to one if the economy is in an expansion in period t, and zero otherwise. The demand for credit comes from consumers who are endowed with stochastic earnings. The state of the economy affects the expected earnings growth and risk.

Risk-free interest rates are also exogenously given, but stochastic. Let r_{1t} denote the expected log gross real return on a risk-free (of default) one-period bond, so that $r_{1t} = \log(1 + R_{1t})$. We assume that it follows an $AR(1)$ process:

$$r_{1t} = \mu_r(1 - \phi_r) + \phi_r r_{1,t-1} + \omega_t, \tag{1}$$

where ω_t is a normally distributed white noise shock with mean zero and variance σ_ω^2. We let innovations to short-term interest rates be correlated with the business cycle variable.

2.2 Agents preferences and earnings

In each period a new set of consumers/households enters our economy and remains in it for T periods. We model the consumption and debt choices of these agents. Let t_i denote the period in which the agent indexed by i enters the economy. We assume that his/her preferences are time separable and exhibit constant relative risk aversion:

$$\max E_{t_i} \sum_{t=t_i}^{t_i+T} \beta_i^{t-t_i} \frac{C_{it}^{1-\gamma_i}}{1-\gamma_i} + \beta_i^T b_i \frac{W_{i,t_i+T+1}^{1-\gamma_i}}{1-\gamma_i}, \tag{2}$$

where β_i is the time discount factor, C_{it} is consumption, and γ_i is the coefficient of relative risk aversion. The agent derives utility from both consumption and terminal real wealth, W_{i,t_i+T+1}, which can be interpreted as the remaining lifetime utility from reaching age $T+1$ with wealth W_{i,t_i+T+1} or as the utility derived from a bequest. The parameter b_i measures the relative importance of the utility derived from terminal wealth. Individuals are heterogeneous and our notation uses the subscript i to take this into account. It is worth noting that the above preferences give rise to a precautionary savings motive, with relative prudence equal to $\gamma_i + 1$.

Each individual that enters the economy is endowed with a stream of stochastic earnings. There is considerable evidence that the nature of the income risk faced by households varies over the business cycle. Several papers have provided evidence for and modeled countercyclical income risk, either in the form of countercyclical variances (among these are Constantinides and Duffie (1996), Krusell and Smith (1997), Storesletten, Telmer, and Yaron (2007)) or of countercyclical left-skewness of shocks (Mankiw (1986), Kocherlakota and Pistaferri (2009), Chen, Michaux, and Roussanov (2013)).

More recently, Guvenen, Ozkan, and Song (2014) have used a large dataset from the U.S. Social Security Administration to provide evidence for countercyclical left-skewness of earnings shocks. In recessions large increases in earnings become less likely and large drops become much more likely. We use their earnings process specification in our model. Let Y_{it} denote the stream of non-tradable stochastic real earnings of individual i. As usual, we use a lower case letter to denote the natural log of the variable, so that $y_{it} \equiv \log(Y_{it})$. Log real earnings is equal to the sum of a transitory (ϵ_{it}) and a persistent (z_{it}) components. Innovations to the persistent component feature a mixture of normals:

$$y_{it} = z_{it} + \epsilon_{it}, \tag{3}$$

$$z_{it} = \rho z_{i,t-1} + \eta_{it}, \tag{4}$$

where $\epsilon_{it} \sim \mathcal{N}(0, \sigma_\epsilon)$ and:

$$\eta_{it} = \begin{cases} \eta_{it}^1 \sim \mathcal{N}(\mu_{1,I_t^{cycle}}, \sigma_1), & \text{with probability } p_1 \\ \eta_{it}^2 \sim \mathcal{N}(\mu_{2,I_t^{cycle}}, \sigma_2), & \text{with probability } 1 - p_1, \end{cases} \tag{5}$$

where recall the subscript I_t^{cycle} indicates whether period t is an expansion or a recession. This setup allows us to capture important deviations of earnings growth from normality, including negative skewness and excess kurtosis, and business cycle variation in expected earnings growth through the different means of the normal distributions. The higher probability of a large drop in earnings in recessions is likely to affect borrowers incentives to default on the loans and the benefits of debt restructuring.

We model the tax code in the simplest possible way, by considering a linear taxation rule. Gross labor income and interest earned are taxed at the constant tax rate ϕ.

2.3 Demand for loans and default

The demand for credit comes from consumers. We model a multi-period (installment) loan with initial maturity τ. In each period agents with no debt outstanding decide whether to borrow using such loan. They may wish to do so to smooth consumption over the life-cycle (earnings grow on average over time) and/or in response to a negative earnings shock. Let $t_i^{'}$ denote the period in which agent i has decided to take out the currently outstanding loan, so that the remaining loan maturity is given by $m_{it} = \tau - (t - t_i^{'})$. Furthermore, let the amount borrowed by individual i at loan initiation be given by K_{it}. This amount may depend on borrower characteristics and the aggregate state at the time that the loan is taken out.

We assume that loans are adjustable-rate, with interest rate given by the one-period bond rate plus a credit risk premium ψ_{it}:

$$R_{it}^{loan} = R_{1t} + \psi_{it}. \tag{6}$$

The premium on the loan compensates lenders for the risk of default on the loan outstanding by borrower i at time t. The subscripts i and t allow for the possibility that the premium depends on borrower characteristics and aggregate variables at the time that the loan was taken out (and the premium determined). The loan premium remains fixed over the life of the loan.[5] The period t installment due on the loan (L_{it}) is given by:

$$L_{it} = R_{it}^{loan} D_{it} + \Delta D_{i,t+1} \tag{7}$$

where D_{it} is the principal amount outstanding on the loan at date t and $\Delta D_{i,t+1}$ is the loan principal repayment due in that period. In order to simplify the solution of the problem, we follow Campbell and Cocco (2015) in assuming that the loan principal repayments are the same as the agent would have to make on loan with a fixed rate, equal to the mean rate on a τ-period bond plus the credit risk premium.[6]

This simplifies the problem since then the current level of the outstanding debt is not a state variable: the loan interest rate, the initial amount borrowed, and the remaining maturity pin down the currently outstanding level of debt (and principal repayments due).

Borrowers choose in each period whether to default on the loan. We assume that loans are non-recourse, but in case of default borrowers are excluded from credit markets for the remaining time horizon. In addition, default carries a utility penalty in the period that the agent defaults equal to λ, which can be interpreted as a social stigma cost (as in for instance Gross and Souleles (2002) and Guiso, Sapienza, and Zingales (2013)).

[5]In the parameterization section we will set $\tau < T$, so that the same individual may take out multiple (not concurrent) loans over the period in which he/she is in our economy.

[6]To model long-term interest rates, we assume that the log expectation hypothesis holds. That is, we assume that the log yield on a long-term n-period real bond, $r_{nt} = \log(1 + R_{nt})$, is equal to the expected sum of successive log yields on one-period real bonds which are rolled over for n periods plus a constant term premium ξ_n.

In the baseline model we rule out loan prepayment, but later on we will consider this possibility. More precisely, we will allow for the possibility that borrowers prepay the loan at a cost equal to a percentage θ_P of the currently outstanding loan balance (in the baseline model we set this cost to infinity). In addition, to simplify the model we assume that borrowers are only allowed to take out one loan at a time.

2.4 Banks

We assume a competitive market for loan providers that set the loan premium so as to on average break-even. In our model with perfect information each loan premium could depend on all the state variables of the problem at the time that the loan is initiated, including the levels of savings, earnings, and so on. But given the large number of state variables this would make the problem intractable. Therefore, for most of the cases considered we assume that the loan premium is the same for all borrowers and time periods. Furthermore, we assume that all agents who have not previously defaulted are able to access credit. In section 5 we relax these assumptions and allow for the possibility that credit availability and loan premia depend on the aggregate state of the economy and on borrower variables such as his/her earnings at loan initiation.

In period $t_i^{'}$ in which agent i takes out a new loan, lender cash-flows are given by:

$$CF_{it}^{\text{lender}} = -K_{it} \tag{8}$$

In periods t subsequent to loan origination and prior to loan maturity, i.e. when $t > t_i^{'}$ and $t \leq t_i^{'} + \tau$, and for the case of no previous default lender cash-flows are given by:

$$CF_{it}^{\text{lender}} = L_{it} \qquad \text{if } \mathbb{1}_{it}^{def} = 0 \tag{9}$$

$$CF_{it}^{\text{lender}} = 0 \qquad \text{if } \mathbb{1}_{it}^{def} = 1 \tag{10}$$

where $\mathbb{1}_{it}^{def}$ is an indicator function that takes a value of one if the consumer defaults in period t. Lenders do not recover anything in case of default. We calculate the present discounted value of the above loan cash-flows using both the risk-free interest rate and a risk-adjusted discount rate that reflects the fact that cash-flow is more valuable in recessions.[7]

We use these present value calculations, averaged across all loans granted, to endogenously determine the loan premium so that lenders' profitability is the same across the different restructuring policy scenarios that we study.

[7] Our model is in several dimensions partial equilibrium so that we cannot endogenously derive a pricing kernel. However, we use the model to parameterize an exogenously specified pricing kernel. We give further details below.

2.5 Restructuring policies

We model several private sector led restructuring policies.[8] These restructuring policies involve some form of concession given to borrowers during recessions. We focus on recessions since from an aggregate point of view leverage and defaults pose particular challenges during bad times (Kiyotaki and Moore (1997)). They may lead to a downward economic spiral, the severity of which may be reduced by the debt restructuring policies that we study. In addition, recessions are aggregate events that are far beyond the control of individual borrowers, which should help to mitigate moral hazard concerns.

In a recession, lenders offer borrowers the choice of whether to restructure or modify the loan, who in turn choose whether to accept the offer or not. We assume that lenders commit to making such offer at loan initiation. Alternatively, one can think of the restructuring as a borrower option that is included in the initial loan agreement. A simplifying assumption is that we allow all borrowers, regardless of their savings or income to take advantage of the restructuring policy (if they wish to do so). In the context of our model with perfect information it would be straightforward to study more complex restructuring policies, for example in which the offer to modify the loan depends on borrowers' savings or income. In our baseline model we do not analyze such policies since implementing them in reality may be difficult: the information required is not always available to lenders (or the government) and borrowers may not have an incentive to disclose it. In the recent financial crisis some lenders and policy makers were reluctant to offer borrowers mortgage modifications due to a concern that even those who were not at an immediate risk of default would pretend otherwise so as to benefit from the concessions (Adelino, Gerardi, and Willen (2013)). Our goal is to study the efficacy of restructuring policies that are simple and have few information requirements.[9]

The first restructuring policy that we model is the possibility of extending loan maturity during recessions. Under this alternative, if borrowers decide to take advantage of it, debt service will temporarily comprise only interest, with principal loan repayments restarting the following period, and loan maturity extended by a period. For multi-year recessions, borrowers choose whether to exercise the option to extend maturity in each of the recession years. Lender cash-flows for the periods in which the loan is restructured are given by:

$$CF_{it}^{\text{lender}} = D_{it} R_{it}^{loan} \qquad \text{if } \mathbb{1}_{it}^{mat} = 1 \tag{11}$$

where $\mathbb{1}_{it}^{mat}$ is an indicator function that takes a value one if at time t agent i chooses to extend the maturity of the loan.

[8]These are often referred as the main methods of private debt restructuring that do not require governmental sponsorship. But the restructuring policies that we study could also be government supported. See for example the IMF Staff Position Note on Household Debt, available at https://www.imf.org/external/pubs/ft/spn/2009/spn0915.pdf.

[9]In addition, a policy that is made available to all borrowers has the additional advantage of being less likely to be perceived as a bail out of a specific group of individuals. For government sponsored/subsidized restructuring programs this may be an important consideration, that may facilitate their political implementation.

The second restructuring policy that we consider is a modification to the loan terms, in the form of a loan interest rate reduction during recession period t. In recessions borrowers still need to pay the principal due according to the original repayment schedule, but the interest payment required is lower so that:

$$CF_{it}^{\text{lender}} = D_{it}(R_{it}^{loan} - \Delta R) + \Delta D_{i,t+1} \qquad \text{if } \mathbb{1}_{it}^{rate} = 1 \tag{12}$$

where ΔR is the interest rate reduction offered. Borrower choice in this case is trivial: all agents will take-up the offer to modify the loan (the indicator function $\mathbb{1}_{it}^{rate}$ will always be equal to one when the choice is offered).

The third policy that we model is loan refinancing: borrowers are allowed to take out a new loan but they must use part of the proceeds to repay the previously outstanding debt. Let $\mathbb{1}_{it}^{ref}$ be an indicator function that takes the value of one if the agent restructures his debt, and zero otherwise, and t^R the period in which the loan is restructured. Lender cash-flow is given by:

$$CF_{it}^{\text{lender}} = D_{it}R_{it}^{loan} + D_{it} - K_{i,t^R} \qquad \text{if } \mathbb{1}_{it}^{ref} = 1 \tag{13}$$

where the first two terms correspond to the repayment of the pre-existing debt and the last term the loan taken out in the re-structuring.

2.6 The optimization problem

To more clearly evaluate the effects of the alternative policies that we study, we first solve the model for a case in which restructuring is not possible. We then analyze each one of the three restructuring policies at a time.

The timing within a period is as follows. The agent starts period t with wealth W_{it} and labor income Y_{it} is realized. Following Deaton (1991) we define cash-on-hand as $X_{it} = W_{it} + Y_{it}$. In each period the agent decides how much to consume C_{it}, whether to take out a new loan (if no loan outstanding nor previous default), and whether or not to default on the loan outstanding (if any). Agents take loan terms as given. For the scenarios in which restructuring is possible, an additional choice variable in recessions is whether to restructure the loan.

The state variables are: the time period t, whether the economy is in an expansion or recession (I_t^{cycle}), the real interest rate (R_{1t}), cash-on-hand (X_{it}), the level of permanent income (Z_{it}), the initial loan amount (K_{it}), the remaining loan maturity (m_{it}), and whether the agent has previously defaulted on his/her debt (I_{it}^{def}). Each of the three problems for when restructuring is allowed does not require any additional state variables.[10] We setup the consumer problem recursively and define two distinct value functions: $V_{it}(\cdot)$ is the value in case of no previous default and loan repayment in period t and $V_{it}^{def}(\cdot)$ is the value of defaulting in period

[10]This is because of instead of keeping track of the period when the currently outstanding loan was initiated we keep track of the number of remaining loan periods. When loan maturity is extended the remaining number of loan periods is unchanged.

t. In case of no previous default the Bellman equation for this problem is given by:

$$V_{it}(X_{it}, Z_{it}, I_t^{cycle}, R_{1t}, K_{it}, m_{it}) = \max\{U(C_{it}) + \beta E_t \max[V_{i,t+1}(\cdot), V_{i,t+1}^{def}(.)]\} \tag{14}$$

where V^{def} denotes the value obtained from defaulting on the debt. It is given by:

$$V_{it}^{def}(X_{it}, Z_{it}, I_t^{cycle}, R_{1t}) = \max\{U(C_{it}) - \lambda + \beta E_t V_{i,t+1}^{def}(\cdot)\} \tag{15}$$

In case of no previous default the agent maximizes equation (14) subject to the law of motion for cash-on-hand and the other model restrictions. In case of previous default the agent maximizes (15) (except that the stigma cost of default is only paid in the period in which default occurs).

In periods when the agent does not default nor take out a new loan, cash-on-hand evolves according to (if there is no debt outstanding L_{it} is equal to zero):

$$X_{i,t+1} = (X_{it} - C_{it} - L_{it})(1 + (1 - \phi)R_{1t}) + (1 - \phi)Y_{i,t+1} \qquad \text{if } \mathbb{1}_{it}^{def} = 0 \tag{16}$$

In periods in which the agent takes out a new loan:

$$X_{i,t+1} = (X_{it} - C_{it} - L_{it} + K_{it})(1 + (1 - \phi)R_{1t}) + (1 - \phi)Y_{i,t+1} \tag{17}$$

where L_{it} denotes the last payment on any previously outstanding loan. In case of default the law of motion for cash-on-hand is simply given by:

$$X_{i,t+1} = (X_{it} - C_{it})(1 + (1 - \phi)R_{1t}) + (1 - \phi)Y_{i,t+1} \qquad \text{if } \mathbb{1}_{it}^{def} = 1 \tag{18}$$

For the case in which there is the possibility of extending loan maturity the equation describing the evolution of cash-on-hand is:

$$X_{i,t+1} = (X_{it} - C_{it} - D_{it}R_{it}^{Loan})(1 + (1 - \phi)R_{1t}) + (1 - \phi)Y_{i,t+1} \qquad \text{if } \mathbb{1}_{it}^{mat} = 1 \tag{19}$$

And for the refinancing policy, in periods when the agent refinances the loan:

$$X_{i,t+1} = (X_{it} - C_{it} - D_{it}(1 + R_{it}^{Loan}) + K_{i,t^R})(1 + (1 - \phi)R_{1t}) + (1 - \phi)Y_{i,t+1} \qquad \text{if } \mathbb{1}_{it}^{ref} = 1 \tag{20}$$

The problem of the agent cannot be solved analytically. We solve it numerically via backward induction, using grid search, non-linear value function interpolation and gaussian quadrature methods. We give details on the numerical solution technique in Appendix A. The agent solves his/her problem given the loan premium.

In each period t a new set of agents enters the economy and they remain in it for T periods. They take the loan premium that they are offered as given. Banks provide loans to these agents and set the loan premium so as to on average break-even across all loans granted. In the baseline version of the model we simplify by assuming a similar loan premium for all agents and time periods, so that $\psi_{it} = \psi$. However, when we compare across restructuring policies we solve endogenously for the loan premium so that lenders' profitability is the same across the different scenarios. Furthermore, in section 5 we allow for the possibility that the loan premium varies over time with the aggregate state of the economy and that banks screen borrowers based on their earnings.

It is important to note that even though we solve endogenously for loan premia our model is not a full general equilibrium one: we do not clear the market for consumer loans nor do we solve endogenously for the risk-free rate. By simplifying along these dimensions we are able to model with much more realism the different restructuring policies.

3 Parameterization

We use a combination of approaches to parameterize the model, including data, parameter values from the literature, and calibration. Each period corresponds to one year.

3.1 Business cycle, interest rates and earnings

To parameterize the annual transition probability matrix for expansions/recessions we use the NBER Business Cycle Dates, from 1855 to 2013. The latter data are quarterly, so we first classify each calendar year as a recession year if for three or four quarters during that year the economy was in a recession. According to this classification, the proportion of recession years is 22%, so that the economy is in a recession on average for one year in every five. The transition probabilities between expansion/recession are reported in Panel A of Table 1.

[Table 1 here]

We choose the earnings process parameters to match the cyclicality of earnings documented by Guvenen, Ozkan, and Song (2014). We use their "persistent-plus-transitory" specification and report their estimated parameters in Panel B of Table 1. Recall that their error structure features a mixture of two normals, whose moments are denoted by (1) and (2) in the table. As Guvenen, Ozkan, and Song (2014) explain, the two normals can be economically interpreted as between-job (1) and with-in jobs (2) earning changes, or as idiosyncratic and aggregate shocks. In any given year, with probability p_1, the agent changes job and his/her earnings shocks have a large standard deviation, equal to 0.325 (determined mainly by idiosyncratic factors). With probability $1 - p_1$ the agent does not change jobs, earnings growth is mainly determined by aggregate factors, and it has low dispersion. The means of the normal distributions are such that expected earnings growth is considerable lower in recessions than in expansions.

3.2 Preferences

In our benchmark parameterization we set the coefficient of relative risk aversion (γ) equal to 2 and the subjective discount factor (β) equal to 0.80. Given the large consumer loan interest rate observed in the data we need to use a sufficiently low value for β to provide the agent with the appropriate incentives to take on consumer debt. In order to reduce further the agent's incentives to save, we set the bequest parameter to zero. We interpret the agents in the model as being at an early stage of the life-cycle and not yet concerned with saving for retirement. Accordingly, we set T equal to twenty. The benchmark preference parameters are summarized in Panel C of Table 1.

3.3 Interest rates and loan parameters

We follow Campbell and Cocco (2015) in the parameterization of the log real interest rate. We set the average log real interest rate to 1.2%, the persistence coefficient to 0.825, the standard deviation of shocks to 1.8%, and the term premium to 0.5% (Panel D of Table 1). We have used the data to calculate mean real interest rates in recession and expansion years. The mean real interest rate in recessions (expansions) is 2.44% (1.54%). The difference is not statistically significant, so that in our baseline parameterization the level of real interest rates does not depend on whether the economy is in an expansion or recession.[11]

There are two main types of household debt: consumer debt (credit card debt, consumer loans) and mortgage debt. In terms of their relative importance, consumer debt constitutes around one-third and mortgage debt around two-thirds of the total outstanding household debt.[12] These two types of debt differ along several important dimensions. Consumer debt is predominantly unsecured (car loans are an exception) and mortgage debt is secured. Accordingly, house values that tend to fluctuate with aggregate economic conditions are an important determinant of the value of mortgage debt. Consumer debt is more prevalent among lower income households whereas mortgage debt is more prevalent among higher income households. In the U.S. consumer debt tends to be predominantly (but not exclusively) adjustable-rate whereas long-term fixed rate are the predominant form of mortgage contracts. The loans in our model are most similar to unsecured consumer loans, so that we use data on this type of debt to parameterize them.

In Figure 2 we plot the evolution over time of consumer loan spreads (both credit card debt and personal loans spreads). Spreads are on average higher for credit card debt than for personal loans. Furthermore, spreads tend to fluctuate over time, mainly as a result of fluctuations in interest rates. Spreads tend to increase in recessions, and to remain high for

[11]It would be straightforward to relax this assumption and study the quantitative effects of a reduction in interest rates in bad times.

[12]The weight of both consumer debt and mortgage debt on disposable income has significantly increased over time: mortgage debt and consumer debt represented 40% and 15% of disposable income in the early eighties compared to roughly 70% and 25% at the end of 2014, respectively.

a number of years after the end of the recession, so that when we compare the average level of the spread between recessions and expansions their difference is not statistically significant (first two rows of Table 2).

[Figure 2 here]

In several of the experiments that we carry out we solve endogenously for loan spreads. However, in order to do so from first principles we would need estimates of the costs and normal profits of loan providers, which we do not have. To overcome this difficulty, we first solve our model setting the loan premium equal to the average value observed in the data of (roughly) 8% (for personal loans, which better resemble the type of loan we model). We then calculate the profits of loan providers, which we take to be the normal profits. In the experiments that we carry out we solve for the loan premium that generates this same level of average profits.[13]

[Table 2 here]

We use data from the Survey of Consumer Finances to parameterize the loan amount (K_{it}). In these data the average value of consumer installment loans outstanding (excluding education and auto loans) per household has increased from 5.8 thousand dollars in 1989 to 15.9 thousand dollars in 2013 (conditional on the household holding positive debt). Dividing the latter value by the average number of adult household members of 1.6 gives us an average amount outstanding of 9.93 thousand dollars. With this in mind, we set the loan amount in our model to ten thousand dollars.[14]

A final loan related parameter that we need to calibrate is the utility penalty in case of default (λ). We choose its value so that our baseline model (roughly) matches the average default rates observed in the data. There are several measures of default that we could use, including delinquency rates, charge-off rates, and personal bankruptcy filings. For the former two we have data by loan type, that we plot in Figure 3, Panels A and B, respectively. For consumer loans delinquency rates are on average higher than charge-off rates, equal to 3.5% and 2.5% respectively. Some of the loans that are past due are eventually repaid, so that lenders do not incur a loss.

A third default measure is bankruptcy filings. It is defined as the proportion of households that file for bankruptcy in a given year. As Panel C of figure 3 shows there has been a large increase in filings over time from an annual rate of less than half a percent in the early eighties

[13] In the baseline model we set the premium equal to 8% for both recessions and expansions, and focus on unconditional profits, but in section 5 we relax this assumption. The fact that the average loan premium is not statistically different across expansions/recessions does not mean that lenders do not differentiate between loans granted at different stages of the business cycle, since the riskiness of the loans granted may be different. We will come back to this, important point, later in the paper.

[14] In a future version of the paper we plan to expand the set of loan choices available to agents.

to values over one percent in the more recent years.[15] With these several data sources in mind, in our baseline parameterization we target an average default rate of 2%, somewhat higher than bankruptcy filings but lower than annual charge-off rates on consumer loans.

[Figure 3 here]

It is important to note that we set λ to be the same in expansions and recessions. Therefore any model generated differences in default rates between recessions and expansions are due to differences in earnings characteristics and the choices of the agents in the model. In the data we observe delinquency and charge-off rates that are significantly higher in recessions than in expansions (the last column of Table 2 reports the t-statistic for a test for the equality of means for recessions and expansions). In the last two rows of Table 2 we report percentage changes in total U.S. consumer debt outstanding (also as a ratio of household disposable income). The last row shows that consumer debt as a ratio of disposable income is procyclical, which contrasts with the countercyclical nature of default rates. In our baseline calibration we do not allow agents to prepay their loans (the prepayment cost is set equal to infinity). The loan parameters are summarized in Panel E of Table 1.

3.4 Risk adjusted discount factors

In order to be able to compare across restructuring policies we need to calculate the present discounted value of the lenders' cash-flows. We compute such present values using both risk-free interest rates and risk-adjusted discount rates. The former do not take into account that cash-flows received during recessions tend to be more valuable than cash-flows received during good times. In order to somehow take this into account, similar to the approach of Campbell and Cocco (2015), we use our model to derive risk-adjusted discount rates.

We proceed in steps. First, we solve the model for agents with a coefficient of relative risk aversion equal to 0.5, a rate of time preference β equal to 0.99 and a bequest motive intensity b equal to one. Such agents may be interpreted as the long-horizon version of the more myopic agents in our model of consumer debt (agents with β equal to 0.80 and a b equal to zero).[16] Second, we use our model results for such agents to calculate expected consumption growth rates for different states of the world (recession/expansion and low/high risk-free interest rates), averaged across all agents. Finally, we use these consumption growth rates to derive a pricing kernel for each state of the world. The implicit assumption is that the marginal utility of a representative long-horizon agent is the relevant metric for pricing cash-flows received in

[15]The annual average over the last decade is 1.05%. The large drop in 2006 follows the passage of the Bankruptcy Abuse Prevention and Consumer Protection Act of 2005, which was effective October 2005. Bankruptcy rates have since then increased.

[16]The reason why we set the coefficient of relative version to a lower value of 0.5 is that otherwise the calculations described below predict an unrealistically high risk-free rate.

different states of the world. Table 3 reports the values of the discount rates.[17] We will perform sensitivity analysis on these.

[Table 3 here]

3.5 Simulated data

We use the stochastic processes for the exogenous variables and the policy functions for the agent choices to generate simulated data. We first generate four hundred different paths for the aggregate variables (recession/expansion and the level of interest rates) over a forty year period. In each of these periods a new set of five hundred agents enters the economy, for whom we generate earnings and simulate choices over their twenty year horizon (after which they drop out from our simulated data). Finally, we discard all the data corresponding to the first twenty years of the aggregate variables. This ensures that in each period a new set of agents enters our economy at the same time that a set of agents drops out from our sample. Thus the total number of observations is four million (four hundred aggregate paths $\times$ five hundred individuals per aggregate path/period $\times$ twenty periods). We generate simulated data for the different experiments that we carry out, but the realizations for the random variables are the same throughout. The results that we discuss in the next section are based on these simulated data.

4 Results

We first describe the baseline model results in which there is no debt restructuring. We then evaluate the impact of the different restructuring policies.

4.1 Baseline results

The first three rows of Table 4 report the first three moments of log earnings growth. The table reports both unconditional moments and moments conditional on whether the economy is in a recession or in an expansion. Earnings moments result directly from our specification and parameterization of the earnings process and are the same for all the experiments that we carry out. On average log earnings grow at an annual rate of 2.7%, but there are significant differences between recessions and expansions, with average annual growth rates of -0.8% and 3.7%, respectively. The standard deviation of log earnings growth is fairly high, but similar for

[17] Since the discount rates for future cash-flows are higher in recessions than in expansions, cash-flows received during recessions are more valuable. It is important to note that our model is not a general equilibrium one, and that we do not clear the market for consumer loans. We are simply using the consumption choices of the long-horizon agents to specify a pricing kernel that takes into account differences in marginal utility across states of the world.

recessions and expansions. Recessions are riskier because of the higher probability of a large drop in earnings, as reflected in left-skewness of the earnings growth distribution.

[Table 4 here]

To better understand the effects of debt we briefly discuss the results from a model where borrowing is not allowed. Panel B of Table 4 reports measures for the first three moments of log consumption growth, based on agents' optimal choices, for such a model. As expected, earnings characteristics are reflected on consumption choices and properties. Average log consumption growth is negative during recessions, so that agents cutback on consumption during bad times. They do so because they expect lower earnings growth, but also because earnings risk is higher and they have a precautionary savings motive. These two channels lead to a drop in average log consumption growth during recessions that is slightly higher (in absolute value) than the drop in average log earnings growth. In spite of this, agents are able to achieve some smoothing of idiosyncratic earnings shocks: the standard deviation of log consumption growth is 0.29 compared to a standard deviation of log earnings growth equal to 0.35. The final row of Panel B reports the average savings generated from the model. They are equal to roughly one thousand dollars, reflecting the fact that agents in our model do not have much of an incentive to save. Thus one should not interpret our buffer-stock model of saving and borrowing behavior as being one of a representative consumer.

In Panel C we report results for the baseline model with consumer debt. Average annual log consumer growth is considerably smaller than in the model without debt, 2.2% compared to 3.1%, respectively. Therefore, debt allows agents to achieve better lifetime consumption smoothing. The difference in consumption growth rates between recessions and expansions is larger, though. When the economy is hit by a recession, those agents who have debt outstanding are forced to cut consumption by more, as part of their earnings are used to meet debt repayments. The quantitative effects are significant: a drop in consumption of 2.7% during recessions, compared to a drop of 1.3% in the model without debt. The larger drop in consumption growth that takes place during recessions helps to explain why the model with debt generates larger skewness in log consumption growth than the model without debt. Debt is beneficial for the agents in our model: the welfare gain of agents from having access to credit, calculated in the form of an equivalent consumption variation, is 1.93% of annual consumption.

The last two rows of Table 4 report lenders' average net present values (at loan initiation) of loan cash-flows (using either the risk-free interest rate or the risk-adjusted discount rate to discount future cash-flows). Their unconditional values are equal to 1.476 and 0.680 thousand dollars, respectively. We interpret the latter value as being the one that covers the costs and normal profits of loan providers. In the different restructuring experiments that we carry out we solve for the loan premium that matches this value.

Table 4 also reports average net present values at loan initiation for loans initiated in recessions and in expansions. There are significant differences across the cycle, particularly when one considers the risk-adjusted calculations. Loans granted in recessions are on average riskier and achieve significantly lower profitability, suggesting that lenders should increase loan premia during bad times. However, in the data we did not find statistically significant differences in average premia in recessions and expansions, so that in this section we set the loan premium to be the same across these periods.[18]

To better understand the model generated business cycle debt dynamics, Panel A of Table 5 reports the probability that agents decide to take out a new loan (conditional on them being allowed to do so, i.e. not having a loan outstanding nor having previously defaulted). On average in each period one in four agents decide to take a new loan. High interest rates reduce the demand for debt: the probability that a new loan is initiated when interest rates are high is 24% compared to 26% when interest rates are low. The differences over the cycle are quantitatively more significant: the probability that a new loan is initiated in a recession is 18% compared to 27% in an expansion. Recessions are characterized by lower expected earnings growth and higher earnings risk, both of which reduce agents' incentives to borrow. The lower incentives to borrow in bad times are reflected in the policy functions: for given levels of permanent income and interest rates, the cash-on-hand threshold below which agents do not take on any debt is higher in recessions than in expansions.

[Table 5 here]

There is however an additional channel: recessions are characterized by a higher probability of a large drop in earnings. Those agents who are hit by the drop do want to borrow. This is visible in Panels B and C of Table 5 where we compare average earnings for those agents who decide to take out a new loan and for those who decide not to borrow. As expected, those agents with lower earnings and savings are the ones who decide to take out a loan. Interestingly, the differences in earnings relative to those who decide not to borrow are larger in recessions than in expansions. The ratio of average earnings between those who do not take out a new loan and those who do so is 1.7 (1.5) in recessions (expansions). Thus, our model generates fairly rich business cycle debt dynamics: recessions are characterized by a lower overall demand for credit, but also by a shift in the composition of borrowers towards relatively high risk (low earnings) agents.

The final Panel of Table 5 reports the probability that agents take a new loan in the period when the previous loan matures.[19] These probabilities are considerably higher than those in Panel A that are not conditional on individuals/periods in which a previous loan matures. This reflects the fact that there is persistence in earnings and in the set of agents who find it beneficial to borrow.

While the demand for credit in our model is procyclical, default is countercyclical. In Panel A of Table 6 we report annual default probabilities. Average annual default rates are as high as

[18] In section 5 we relax this assumption and allow for the possibility that the loan premium is higher for loans granted in recessions.

[19] Recall that for tractability we have assumed that individuals may only have one loan outstanding at a time.

2.8% in recessions, compared to 1.6% in expansions. The average unconditional annual default rate is 1.8% which is the value targeted by our calibration of the utility cost of default λ. Recall that this cost is the same during good times and bad times, so that the differences in default rates over the cycle arise from the different earnings characteristics. During recessions more borrowers are hit by a large drop in their earnings, and the resulting lower cash-on-hand leads them to default. Default probabilities are higher when interest rates are high than when they are low, but the quantitative difference is smaller than the difference in default rates between expansions and recessions.

Panels B and C of Table 6 compare the characteristics of those who decide to default to those who decide not to do so. On average defaulting agents have lower earnings, they have recently experienced a large negative earnings shock, and they tend to have higher levels of outstanding debt.

The default rates reported in Panel A are per period, i.e. based on the proportion of loans outstanding at the beginning of the period for which there is default in that period. Some of these loans were initiated in recessions and others in expansions. In the last panel of Table 6 we report per loan default probabilities, conditional on the state of the economy when the loan was initiated (and not when default occurred). These default probabilities are calculated using one observation per loan and they are not annualized, thus their larger values. Loans granted in recessions are considerably riskier than loans granted in expansions. This is because recessions are persistent and characterized by lower earnings growth and higher earning risk, and because agents who take out loans in recessions tend to have lower earnings.

[Table 6 here]

As an illustration of the effects at work in our model in Figure 4 we plot simulated cross sectional means of log earnings and consumption growth, leverage and default for an economy calibrated to match the 1993-2013 period in terms of the business cycle and interest rate fluctuations. We simulate the optimal decisions for five thousand agents. Recession years correspond to the shaded areas in the figure. Earnings and consumption growth decline in recessions. Consumption growth also responds to the fluctuations in the real interest rate that we plot in the second panel. In the third panel we plot two measures of leverage: the ratio of total outstanding debt to total earnings and the growth rate in total debt outstanding. There is a deleveraging in the economy during recessions, with a negative growth rate in total debt outstanding (right scale). The fourth panel in the figure plots default rates: they increase in recessions and when interest rates go up. The decline in interest rates that took place in the recession year of 2001 helps to explain why the model predicted default rates for this year are not as high as those for the 2008 recession. The last panel of Figure 4 plots lender cash-flows. They tend to be higher in periods in which there is deleveraging.

[Figure 4 here]

4.2 Restructuring Policies

We now study the effects of allowing for debt restructuring. We evaluate the impact of the policies on several variables, including consumption, demand for credit, default, agents' welfare, and lenders' cash-flows. To facilitate the comparison we first report results for the same loan premium as in the baseline model. But we also solve (and report results) for loan premia endogenously determined so that lenders' expected profitability is the same as in the baseline model. We consider the effects of each of the restructuring policies one at a time, but we use the same realizations for the shocks throughout.

4.2.1 Loan maturity extension

When a recession hits borrowers have the option to extend loan maturity by one period and to temporarily make only interest payments on the loan. Panel B of Table 7 reports the effects of this restructuring policy for a constant loan premium of 8%. And to facilitate the comparison in Panel A we report the previously discussed baseline model results where restructuring is not allowed. From the comparison of the consumption growth rates we see that the policy allows agents to better smooth consumption over the life-cycle: the unconditional average log consumption growth is equal to 2.1% compared to 2.2% in the baseline model. Agents are also better able to smooth consumption across aggregate states: the average growth rate of consumption in recessions is now higher and the difference between recessions and expansions smaller. The fact that debt has now become more attractive is reflected in the higher probability that agents decide to take out a loan: 26.4% compared to 24.9% in the baseline model.

[Table 7 here]

Even though in economies where restructuring is possible leverage is on average higher, annual default probabilities are marginally lower. The main difference as far as default is concerned is the shift that occurs from recessions to expansions. The fewer agents who default in bad times do so at higher values of outstanding debt: 8.7 compared to 8.4 thousand dollars.

Lenders' average net present values of loan cash-flows are higher than in the base case (both when discounted at the riskfree rate and at the risk-adjusted discounted rate). The slightly higher losses in case of default are more than offset by the fact that on average loans last longer, with larger amounts of debt outstanding (due to the deferment of principal repayments), and lenders earn the premium on those loans that do not default. In a competitive market one might expect loan premia to decrease so that lenders profitability is the same as in the base model.

In Panel C of Table 7 we report the results for a loan premium calculated so that lenders' unconditional risk-adjusted net present value of loan cash-flows is the same as in the base case (0.68 thousand dollars). Since lenders' cash-flows depend on agents' choices and the latter depend on the loan premium, the calculation of the premium that generates the same net present value requires us to solve several iterations of our model to find a fixed point. The loan premium that yields such fixed point is 7.225%. This lower loan premium contributes to a further reduction in default probabilities and makes debt even more attractive: the unconditional probability of a new loan increases to 0.3 and the welfare gain of the option to extend maturity, calculated as the certainty equivalent consumption stream that makes the individual as well off as in the case when restructuring is not possible, increases to 0.75%.[20]

In order to investigate further the decision to restructure, in Table 8 we report the proportion of borrowers who exercise the option to extend maturity. Not all borrowers decide to extend maturity: the overall proportion of those who decide to do so is 0.57, it is at its highest level of 0.80 early on, and it declines over the life of the loan, except in the last period when it increases again (third column of Panel A).[21] In the last period, when faced with a recession, a higher proportion of borrowers take a cautious approach and extend maturity. Of those who do not extend, 45% do so to take out a new loan and in this way access new funds (Panel B).

Both for the baseline model and for the model with the maturity extension option, the probabilities of a new loan conditional on the previous one maturing are higher than the unconditional probabilities of a new loan, so that there is persistence in the borrowers who decide to make use of debt to finance consumption. For instance, for the baseline model the probability of a new loan upon maturity of the previous one is 0.50 (0.41) for an expansion (recession), and the corresponding unconditional probability is 0.27 (0.18) as reported in the first row of Table 5. The agents with lower earnings are the ones who decide to borrow, and there is persistence in earnings.

[Table 8 here]

In Panel C we report average earnings for those agents who decide to extend loan maturity. Before the last period of the loan the agents who do so are those with intermediate earnings. Those with very low earnings default, those with high earnings repay as planned. In the last loan period those with lower earnings repay and take out a new loan. The values for average earnings are 14.4, 20.3 and 38.4 for those who decide to repay and take out a new loan, extend loan maturity, and repay and not take a out a new loan, respectively (conditional on a recession, Panel D).

The last panel of Table 8 reports the proportion of agents/periods for which there is a given loan amount outstanding (for agents who have not previously defaulted). Compared to the baseline model, the probability mass on larger loan amounts is increased and there is a smaller proportion of observations corresponding to agents/periods with zero loan amount outstanding.

[20]For each scenario, including the benchmark case and the one in which restructuring is allowed, we compute the certainty equivalent, i.e. the steady consumption stream that makes the agent as well-off in expected utility terms. The welfare gain is then the percentage of the consumption stream that agents are willing to give up not to have acess to the option to extend the loan maturity. We perform analogous calculations for the other restructuring policies.

[21]Due to the possibility of extending maturity, there is no longer a one-to-one mapping between amount outstanding and loan period.

Thus there is an increase in leverage in the economy both because agents are more likely to get a new loan and because restructuring delays principal repayments.

4.2.2 Interest rate reduction

The second restructuring policy that we study is the option to obtain a reduction in the loan interest rate of one hundred basis points during recessions. Borrowers still make the principal repayments as scheduled, but the interest due on the outstanding debt is lower.[22] All borrowers (trivially) exercise the option (Panel A of Table 8), so that this policy may also be interpreted as contingent debt, with lower servicing costs in bad times. These are precisely the times when expected earnings growth is lower and when there is a higher probability of a large drop in earnings. Borrowers benefit from debt structured in this way: the welfare gain relative to the base case is 0.09% (Table 9, Panel B). There is however a less desirable aspect of the policy which is the fact that ex-post, i.e. when a recession hits, all agents take advantage of it, regardless of whether there has been a large fall in their earnings. This leads to a reduction in lenders' profitability.[23]

[Table 9 here]

In order for this policy to generate the same (unconditional) risk-adjusted net present value per loan as the baseline model (of 0.68 thousand dollars per loan), the loan premium must increase to 8.25% (Table 9, Panel C). This reduces the benefits of the policy for borrowers to 0.04%, a value significantly lower than the one we obtained for the maturity extension policy. It is possible that other combinations of reduction in loan rate in recessions and higher loan premium generate higher welfare gains for borrowers and the same profitability for lenders. But the important shortcoming of this policy that ex-post all borrowers will want to take advantage of it will still be there. This reduces the efficacy of the policy.

4.2.3 Refinancing

In our last policy experiment we allow agents to refinance their debt. This means that in recessions they are allowed to take out a new loan even if there is debt outstanding, but they must also use the proceeds from the new loan to repay any previously outstanding debt. The results are shown in the last column of Table 8. Not all agents exercise the option to restructure (Panel A), those with lower earnings do so (Panel C). These are the agents who benefit the

[22] We have experimented with alternative values for the interest reduction. The main shortcoming of this policy that we discuss below remains.

[23] If it was possible to offer the option to restructure only to those who have lower cash-on-hand and earnings the drop in lenders' profitability would be smaller. In reality, it may be difficult for lenders to obtain complete information on individuals' savings and earnings. And borrowers may have the incentive to pretend that their financial situation is worse than it actually is so as to benefit from the interest reduction. Furthermore, the offering of an interest reduction only to a specific group of individuals may be perceived as a bail out of this group.

most from any additional funds that they access under the restructuring. There is however a significant increase in leverage in this economy: the proportion of agents/periods with the highest loan amount outstanding is 0.21 compared with 0.13 in the baseline model (Panel E).

The effects of the policy on consumption, default and borrower welfare are shown in Table 10. This policy allows for better life-cycle consumption smoothing and better consumption smoothing across states than both the baseline model and the maturity extension policy, as it can be seen by the lower average (unconditional) consumption growth rate and the smaller difference in consumption growth rates across business cycle states.

For a constant loan premium, unconditional default rates are marginally lower than in the baseline model and there is a significant shift in default from recessions to expansions. The few agents who default in bad times do so at the highest possible value of outstanding debt (otherwise the agents would simply refinance). The higher average loan losses in case of default are a feature of this policy: 8.7 thousand dollars per loan compared to 8.4 thousand dollars per loan in the baseline model.

[Table 10 here]

In spite of the higher average loan losses in case of default, lenders profitability is higher than in both the baseline model and the maturity extension policy. The loan premium so that lenders' (unconditional) risk-adjusted net present value of cash-flows is equal to the baseline value of 0.68 thousand dollars per loan is 6.785% (Panel C of Table 10), which is lower than in the maturity extension policy (recall that it was equal to 7.225%). This lower premium increases the welfare benefits of the policy for borrowers to 1.17% of annual consumption. The main shortcoming of this policy is the large downside risk that it imposes on lenders' cash-flows, an issue that we now investigate.

4.2.4 Lenders' cash-flows

If the risk-adjusted discount rates that we have derived fully capture the risks that financial institutions face, the relevant properties of lender cash-flows are captured in the discounted cash-flows. But one may reasonably question the extent to which the risk-adjusted discount rates derived from consumption fully capture such risks, including funding risk, regulatory risks arising from value at risk constraints, among others.

With this in mind, we use the simulated data to plot in Figure 5 the distribution of lenders' cash-flows for the baseline model and for the different restructuring policies. Focusing first on the unconditional distribution for the maturity extension policy, we see that shape of the distribution is fairly similar to the benchmark model. In fact, under the maturity extension policy lenders have higher average cash-flows and lower standard deviation of cash-flows. However, they face more downside risk: the skewness is -0.18 compared to -0.03 in the benchmark. The comparison of the distributions for recessions and expansions helps us to understand why. Relative to the baseline model, in the maturity extension policy the distribution of per-period cash-flows in recessions is shifted to the left, as some borrowers exercise their option to postpone principal repayments.

[Figure 5 here]

These effects are clearly visible in Table 11 where we report summary statistics for the distributions of lenders' cash-flows. Panel D reports the proportion of periods in which lenders have negative cash-flows. The overall proportion for the maturity extension policy is 0.14 compared to 0.20 in the baseline model. The proportions conditional on recession (expansion) are 0.12 (0.14) compared with 0.02 (0.26) in the baseline.

However, the value for recessions for the maturity extension policy is an order of magnitude smaller than the value for the refinancing policy scenario: for the latter the proportion of recession periods with negative cash-flows is as high as 0.73 as existing borrowers exercise the option to refinance to access cash. As a result, the average per period lender cash-flows are negative in recessions (Panel A), the only policy for which this happens. The large downside risk in lenders cashflows for the refinancing policy is clearly visible in the last set of panels in Figure 5. The overall skewness of lenders' cash-flows is as high as -0.76. Therefore the refinancing policy exposes lenders to very large downside cash-flow (and funding) risk which is an important shortcoming of the policy.[24]

[Table 11 here]

In light of these results, a natural question to ask is the extent to which the net present value of lenders' cash-flows is sensitive to our previous choice of risk-adjusted discount rates. In Figure 6 we address this question. More precisely, we consider the impact of a reduction of Δ^e in the discount rate in expansions and an increase in the discount rate in recessions of Δ^r, calculated so that the overall average discount rate remains unchanged. Panel B plots the results when we apply different values for the mean-preserving spreads to the previously used risk-adjusted discount rates. Clearly, the net present value of lenders in the refinancing policy scenario is the most sensitive to increases in the discount rate used in recessions. This arises due to the fact under this policy lenders are much more often asked to provide additional cash to borrowers in bad times.

[Figure 6 here]

The relatively lower cash-flows that lenders receive in recessions under the maturity extension restructuring policy economy also make this policy more sensitive to the increases in the discount rate than the baseline model. However, as Panel B of Figure 8 shows the sensitivity is an order of magnitude smaller than in the refinancing scenario.

[24] It may also lead financial institutions to violate value-at-risk constraints.

4.2.5 Specific aggregate path

In order to further illustrate the effects at work in our model, we repeat the previous exercise of plotting simulated cross sectional means for several variables for an economy calibrated to match the 1993-2013 period in terms of business cycle and interest rate fluctuations, but now we also plot these means for the economies where restructuring is allowed. It is important to keep in mind that this is only one path, that we use for illustrative purposes, and that the effectiveness (or not) of a policy should be decided based on the response for all the possible realizations and not just one.

Figure 7 plots the results for the maturity extension policy. The first panel shows that under this policy consumption growth is smoother and drops less in recessions than in the baseline model. When restructuring is possible, debt becomes more attractive, which helps to explain why the ratio of total debt to income is slightly higher than in the benchmark. The fourth panel plots default rates: they decrease in recessions, as worse-off borrowers exercise their option to extend loan maturity, but they increase in expansions, just after the recession finishes and the option to extend is no longer available. Therefore, overall there is only a small decrease in default rates. The final panel plots lender cash-flows: relative to the baseline model, they are higher in recessions as borrowers extent maturity and do not take a new loan, but they are lower in the period after.

In Figure 8 we plot the data for the refinancing policy. This policy is very effective at preventing consumption from falling in recessions, but this is achieved at the expense of high and volatile leverage as can be seen in the third panel of the figure. There is a large increase in the ratio of total debt to income in recessions as borrowers restructure their loans and reset the loan amount to the maximum allowed. This ratchet effect helps to explain why default increases after the recession has ended and stays high for longer than in the maturity extension policy. Lender cash-flows are negative in recessions as borrowers exercise the option to refinance.

[Figures 7 and 8 here]

5 Credit rationing

In the previous analysis we have set the loan premium to be the same in recessions and in expansions. We did so because in the data we did not find statistically significant differences in the average premium across these two periods. But since in the model the loans initiated in recessions are riskier (have higher default rates at higher outstanding loan amounts) than those initiated in expansions, the model predicts that the former have much lower profitability than the latter. Unless the administrative costs of granting loans and/or the normal profits of loan providers are lower in recessions than in expansions, one may reasonably expect loan providers to adjust the terms on the loans granted in recessions so as to improve their expected profitability. In this section we study the effects of loan premium and credit (quantity) rationing on loan profitability. We then evaluate the different restructuring policies in a setting where risk-adjusted loan profitability is the same for loans granted in recessions and in expansions.

5.1 Prices versus quantities

There are at least two ways to (potentially) achieve higher profitability on the loans granted in recessions. The first is to increase the loan premium. As previously discussed, in the data we do not find strong evidence for it. The average loan premium is slightly higher in recessions than in expansions, 8.6% compared to 8.1%, respectively, but the difference is not statistically significant.

In spite of this evidence, we use our model to investigate the effects of increasing the premium on loans granted in recessions. The solution to this more general model requires an additional (binary) state variable, whether the currently outstanding loan (if any) was initiated in a recession or in an expansion.

The results are shown in Table 12. We report results for a loan premium in recessions equal to 8.0% (the baseline, Panel A), 8.6% (the value in the data, Panel B) and for a considerably higher value of 15% (Panel C). Due to its higher cost, debt becomes less attractive as an instrument to smooth consumption over time and across states. This leads to a reduction in the demand for loans. The higher cost of debt also explains why the default probabilities are now higher than before. Default rates increase during both recessions and expansions: some of the loans on which there is default in expansions were granted in recessions and they carry a higher premium. The lower attractiveness of debt leads borrowers to default earlier in the life of the loan, at higher values of outstanding debt.

[Table 12 here]

The third row of each panel of Table 12 reports the annual default rates calculated using loan/year as the unit of observation. That is: we calculate the proportion of loans outstanding at the beginning of the period for which there is default in that period. Therefore, these default rates are conditional on the business cycle upon default, i.e. whether the loan defaulted during a recession or an expansion. These default probabilities can more easily be compared with the (annual) default rates usually reported in the data. Since our loans are multiperiod, they contribute to the calculation of annual default probabilities in more than one year (unless there is immediate default).

We can also calculate default probabilities using one observation per loan. That is: we can calculate the proportion of loans for which there is default over the whole life of the loan, also conditional on the state of the business cycle at loan inception (and not at default). We report them in the fourth row of each panel (these are not annual default probabilities).

When the loan premium for loans initiated in recession increases, so do the default probabilities on these loans. The quantitative effects are significant: for an increase in loan premium for loans granted in recessions from 8% to 15% there is an increase in their default rate from 13% to 21%. This helps to explain why in spite of the large increase in premium there is a relatively smaller effect on the net present value of these loans, that increases from -0.025 to 0.211. The latter value is still much lower than the net present value for loans granted in expansions (at a premium of 8%). This shows that increases in the premium are somewhat ineffective in improving loan profitability: as the premium increases the riskier borrowers are the ones who will still demand credit, so that expected default rates and loan losses go up.

An alternative way for lenders to improve the profitability of loans granted in recessions is to deny credit to the riskiest borrowers. We model a simple credit rationing rule: borrowers with permanent income below a given threshold $\underline{z}$ are not able to take out a new loan in recessions (they may still have debt outstanding from a loan taken out in an earlier period). This rule could be implemented by requiring that borrowers present proof of their earnings (e.g. payslips) prior to being approved for the loan.[25] In terms of our model, it means that if the (log) permanent income of borrower i in recession period t is such that:

$$z_{it} < \underline{z} \tag{21}$$

then this borrower is not given a new loan. Since the level of permanent income is a state variable of the model, the implementation of the above restriction does not require an additional state variable. We solve endogenously for the cut-off $\underline{z}$, so as to equate the risk-adjusted profitability of the loans granted in recessions and in expansions. This cut-off is -0.45 which means that during a recession 8% of the overall population of agents are excluded from the loan market. This is 26% of the set of agents that do decide to take out a new loan.

The results are shown in Table 13. The probability of a new loan being granted in recessions decreases, from 18% to 15%. Some of the borrowers who are refused credit during the recession period eventually take out a new loan when aggregate economic conditions change. But in spite of this, there still is a decline in the probability of a new loan being taken out in expansions. The reason is that debt is now overall less attractive: borrowers will not be able to access a new loan precisely in the states of the world when they may need it the most, when their income is low. The lower attractiveness of debt helps to explain the small increase in annual default probabilities. Recall that these annual recession (expansion) default probabilities include default by loans that began in expansions (recessions).

[Table 13 here]

In the third row of Table 13 we report cumulative default probabilities for loans granted in recessions/expansions (one observation per loan). As a result of riskier borrowers being denied credit, default rates for loans that began in recessions drop considerably, from 13.3% to 6.2%.

[25] Payslips provide proof of total income and not of permanent income, the difference arising from temporary fluctuations in income. In the model we consider a screening rule based on permanent income since it simplifies considerably the solution of the model.

On the other hand, default rates for loans granted in expansions rise slightly, as some of the risky agents who are excluded from borrowing in recessions shift their demand to expansions.

5.2 Restructuring policies

We now evaluate the effects of the different restructuring policies (interest rate reduction, maturity extension, refinancing), but in a setting in which lenders engage in credit rationing during recessions, so as to equate the profitability of loans granted at different stages of the business cycle. For comparability, the results that we report for the different restructuring policies are for the same level of credit rationing as above (i.e. borrowers with $z_{it} < -0.45$ are denied a new loan in recessions). As before, we let borrowers decide whether or not they wish to take advantage of the policies, and we allow all borrowers (including those below the credit rationing cut-off) to take advantage of them. We adjust the loan premium so that risk-adjusted profitability is the same throughout.

The results are reported in Table 14. The first panel reports the results for the model where debt restructuring is not possible, and the following panels reports the results for the different restructuring policies.

[Table 14 here]

Focusing first on the maturity extension policy, the reduction in the loan premium so that profitability remains the same is larger for loans initiated in expansions than for those initiated in recessions. Cash-flow in recessions is more valuable than in expansions. Furthermore, the option to extend loan maturity is more likely to be exercised for loans initiated in recessions. Lenders need to be compensated for this through a higher loan interest rate. This is in spite of the slightly higher default rates for loans initiated in expansions than for those initiated in recessions. As before, the maturity extension policy allows borrowers to better smooth consumption over time (smaller average consumption growth) and across the cycle (smaller difference in average consumption growth across recessions and expansions). The policy leads to a reduction in overall average lender cash-flows in recessions and an increase in expansions. The proportion of recession periods in which lenders have negative cash-flows increases from 0.5 percent to 5.5 percent.

As before, the policy of allowing for a reduction in loan interest rate in bad times to 7% is fairly ineffective (Panel C of Table 14). Ex-post all individuals will want to take advantage of it. The loan premium, both for loans initiated in recession and expansion, must increase to account for this, reducing the benefits of the policy along several dimensions (consumption smoothing, borrower welfare, default probabilities).

Panel D reports the results for the refinancing policy. As before, from a borrower perspective, this policy is the most effective. However, it comes at the expense of very volatile lender cash-flows, which become on average very negative during recessions. Therefore, the main trade-offs and conclusions are similar to the analysis in which lenders do not restrict borrowers' access to credit in bad times.

6 Conclusion

We have quantitatively evaluated the trade-offs of alternative consumer debt restructuring policies. We have done so in the context of a dynamic model in which agents face earnings risk, both of idiosyncratic and aggregate sources. Recessions are characterized by lower expected earnings growth and a higher probability of a large drop in earnings. As a result, agents are more likely to cutback on consumption during bad times and the demand for credit is procyclical. However, those agents who experience the realization of a large drop in earnings in recessions do want to borrow so that the pool of new borrowers becomes riskier. And those who have previously outstanding debt are more likely to default, which explains the countercyclicality of default rates.

Among the three debt restructuring policies that we have analyzed the one that leads to better outcomes is loan maturity extension. It leads to slightly lower default rates, a smaller drop in consumption in recessions, and increased borrower welfare. Interestingly, not all borrowers decide to take up the option to extend the loan maturity. Only those who have lower cash-on-hand do so. For the remainder, the lower expected earnings growth and the higher risk that characterize recessions lead them to want to deleverage, also for precautionary reasons. Under this policy lenders receive lower average but still positive cash-flows in recessions.

A loan modification policy characterized by a decrease in the loan interest rate in recessions turns out to be too costly for lenders. Ex-post, i.e. when faced with the recession, all borrowers wish to benefit from the reduction, regardless of their financial position. Lenders need to be compensated for this ex-ante, so that the benefits of the policy are reduced. The final policy that we have considered is to give borrowers the option to refinance the loan during bad times. This involves taking out a new loan and repaying the previous one. Even though this policy is very effective in reducing the effects of recessions on consumption and default, it has a very large impact on the properties of the cash-flows of lenders. They become on average negative in recessions and they have substantial downside risk. Therefore, given the trade-offs, the maturity extension policy results in more balanced outcomes.

Our model provides important insights on the optimal clauses to be included on consumer loan contracts. In particular, our analysis supports the idea that it would be beneficial for lenders to include clauses that allow borrowers to extend the loan maturity in case of a recession. This would contribute to a reduction in default rates and a smaller fall in consumption in bad times, and potentially help to prevent or attenuate the downward spirals that seem to characterize recessions. Policymakers also have an important role to play, by putting in place the relevant legal and institutional framework that facilitates such restructuring of loans.

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A Appendices

A.1 Numerical Solution

We take the loan premium and the form of debt restructuring available as given and solve the agent's problem using backward induction. In the last period ($t = T$) the policy functions are trivial, the agent simply decides whether or not to default on the outstanding debt. Absent the *stigma* cost agents would always default in the last period since the threat of exclusion from credit markets no longer plays a role. In other words, in the last period the psychological, legal and financial costs of default are the only mechanism preventing default. In case of no default the agent repays the principal amount still outstanding and consumes his cash-on-hand. In this period the value function corresponds to the indirect utility function. We then iterate backwards.

For every period t prior to T, and for each combination of values for the state variables, we optimize over the choice variables using a discrete grid search. We use an equally spaced grid for cash-on-hand (X_t) and for the log level of permanent income (z_t). The upper and lower bounds for these grids were chosen to be non-binding at all times. And in order to improve accuracy and efficiency of the solution we let the boundaries for the grid z_t to increase from period t to T. The density functions of the random variables (i.e. shocks to the earnings process and to interest rates) were approximated using Gaussian quadrature (Tauchen and Hussey (1991)). For points that do not lie on the state space grid, we evaluate the value function using a cubic spline interpolation for the cash-on-hand grid and a linear interpolation for the permanent income grid. We calculate the value function associated with all possible values for the choice/control variables and optimize over these. In this way we obtain the optimal choices of consumption, borrowing, default, and whether to restructure the loan.

We use the optimal choices of the agents to calculate the cash-flows of lenders. If their present value is higher (lower) than in the baseline model where the option to restructure is not available we decrease (increase) the loan premium and solve the agent's problem again. We repeat the process until we find a fixed point in which the present value of the risk-adjusted cash-flows of lenders is the same in the model with restructuring and in the baseline model where debt restructuring is not available. We repeat this process for each of the debt restructring policies analyzed.

A.2 Data Description

In this section we describe the sources for the data that we use in the paper.

Household Debt - Data on US household debt is taken from the Federal Reserve Database, namely from the Z.1 Financial Accounts (table L.100). Total Household Debt is the sum of Mortgage Debt, Consumer Debt and Other.[26]

- Home Mortgages - Includes loans made under home equity lines of credit and home equity loans secured by junior lien (unique identifier Z1/Z1/FL153165105.Q).
- Consumer Credit - Outstanding credit extended to individuals for household, family, and other personal expenditures, excluding loans secured by real estate (unique identifier Z1/Z1/FL153166000.Q).
- Other loans - Includes cash accounts at brokers and dealers and syndicated loans to nonfinancial corporate business by nonprofits and domestic hedge funds (unique identifier Z1/Z1/FL383169005.Q

Disposable Income, GDP, Inflation and Recession Periods

- Nominal GDP Data - The nominal GDP data is again from the Z.1 Financial Accounts from the Federal Reserve (unique Identifier: Z1/Z1/FA086902005.Q).
- Disposable Income Data - The disposable income data is from the Bureau of Economic Analysis (Table 2.1. Personal Income and Its Disposition)[27]
- Recession Periods - The recession periods are defined according to the NBER business cycle dates.[28]
- Inflation Data - The inflation data is the Consumer Price Index for All Urban Consumers from FRED (unique identifier: CPIAUCSL).[29]
- Expected Inflation Data - The expected inflation data is taken from the University of Michigan Inflation Expectation Survey available from FRED (unique identifier: MICH).[30]

Credit Spreads

- Consumer Debt - We take data for interest rates on credit card plans, 24-month personal loans and 48-months new car loans from the FED. Interest rates for new-car loans and

[26] The latest statistical release can be found here: http://www.federalreserve.gov/releases/Z1/Current/z1.pdf

[27] The FED uses data on Disposable Income from BEA on its calculations: http://www.federalreserve.gov/releases/housedebt/about.htm.
Data can be found here: http://www.bea.gov/iTable/iTable.cfm?ReqID=9&step=1#reqid=9&step=3&isuri=1&904=2014&903=58&906=q&905=1929&910=x&911=1

[28] http://www.nber.org/cycles.html

[29] http://research.stlouisfed.org/fred2/series/CPIAUCSL#

[30] https://research.stlouisfed.org/fred2/series/MICH

personal loans at commercial banks are simple unweighed averages of each bank's most common rate and for credit card accounts, the rate for all accounts is the stated APR averaged across all credit card accounts at all reporting banks.

- Treasury Bills - t-bill rates are taken from the FED, except for the 1-month t-bill which is from the Kenneth French library (i.e. from Ibbotson Associates) given this series is longer than the FED.

Non-performing Loans - Data on charge-off rates and Delinquency rates is taken from FED. The data is compiled quarterly by the Federal Financial Institutions Examination Council.[31] The data on personal bankruptcy filling rates is from Administrative Office of the U.S. Courts and the U.S. Census Bureau.[32]

- Charge-off rates - Charge-offs are the value of loans and leases removed from the books and charged against loss reserves. The charge off rate is the net charge-off (gross charge-offs minus recoveries) during a quarter divided by the average level of it loans outstanding over that quarter. The figure is then annualized.
- Delinquency rates - Delinquent loans and leases are those past due thirty days or more and still accruing interest as well as those in nonaccrual status. The delinquency ratio is the ratio between the dollar amount of a bank's delinquent loans to the dollar amount of total loans outstanding. The rate is then annualized.
- Bankruptcy filling rates - Personal bankruptcy filling rates rates are the total number of households who file for bankruptcy in the U.S. (annual non-business fillings) divided by the total number of U.S. households.

[31] http://www.federalreserve.gov/releases/chargeoff/

[32] http://www.uscourts.gov/report-name/bankruptcy-filings and http://www.abi.org/newsroom/bankruptcy-statistics

Figure 1: Total Household debt and Consumer Debt relative to GDP

This figure plots the ratio of total US household debt to GDP (Panel A) and the ratio of Consumer Debt to GDP (Panel B) between Q1-1952 and Q3-2014. Data on US household debt, consumer debt and GDP are from the Federal Reserve Database. The grey bands are the NBER recession periods.

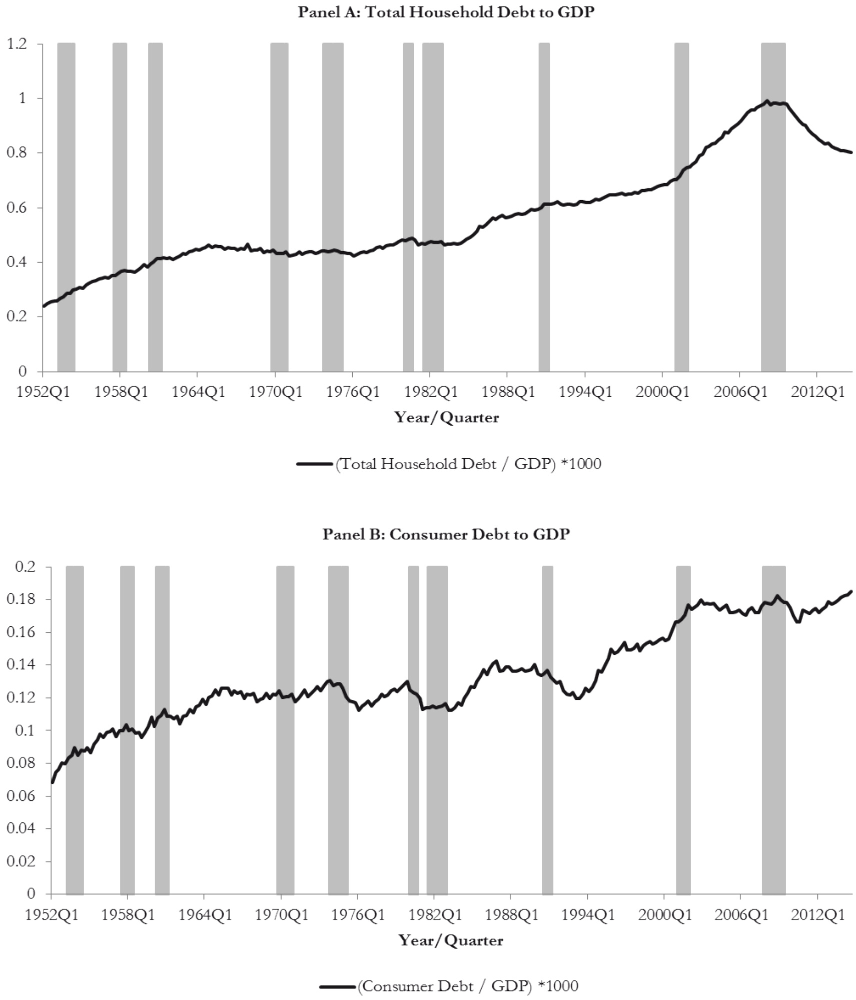

Figure 2: Credit card and personal loan rate spreads.

This figure plots credit card and 24-month personal loan rate spreads between Q4-1994 and Q3-2014. The spread is defined as the difference between the credit card rate or the 24-month personal loan rate and the 1-month yield. Data on credit card and personal loans interest rates is from the Federal Reserve Database and the 1-month yield is from the Kenneth French data library. The grey bands are the NBER recession periods.

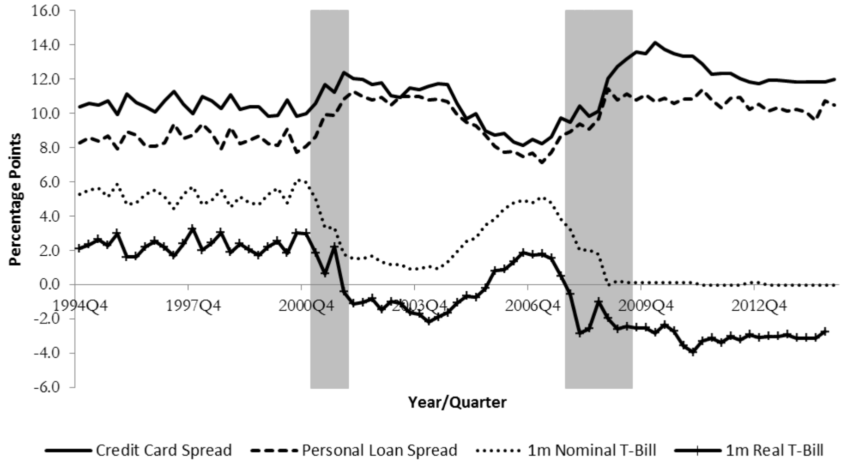

Figure 3: Default Rates

This figure plots delinquency rates, charge-off rates, and personal bankruptcy fillings (definitions of these variables in Appendix A.2). Panel A shows the annual delinquency rates by loan type between Q1-1985 and Q3-2014. Panel B shows the annual charge-off rates by loan type between Q1-1987 and Q3-2014. Panel C shows the annual personal bankruptcy filling rates between 1980 and 2014. Data for delinquency rates and charge-off rates is taken from the Federal Reserve Database. Data for the personal bankruptcy fillings is taken from the Administrative Office of the U.S. Courts and the U.S. Census Bureau. The grey bands are the NBER recession periods.

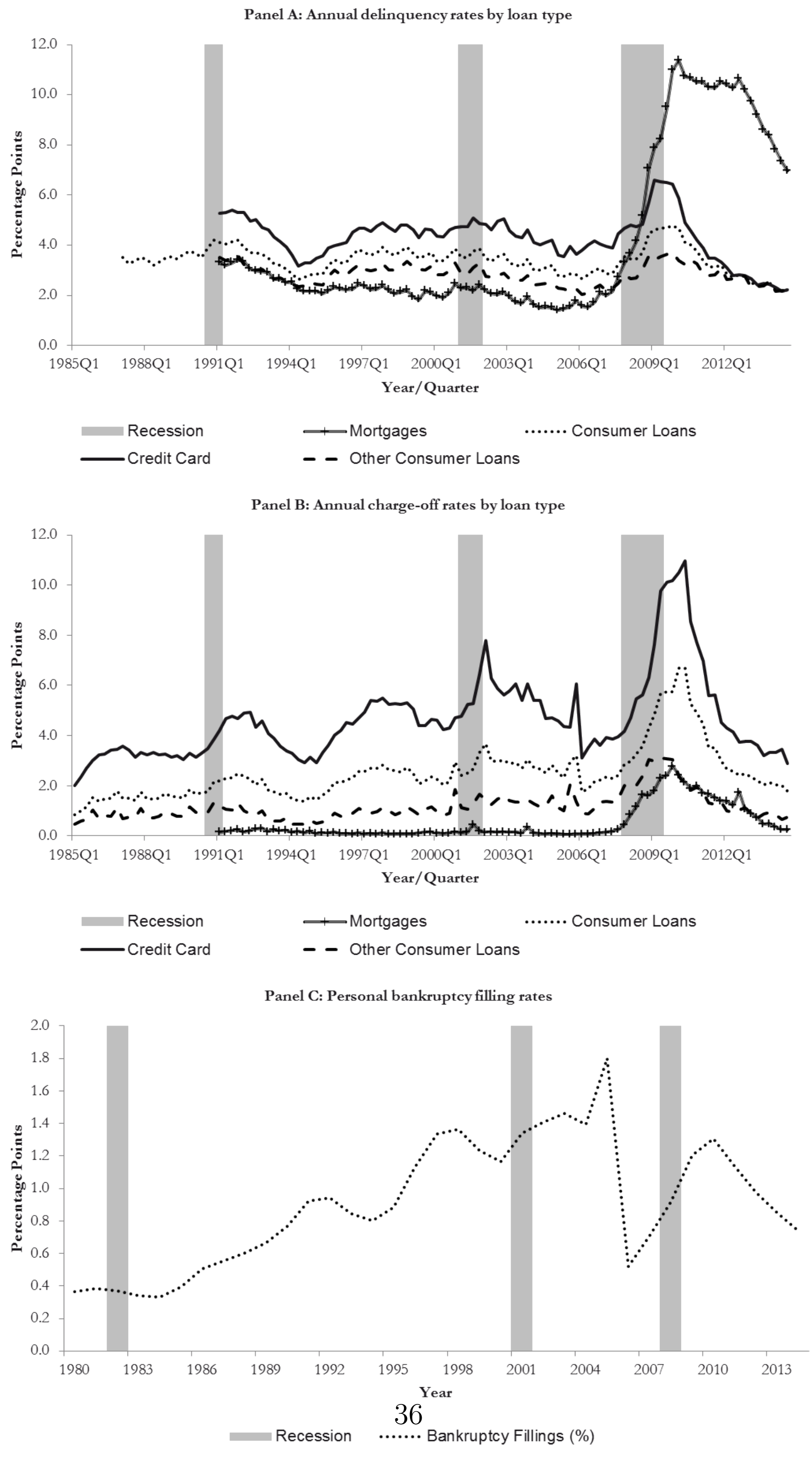

Figure 4: Simulated profiles for benchmark scenario calibrated for the 1993-2013 period

This figure plots the cross sectional means of simulated consumption growth and income growth (Panel A), growth rate of total leverage, ratio of total leverage to income (Panel C), default rates (Panel D) and lender's cash-flows (Panel D) for the benchmark case. The business cycle and interest rate levels were calibrated to match the 1993-2013 period. The grey bands are recession years. We consider a year to be a recession year if three or more quarters of the year is a recession according to the NBER's Business Cycle Dating, and we consider the real risk-free rate to be high (low) if the real risk-free rate is above (below) the average real risk-free during the sample period.

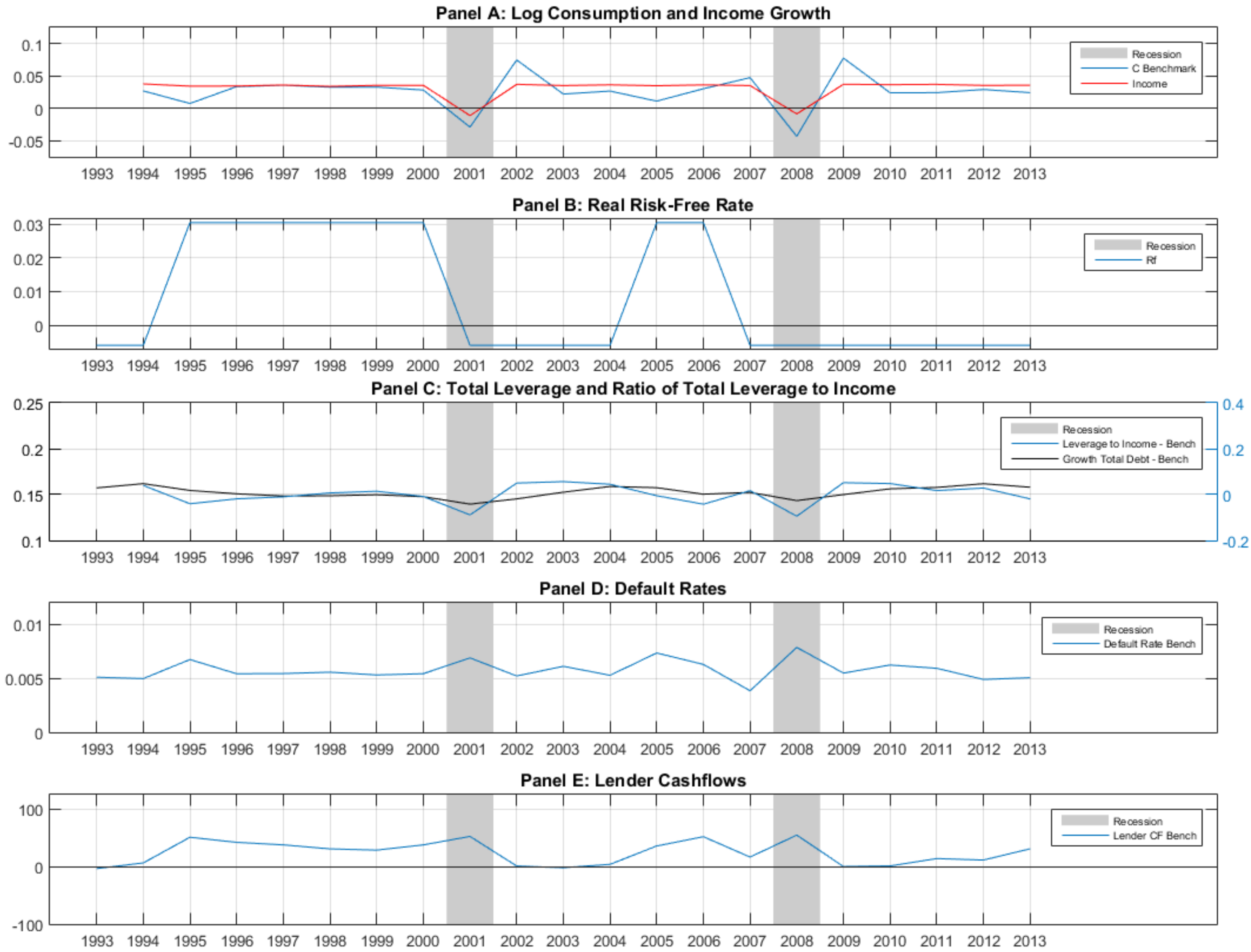

Figure 5: Distribution of Lenders' cashflows

This figure plots the model generated distributions of per period total lenders' cash-flows for the four scenarios under analysis (benchmark, maturity extension, low premium, and refinancing). The figure plots both the overall distribution and the distributions conditional on the aggregate state of the economy. The data is obtained from simulating the model.

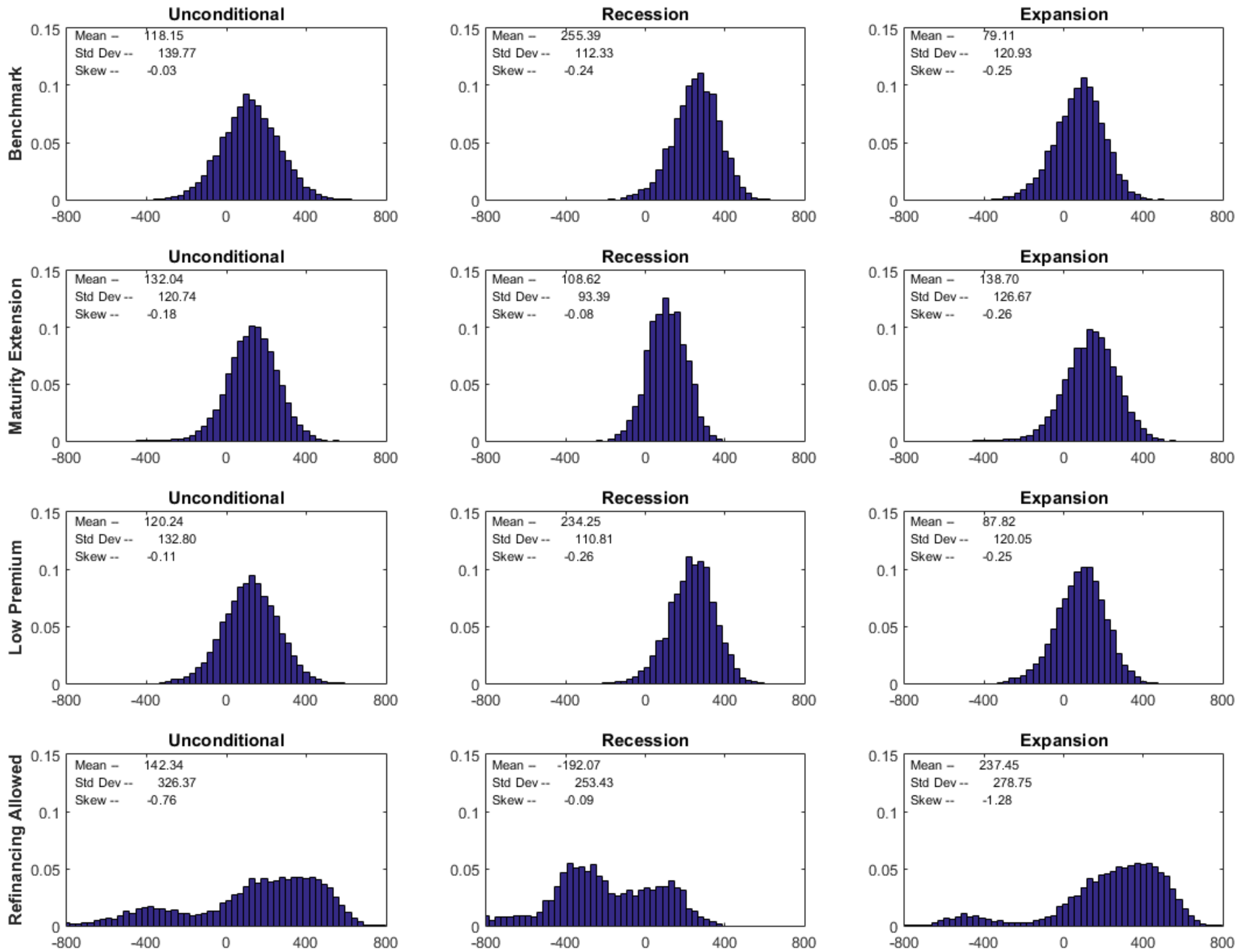

Figure 6: Mean-Preserving Spreads

This figure plots the lenders' net present value per loan considering a decrease of the discount rate in expansions and an increase of the discount rate in recessions while keeping the average discount rate the same (mean-preserving spreads). The x-axis is the change in the expansion discount rate. Panel A (Panel B) plots the NPVs discounted at the risk-free rate (risk-adjusted discount rate) and the mean-preserving spread is applied to this rate.

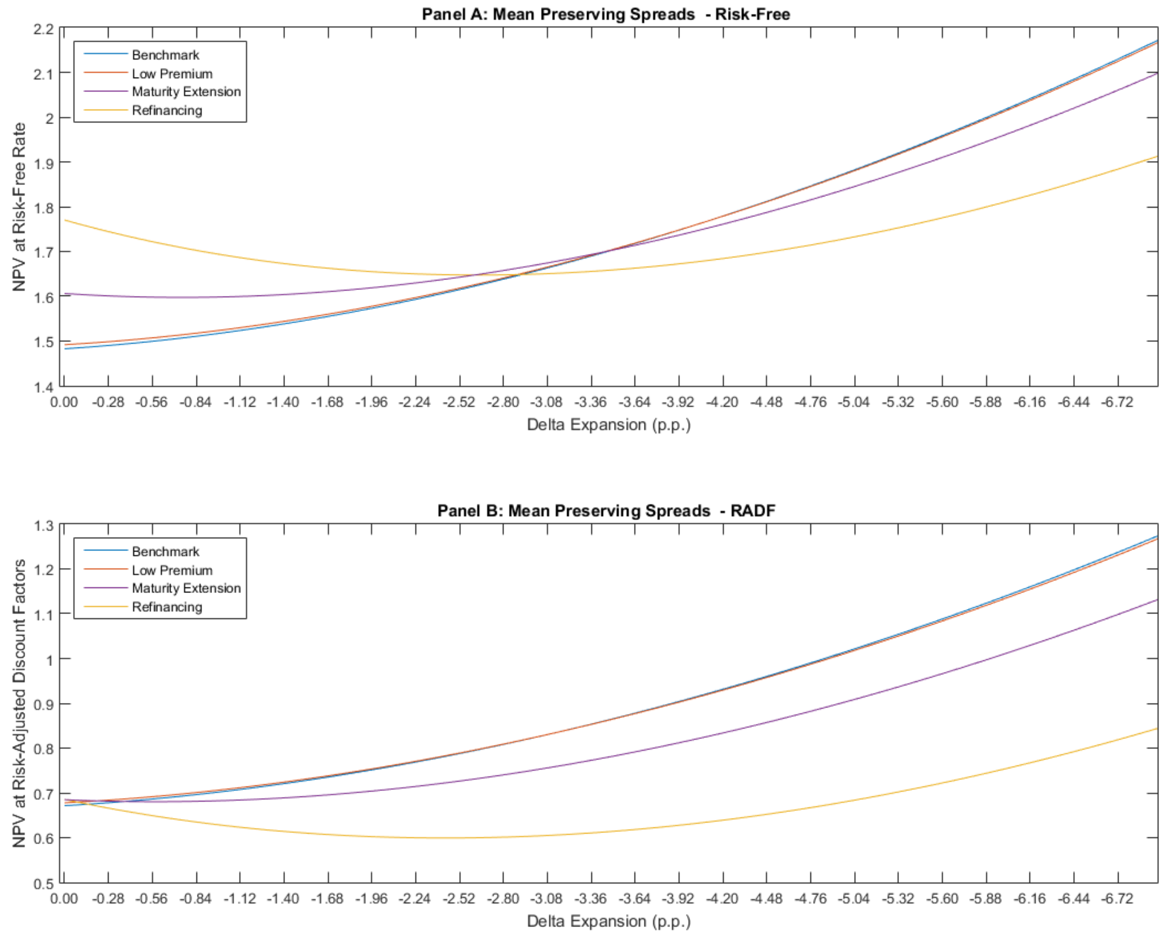

Figure 7: Simulated profiles for benchmark and maturity extension scenarios calibrated for the 1993-2013 period

This figure plots the cross sectional means of simulated consumption growth and income growth (Panel A), growth rate of total leverage and ratio of total leverage to income (Panel C), default rates (Panel D) and lender's cash-flows (Panel E) for the benchmark (solid lines) and maturity extension (dotted lines) scenarios. The business cycle and interest rate levels were calibrated to match the 1993-2013 period. The grey bands are recession years. We consider a year to be a recession year if three or more quarters of the year is a recession according to the NBER's Business Cycle Dating, and we consider the real risk-free rate to be high (low) if the real risk-free rate is above (below) the average real risk-free during the sample period.

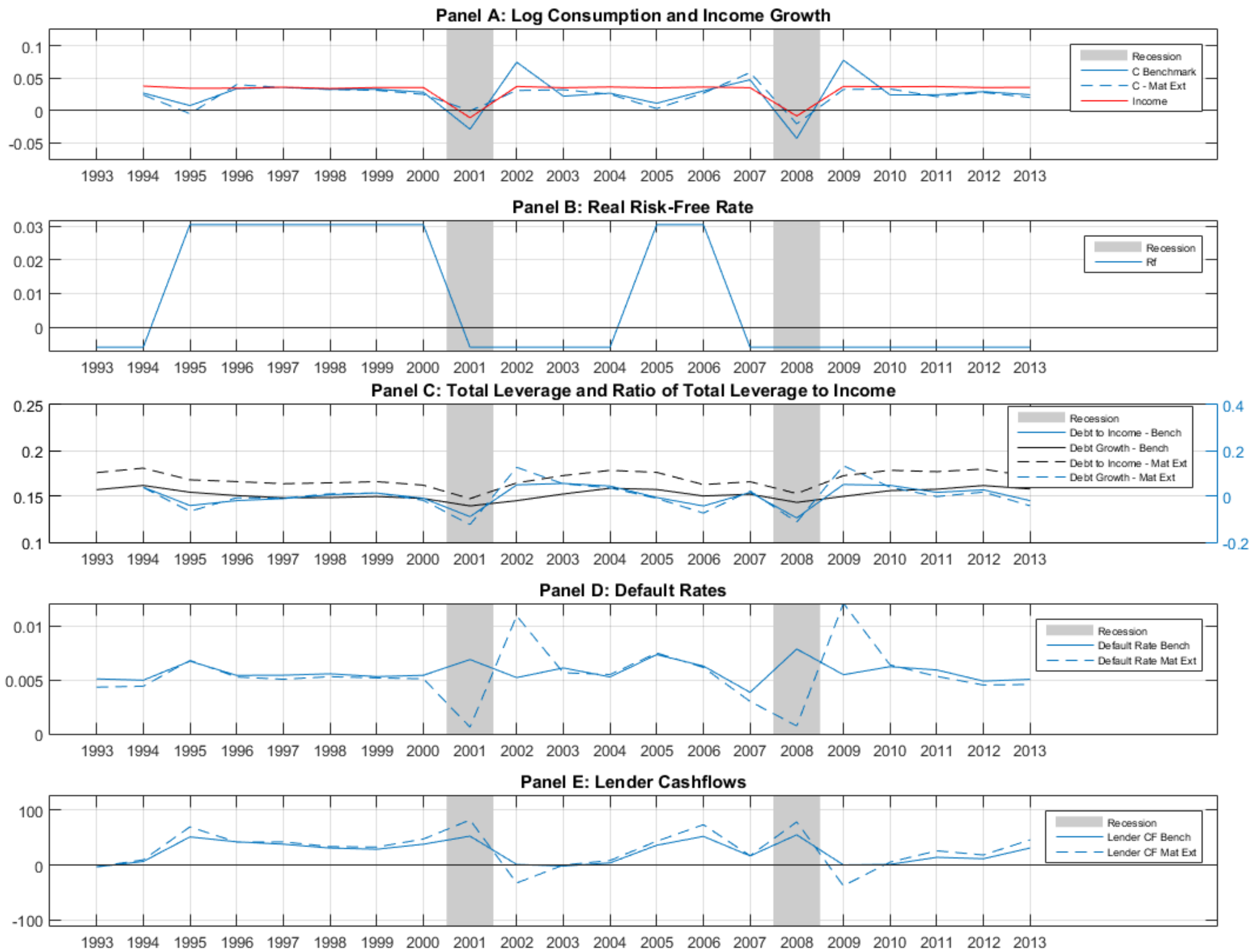

Figure 8: Simulated profiles for benchmark and refinancing scenarios calibrated for the 1993-2013 period

This figure plots the cross sectional means of simulated consumption growth and income growth (Panel A), growth rate of total leverage and ratio of total leverage to income (Panel C), default rates (Panel D) and lender's cash-flows (Panel E) for the benchmark (solid lines) and refinancing (dotted lines) scenarios. The business cycle and interest rate levels were calibrated to match the 1993-2013 period. The grey bands are recession years. We consider a year to be a recession year if three or more quarters of the year is a recession according to the NBER's Business Cycle Dating, and we consider the real risk-free rate to be high (low) if the real risk-free rate is above (below) the average real risk-free during the sample period.

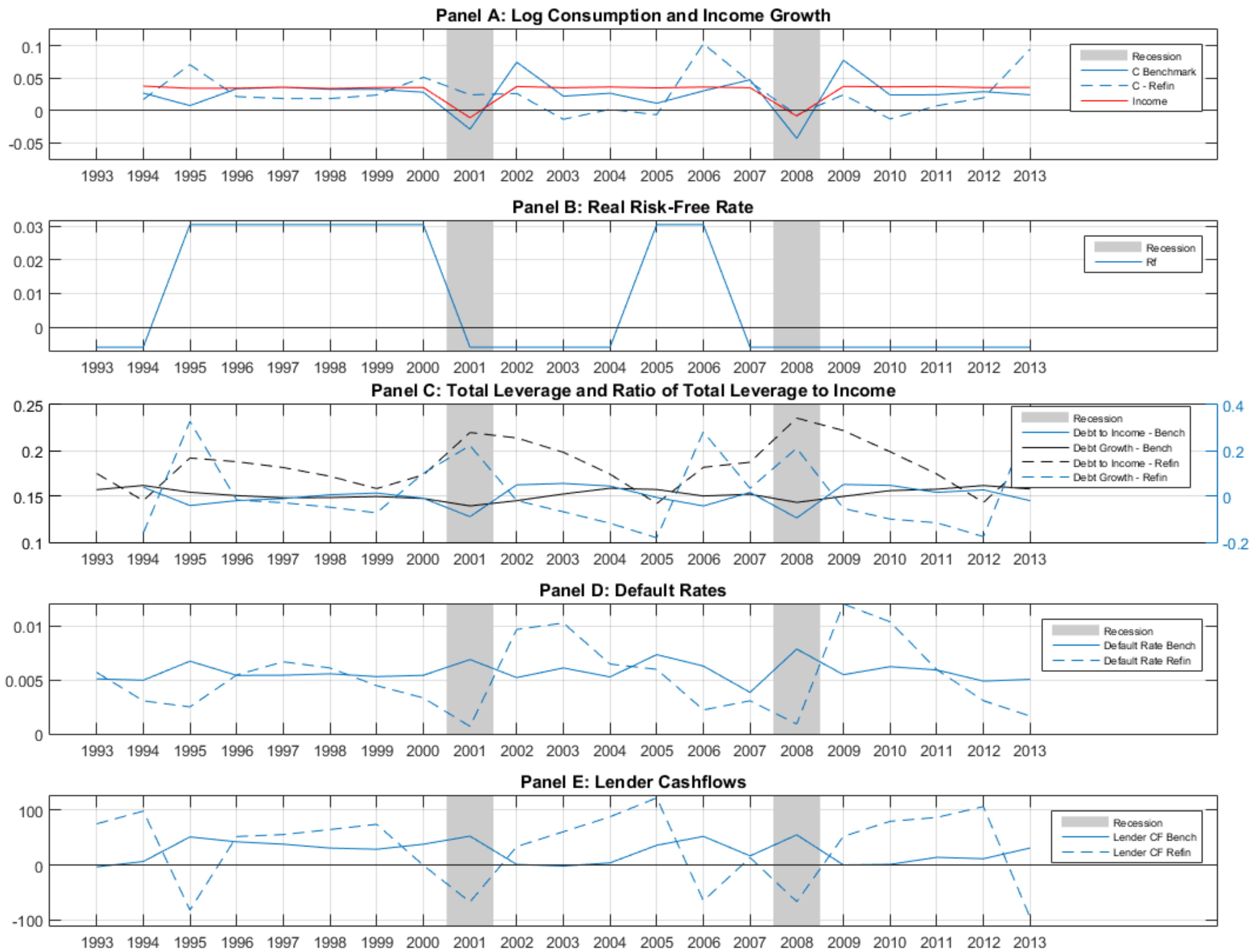

Table 1: Baseline parameters.

This table reports the baseline model parameters.

Description	Parameter	Value
Panel A: Business Cycle Transition Probabilities		
Prob (Recession | Recession)		0.37
Prob (Recession | Expansion)		0.18
Panel B: Labor Income Process		
Log permanent income AR(1) coefficient	ρ	0.979
Prob. aggregate/idiosyncratic shock	p_1	0.49
Mean log earnings growth expansion (1)	μ_{1E}	0.119
Mean log earnings growth expansion (2)	μ_{2E}	-0.026
Mean log earnings growth recession (1)	μ_{1R}	-0.102
Mean log earnings growth recession (2)	μ_{2R}	0.094
St. dev permament income shock (1)	σ_1	0.325
St. dev permament income shock (2)	σ_2	0.001
St. dev. temporary shock	σ_ϵ	0.186
Tax Rate	ϕ	20%
Panel C: Time and Preference parameters		
Subjective discount factor	β	0.8
Risk aversion	γ	2
Number of periods	T	20
Bequest motive	b	0
Panel D: Real Interest Rate		
Mean log real rate	μ_r	0.012
Log real rate AR(1) coefficient	ϕ_r	0.825
St. dev. of real rate	σ_r	0.018
Term-premiun	ξ	0.005
Panel E: Consumer Loans		
Loan premium	ψ	8.00%
Loan amount	K	$10k
Loan maturity	τ	5 years
Default utility penalty	λ	0.160
Prepayment cost	θ_P	∞

Table 2: Means of different variables over the business cycle.

This table reports the mean for several variables, also conditional on the economy being in a recession or an expansion. The variables are defined in the appendix. We use the NBER business cycle dates to define recession/expansion periods. The last column reports the t-statistics for tests of the difference in means across recesssions/expansions. The symbols ***, ** and * denote statistical significance at the 1%, 5% and 10% levels, respectively.

	Unconditional	Recession	Expansion	t-stat Rec=Exp
Spread: Personal loan - 1m t-bill	8.52	8.10	8.60	0.92
Spread: Credit card loan - 1m t-bill	11.06	11.26	11.03	-0.55
Charge-off rate on cons. loans	2.50	3.18	2.41	-2.47**
Charge-off rate on credit card	4.63	5.50	4.51	-2.08*
Charge-off rate on other cons. loans	1.17	1.86	1.07	-3.74***
Delinquency rate on cons. loans	3.41	3.92	3.33	-4.55***
Delinquency rate on credit card	4.29	5.22	4.15	-4.79***
Delinquency Rate on other cons. loans	2.82	3.12	2.78	-3.14***
Δ (Cons. debt)	2.00	0.97	2.24	3.23***
Δ (Cons. debt/Disp. inc.)	0.39	-0.32	0.55	2.07**

Table 3: Risk-adjusted and risk-free discount rates.

This table reports the discount rates that we use to discount lenders' future cash-flows and calculate their present value. The left column reports risk-adjusted discount rates and the right column reports the real risk-free interest rate. We use our model to calculate these risk-adjusted discount rates: we solve for the optimal consumption choices of an investor with a β of 0.99, a bequest motive of one, and coefficient of relative risk aversion of 0.5. We use these preference parameters and the model predicted growth rates of average consumption to calculate the risk-adjusted discount rates.

Aggregate state	Risk-adjusted	Risk-free
Recession and low interest rate	0.040	-0.006
Recession and high interest rate	0.061	0.030
Expansion and low interest rate	0.026	-0.006
Expansion and high interest rate	0.044	0.030

Table 4: Model without versus model with debt.

This table compares the results of the model without debt to the baseline model with debt. The data are obtained by simulating the model with the baseline parameters reported in Table 1. Panel A reports earnings characteristics which are the same for both models. The average level of savings are in thousands of dollars. The welfare benefits of debt are calculated under the form of consumption equivalent variations, so that the reported value measures the percentage increase in consumption required to make the agent as well off in the model without debt as in the model with debt. The table reports means conditional on the economy being in a recession or in an expansion (except for the welfare benefits of debt which are calculated from an ex-ante point of view using the value function of the agent). The final two rows report the lenders' average net present value per loan (in thousands of dollars) calculated using both the riskless and a risk-adjusted discount rate. The table also reports the present values for loans initiated in recessions and in expansions.

		Model Period	
	Unconditional	Recession	Expansion
Panel A: Earnings characteristics			
Average log inc. growth	0.027	-0.009	0.037
Stdev log inc. growth	0.353	0.359	0.351
Skewness log inc. growth	0.108	-0.335	0.247
Panel B: Model without debt			
Average log cons. growth	0.031	-0.013	0.044
Stdev log cons. growth	0.292	0.291	0.291
Skewness log cons. growth	0.283	-0.446	0.496
Savings ($1k)	1.106	1.162	1.090
Panel C: Model with debt			
Average log cons. growth	0.022	-0.027	0.037
Stdev log cons. growth	0.290	0.286	0.290
Skewness log cons. growth	0.436	-0.296	0.643
Savings ($1k)	2.043	2.081	2.033
Welfare benefits of debt (percent)	1.930		
		Loans initiated in	
	Unconditional	Recession	Expansion
Lenders' npv risk-free rate ($1k)	1.476	0.875	1.620
Lenders' npv risk-adjusted ($1k)	0.680	-0.025	0.848

Table 5: Probability of new loan and borrower characteristics

Panel A reports the probabilities that agents decide to take a new loan. Panel B (Panel C) reports the characteristics of those who decide to do (not to do) so. The data are obtained from simulating the baseline model with debt, with the parameter values reported in Table 1. The table reports the probabilities and borrower characteristics across all periods, and conditional on recession/expansion.

		Model Period	
	Unconditional	Recession	Expansion
Panel A: Probabilities of new loan			
Prob new loan	0.249	0.184	0.268
Prob new loan | low int. rate	0.263	0.196	0.282
Prob new loan | high int. rate	0.236	0.172	0.254
Panel B: Borrower characteristics, take a new loan			
Income	16.925	14.611	17.385
Change in log income	-0.173	-0.247	-0.158
Savings ($1k)	0.422	0.383	0.431
Risk-free interest rate	0.0115	0.0118	0.0115
Panel C: Borrower characteristics, do not take a new loan			
Income	26.242	24.757	26.723
Change in log income	0.023	-0.016	0.036
Savings ($1k)	1.263	1.268	1.262
Risk-free Interest rate	0.0129	0.0132	0.0128
Panel D: Probability of a new loan when the previous matures			
Prob. new loan at maturity	0.472	0.412	0.503

Table 6: Probability of default and borrower characteristics

Panel A reports the probabilities that agents decide to default. Panel B (Panel C) reports the characteristics of those who decide to default (not to default). The data are obtained from simulating the baseline model with debt, with the parameter values reported in Table 1. The table reports the probabilities and borrower characteristics across all periods, and conditional on recession/expansion.

		Model Period	
	Unconditional	Recession	Expansion
Panel A: Annual probabilities of default			
Prob default	0.018	0.028	0.016
Prob default | low int. rate	0.016	0.025	0.014
Prob default | high int rate	0.021	0.031	0.018
Panel B: Borrower characteristics, default			
Income	5.093	4.961	5.158
Change in log income	-0.255	-0.354	-0.206
Outstanding debt	8.349	8.444	8.302
Risk-free interest rate	0.0140	0.0139	0.0141
Panel C: Borrower characteristics, do not default			
Income	23.783	22.963	24.010
Change in log income	0.072	0.040	0.081
Outstanding debt	6.563	6.494	6.582
Risk-free interest rate	0.0118	0.0122	0.0117
Panel D: Probabilities of default per loan			
		Loans initiated in	
	Unconditional	Recession	Expansion
Prob default per loan	0.079	0.133	0.068

Table 7: Debt restructuring: Maturity extension

Panel A reports statistics for the baseline model for which re-structuring is not allowed. Panel B reports results for the model in which borrowers have the option to extend loan maturity in recessions, for the same loan premium as in the baseline model. Panel C reports results for the model with the option to extend maturity but for a lower loan premium determined so that lenders' risk-adjusted net present value is the same as in the baseline model without debt. The data are obtained from simulating the model.

Panel A: Baseline model, loan premium= 8%			
		Model Period	
	Unconditional	Recession	Expansion
Average log cons. growth	0.022	-0.027	0.037
Probability of new loan	0.249	0.184	0.268
Default probability	0.018	0.028	0.016
Average earnings conditional on default ($1k)	5.093	4.961	5.158
Average outstanding debt at default ($1k)	8.349	8.444	8.302
		Loans initiated in	
	Unconditional	Recession	Expansion
Lenders' npv risk-free rate ($1k)	1.476	0.875	1.620
Lenders' npv risk-adjusted ($1k)	0.680	-0.025	0.848
Panel B: Maturity extension, loan premium = 8%			
		Model Period	
	Unconditional	Recession	Expansion
Average log cons. growth	0.021	-0.012	0.031
Probability of new loan	0.264	0.158	0.292
Default probability	0.017	0.005	0.020
Average earnings conditional on default ($1k)	5.133	3.584	5.251
Average outstanding debt at default ($1k)	8.362	8.718	8.336
Welf. gain relative to baseline (percent)	0.419		
		Loans initiated in	
	Unconditional	Recession	Expansion
Lenders' npv risk-free rate ($1k)	1.777	1.234	1.887
Lenders' npv risk-adjusted ($1k)	0.848	0.138	0.991
Panel C: Maturity extension, loan premium = 7.225%			
		Model Period	
	Unconditional	Recession	Expansion
Average log cons. growth	0.021	-0.012	0.030
Probability of new loan	0.299	0.185	0.331
Default probability	0.015	0.005	0.018
Average earnings conditional on default ($1k)	5.032	3.441	5.145
Average outstanding debt at default ($1k)	8.388	8.716	8.365
Welf. gain relative to baseline (percent)	0.746		
		Loans initiated in	
	Unconditional	Recession	Expansion
Lenders' npv risk-free rate ($1k)	1.599	1.171	1.690
Lenders' npv risk-adjusted ($1k)	0.681	0.078	0.809

Table 8: Debt restructuring: Summary statistics.

This table reports several summary statistics for the model with the different restructuring policies. For comparison, the first column reports results for the baseline model in which restructuring is not allowed. Panel A reports the proportion of borrowers who take up the option to restructure the loan. Panel B reports the proportion of borrowers who decide to take a new loan at maturity. Panel C (Panel D) reports average earnings for those who decide to restructure (take or not a new loan at maturity). Panel E reports the overall distribution of outstanding loan amounts (including both recessions and expansions). The table shows results for the restructuring scenarios in which lenders' risk-adjusted net present value is the same as in the baseline model without debt. The data are obtained from simulating the model.

	Baseline	Mat. Ext.	Low rate	Refinancing
Prop. who exerc. option to restr.	n/a	0.57	1.00	0.66
Panel A: Proportion who restructure, by outstanding loan amount				
Amount = 10	n/a	0.80	1.00	0.79
8<Amount<10	n/a	0.66	1.00	0.66
6<Amount<8	n/a	0.49	1.00	0.55
4<Amount<6	n/a	0.25	1.00	0.37
2<Amount<4	n/a	0.51	1.00	n/a
Panel B: Probability of new loan at maturity				
Recession	0.41	0.45	0.45	0.48
Expansion	0.50	0.57	0.54	0.57
Panel C: Average earn. for those who restructure, by outst. loan amount				
Amount = 10	n/a	15.32	20.32	14.95
8<Amount<10	n/a	15.77	21.65	15.68
6<Amount<8	n/a	16.19	22.78	15.59
4<Amount<6	n/a	16.90	23.63	15.17
2<Amount<4	n/a	20.32	24.00	n/a
Panel D: Average earnings by decision to take a new loan at maturity				
New loan given recession	14.74	14.38	14.88	16.30
No new loan given recession	31.45	38.40	31.59	34.72
New loan given expansion	17.50	17.66	17.52	18.55
No new loan given expansion	34.57	35.80	34.97	37.80
Panel E: Dist. of outstanding loan amount, given no previous default				
Amount = 10	0.13	0.16	0.13	0.21
8<Amount<10	0.12	0.14	0.12	0.16
6<Amount<8	0.12	0.13	0.11	0.13
4<Amount<6	0.11	0.11	0.11	0.11
2<Amount<4	0.10	0.12	0.10	0.10
Amount = 0	0.42	0.34	0.43	0.30

Table 9: Debt restructuring: Low rate

Panel A reports statistics for the baseline model for which re-structuring is not allowed. Panel B reports results for the model in which borrowers have the option to benefit from a reduction of 1% in the loan interest rate in recessions. Panel C reports results for a model with the option of a lower rate in recessions, but with a higher loan premium determined so that lenders' risk-adjusted net present value is the same as in the baseline model without debt. The data are obtained from simulating the model.

Panel A: Baseline model, loan premium = 8%			
		Model Period	
	Unconditional	Recession	Expansion
Average log cons. growth	0.022	-0.027	0.037
Probability of new loan	0.249	0.184	0.268
Default probability	0.018	0.028	0.016
Average earnings conditional on default ($1k)	5.093	4.961	5.158
Average outstanding debt at default ($1k)	8.349	8.444	8.302
		Loans initiated in	
	Unconditional	Recession	Expansion
Lenders' npv risk-free rate ($1k)	1.476	0.875	1.620
Lenders' npv risk-adjusted ($1k)	0.680	-0.025	0.848
Panel B: Loan premium = 8%, reduced by 1% in recessions			
		Model Period	
	Unconditional	Recession	Expansion
Average log cons. growth	0.022	-0.026	0.036
Probability of new loan	0.261	0.198	0.280
Default probability	0.018	0.026	0.016
Average earnings conditional on default ($1k)	5.064	4.883	5.148
Average outstanding debt at default ($1k)	8.354	8.492	8.291
Welf. gain relative to baseline (percent)	0.087		
		Loans initiated in	
	Unconditional	Recession	Expansion
Lenders' npv risk-free rate ($1k)	1.446	0.894	1.583
Lenders' npv risk-adjusted ($1k)	0.649	-0.011	0.813
Panel C: Loan premium = 8.25%, reduced by 1.25% in recessions			
		Model Period	
	Unconditional	Recession	Expansion
Average log cons. growth	0.022	-0.026	0.036
Probability of new loan	0.256	0.193	0.274
Default probability	0.018	0.026	0.016
Average earnings conditional on default ($1k)	5.074	4.886	5.159
Average outstanding debt at default ($1k)	8.370	8.494	8.314
Welf. gain relative to baseline (percent)	0.044		
		Loans initiated in	
	Unconditional	Recession	Expansion
Lenders' npv risk-free rate ($1k)	1.485	0.894	1.630
Lenders' npv risk-adjusted ($1k)	0.685	-0.011	0.856

Table 10: Debt restructuring: Refinance

Panel A reports statistics for the baseline model for which re-structuring is not allowed. Panel B (and Panel C) report results for the model in which borrowers have the option to refinance the loan in recessions, meaning that they are allowed to take a new one but must use the proceeds to repay any previously outstanding debt. Panel B reports results for the same loan premium as the baseline model and Panel C for a lower loan premium determined so that lenders' risk-adjusted net present value is the same as in the baseline model without debt. The data are obtained from simulating the model.

Panel A: Baseline model, loan premium = 8%			
		Model Period	
	Unconditional	Recession	Expansion
Average log cons. growth	0.022	-0.027	0.037
Probability of new loan	0.249	0.184	0.268
Default probability	0.018	0.028	0.016
Average earnings conditional on default ($1k)	5.093	4.961	5.158
Average outstanding debt at default ($1k)	8.349	8.444	8.302
		Loans initiated in	
	Unconditional	Recession	Expansion
Lenders' npv risk-free rate ($1k)	1.476	0.875	1.620
Lenders' npv risk-adjusted ($1k)	0.680	-0.025	0.848
Panel B: Refinance, loan premium = 8%			
		Model Period	
	Unconditional	Recession	Expansion
Average log cons. growth	0.020	0.003	0.025
Probability of new loan	0.284	0.218	0.303
Default probability	0.017	0.005	0.020
Average earnings conditional on default ($1k)	5.168	3.760	5.276
Average outstanding debt at default ($1k)	8.665	10.000	8.562
Welf. gain relative to baseline (percent)	0.723		
		Loans initiated in	
	Unconditional	Recession	Expansion
Lenders' npv risk-free rate ($1k)	2.081	1.730	2.173
Lenders' npv risk-adjusted ($1k)	0.989	0.457	1.128
Panel C: Refinance, loan premium = 6.875%			
		Model Period	
	Unconditional	Recession	Expansion
Average log cons. growth	0.020	0.005	0.024
Probability of new loan	0.327	0.255	0.347
Default probability	0.015	0.004	0.018
Average earnings conditional on default ($1k)	5.044	3.506	5.143
Average outstanding debt at default ($1k)	8.698	10.000	8.614
Welf. gain relative to baseline (percent)	1.165		
		Loans initiated in	
	Unconditional	Recession	Expansion
Lenders' npv risk-free rate ($1k)	1.797	1.539	1.867
Lenders' npv risk-adjusted ($1k)	0.692	0.252	0.811

Table 11: Properties of lender cash-flows

This table reports summary statistics on the properties of lenders' per period cash-flows, both overall and conditional on the aggregate state of the economy, for the baseline model and for the models where restructuring is allowed. Panels A. B, and C report average, standard deviation, and skewness of cash-flows, respectively. Panel D reports the proportion of periods in which lenders have negative cash-flows. The data are obtained from simulating the model.

	Unconditional	Recession	Expansion
	Panel A: Mean cashflow (per period)		
Baseline	118.15	255.39	79.11
Maturity extension	132.04	108.62	138.70
Low rate	120.25	234.25	87.82
Refinancing	142.35	-192.06	237.45
	Panel B: Std. deviation of cashflow		
Baseline	139.77	112.33	120.93
Maturity extension	120.74	93.39	126.66
Low rate	132.80	110.81	120.05
Refinancing	326.37	253.43	278.75
	Panel C: Skewness cashflows		
Baseline	-0.03	-0.24	-0.25
Maturity extension	-0.18	-0.08	-0.26
Low rate	-0.11	-0.26	-0.25
Refinancing	-0.76	-0.09	-1.28
	Panel D: Proportion of periods with negative cashflows		
Baseline	0.200	0.020	0.260
Maturity extension	0.140	0.120	0.140
Low rate	0.190	0.030	0.230
Refinancing	0.270	0.730	0.140

Table 12: Credit Rationing: Increasing Loan Premium in Recessions

This table reports statistics for the model in which the loan premium is increased for loans taken in recessions. Panel A reports statistics for the baseline model in which the premium is 8.00% for both loans taken in recession and expansions. Panel B (Panel C) reports statistics for the model in which the premium for loans taken in recessions is increased to 8.60% (15.00%). The first three rows of each panel report means conditional on the economy being in a recession or expansion. The last row of each panel reports means conditional on the business cycle at loan initiation. The data are obtained from simulating the model.

Panel A: Loan Premium in Recessions: 8.00%			
		Model Period	
	Unconditional	Recession	Expansion
Average log cons. growth	0.022	-0.027	0.037
Probability of new loan	0.249	0.184	0.268
Default rates (annual)	0.018	0.028	0.016
Outstand. debt at default	8.349	8.444	8.302
		Loans initiated in	
	Unconditional	Recession	Expansion
Default rates (per loan)	0.079	0.133	0.068
Lenders npv risk-adjusted	0.680	-0.025	0.848
Panel B: Loan Premium in Recessions: 8.60%			
		Model Period	
	Unconditional	Recession	Expansion
Average log cons. growth	0.022	-0.027	0.037
Probability of new loan	0.244	0.177	0.264
Default rates (annual)	0.019	0.028	0.016
Outstand. debt at default	8.390	8.484	8.343
		Loans initiated in	
	Unconditional	Recession	Expansion
Default rates (per loan)	0.080	0.140	0.069
Lenders npv risk-adjusted	0.671	-0.021	0.841
Panel C: Loan Premium in Recessions: 15.00%			
		Model Period	
	Unconditional	Recession	Expansion
Average log cons. growth	0.023	-0.026	0.037
Probability of new loan	0.203	0.134	0.223
Default rates (annual)	0.022	0.033	0.019
Outstand. debt at default	8.664	8.751	8.622
		Loans initiated in	
	Unconditional	Recession	Expansion
Default rates (per loan)	0.092	0.208	0.072
Lenders npv risk-adjusted	0.701	0.211	0.790

Table 13: Credit Rationing: Screening

This table compares the results of the baseline model with no screening (Panel A) to the model in which lenders screen borrowers based on their permanent income (Panel B). The screening rule is defined such that lenders' risk-adjusted net present value is equalized for loans granted in recessions and expansions. The first three rows of each panel report means conditional on the business cycle at loan initiation. The remaining rows report means conditional on the economy being in a recession or expansion. The data are obtained from simulating the model.

Panel A: Baseline Model (no Screening)			
		Loans initiated in	
	Unconditional	Recession	Expansion
Loan premium		8.00%	8.00%
Lenders npv risk-adjusted	0.680	-0.025	0.848
Default prob. (per loan)	0.079	0.133	0.0683
		Model Period	
	Unconditional	Recession	Expansion
Average log cons growth	0.022	-0.027	0.037
Prob. of new loan	0.249	0.184	0.268
Default prob. (annual)	0.018	0.028	0.016
Outstand. debt at default	8.349	8.444	8.302
Welfare benefits of debt (percent)	1.930		
Average cash-flows of lenders	118.2	255.4	79.1
Prop. of periods with cash-flow<0	0.200	0.020	0.260

Panel B: Baseline Model with Screening			
		Loans initiated in	
	Unconditional	Recession	Expansion
Loan premium		8.00%	8.00%
Lenders npv risk-adjusted	0.68	0.682	0.671
Default prob. (per loan)	0.082	0.062	0.083
		Model Period	
	Unconditional	Recession	Expansion
Average log cons growth	0.023	-0.034	0.039
Prob. of new loan	0.236	0.151	0.26
Default prob. (annual)	0.019	0.029	0.016
Outstand. debt at default	8.052	7.658	8.249
Welfare benefits of debt (percent)	1.468		
Average cash-flows of lenders	115.0	303.0	61.5
Prop. of periods with cash-flow<0	0.234	0.005	0.299

Table 14: Credit Rationing: Screening

This table reports the statistics for different restructuring policies when lenders screen borrowers based on their level of permanent income. Across all restructuring policies the level of credit rationing is kept the same as on the baseline model with screening. The loan premiums are adjusted so that lenders' risk-adjusted net present values are the same for loans granted in recessions and expansions. The first three rows of each panel report means conditional on the business cycle at loan initiation. The remaining rows report means conditional on the economy being in a recession or expansion. The data are obtained from simulating the model.

Panel A: Baseline Model with Screening			
		Loans initiated in	
	Unconditional	Recession	Expansion
Loan premium		8.00%	8.00%
Lenders npv risk-adjusted	0.68	0.682	0.671
Default prob. (per loan)	0.082	0.0618	0.083
		Model Period	
	Unconditional	Recession	Expansion
Average log cons growth	0.023	-0.034	0.039
Prob. of new loan	0.236	0.151	0.26
Default prob. (annual)	0.019	0.029	0.016
Outstand. debt at default	8.052	7.658	8.249
Welfare benefits of debt (percent)	1.468		
Average cash-flows of lenders	115.0	303.0	61.5
Prop. of periods with cash-flow<0	0.234	0.005	0.299

Panel B: Maturity Extension with Screening			
		Loans initiated in	
	Unconditional	Recession	Expansion
Loan premium		7.375%	7.125%
Lenders npv risk-adjusted	0.682	0.686	0.689
Default prob. (per loan)	0.0719	0.0652	0.0728
		Model Period	
	Unconditional	Recession	Expansion
Average log cons growth	0.020	-0.017	0.031
Prob. of new loan	0.299	0.165	0.338
Default prob. (annual)	0.015	0.004	0.018
Outstand. debt at default	8.334	8.519	8.322
Welfare benefits of the policy (percent)	0.822		
Average cash-flows of lenders	132.8	142.6	130.1
Prop. of periods with cash-flow<0	0.138	0.055	0.162

Table 14 - continued

Panel C: Low Premium in recessions (7%) and Screening			
		Loans initiated in	
	Unconditional	Recession	Expansion
Loan premium		9.400%	8.500%
Lenders npv risk-adjusted	0.69	0.689	0.693
Default prob. (per loan)	0.0796	0.061	0.0828
		Model Period	
	Unconditional	Recession	Expansion
Average log cons growth	0.022	-0.032	0.038
Prob. of new loan	0.239	0.156	0.263
Default prob. (annual)	0.019	0.028	0.016
Outstand. debt at default	8.054	7.614	8.26
Welfare benefits of the policy (percent)	0.005		
Average cash-flows of lenders	116.6	281.4	69.7
Prop. of periods with cash-flow<0	0.220	0.007	0.281

Panel D: Refinancing and Screening			
		Loans initiated in	
	Unconditional	Recession	Expansion
Loan premium		8.250%	6.375%
Lenders npv risk-adjusted	0.685	0.685	0.685
Default prob. (per loan)	0.0726	0.0954	0.0681
		Model Period	
	Unconditional	Recession	Expansion
Average log cons growth	0.019	0.003	0.024
Prob. of new loan	0.332	0.244	0.357
Default prob. (annual)	0.014	0.004	0.017
Outstand. debt at default	8.695	10.000	8.617
Welfare benefits of the policy (percent)	1.085		
Average cash-flows of lenders	139.5	-180.8	230.5
Prop. of periods with cash-flow<0	0.262	0.680	0.143