Regulating Small Dollar Loans: The Role of Delinquency[*]

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Abstract

This paper analyzes whether and how to regulate small dollar lending in the United States. To that end, I develop a structural model of unsecured lending where heterogeneous households can not only file for bankruptcy but also become delinquent. Introducing fixed cost of loan creation endogenously produces realistic interest rates of up to 300% for small loans. In the face of income and expenditure risk, households can partially insure through bankruptcy that provides legally mandated debt relief. However, lump sum court fees and lawyer costs prevent low income households from filing for bankruptcy protection. Without access to bankruptcy, these households become delinquent and pay late fees to avoid collection efforts from their banks. My quantitative results show that delinquency offers insufficient insurance against adverse events, granting room for welfare-improving policy interventions. In one such intervention, low income households are allowed to repay bankruptcy filing costs *after* debt relief, making bankruptcy more affordable. I show that bankruptcy filings increase and delinquency decreases. Low income households enjoy a 1% welfare increase, while aggregate welfare increases by 0.1%. The repayment plan proposed by the Consumer Financial Protection Bureau, that allows households to spread repayment over three periods, does not yield any welfare gains.

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1 Introduction

Small, short-term loans are an important source of liquidity for many households. Especially sub-prime, low income households have little or no access to mainstream sources of credit such as credit cards or bank overdraft. Hence, financially constrained households turn to payday loans, deposit advance products, and other small dollar loans to gain access to credit. These loans are usually short-term, relatively small, and very expensive. Payday loans for example are due after two to four weeks and usually amount to less than $\$1,000$. Interest rates as high as 20% per loan amount to annualized percentage rates (APRs) of up to 700%. Despite being very expensive, payday loans constitute a sizable market in the United States. Annual lending of $50 billion creates $8 billion in interest payments. About 12 million borrowers use payday loans each year. Although intended to provide short-term liquidity, payday loan users roll over increasing amounts of debt many times. More than 15% of loans are rolled over at least ten times.

High prices and numerous roll-overs sparked a lively policy debate on how to regulate small dollar loans. Current state-level legislation spans from not regulating small dollar loans at all to prohibiting small dollar loans completely.[1] Nationwide regulation is absent, but the recently established Consumer Financial Protection Bureau (CFPB) has just proposed a first attempt to regulate such loans.[2] The CFPB argues that small dollar loans are "consumer debt traps" not only because of their exorbitantly high price but also because fees, interest payments and the principal are all due in one balloon payment, which is unlikely to be paid back in full.[3] Some consumer agencies contend that unaffordable balloon payments form an essential part of the business model of small dollar lenders. To that end, lenders allegedly provide loans that households can never repay in full. Keeping households in debt, these lenders are presumed to generate profit through repeatedly charging late fees for unpaid loans.[4] In an other line of argument, Pew Charitable Trusts (2013) is concerned that borrowers do not fully understand the contracts they are offered. However, the rationale for regulation remains unclear: While prices may be high, small dollar loans are effectively the only tool to smooth consumption that is available to low-income households.

[1] For an overview of current state-level legislation, please see http://www.pewtrusts.org/en/multimedia/data-visualizations/2014/state-payday-loan-regulation-and-usage-rates.

[2] Small dollar lenders are of course subject to other, more general regulation applicable to any commercial credit supplier such as the Fair Credit Reporting Act or the Truth in Lending Act.

[3] The full text of the proposal is available at http://files.consumerfinance.gov/f/documents/Rulemaking_Payday_Vehicle_Title_Certain_High-Cost_Installment_Loans.pdf.

[4] See, for example, http://www.pewtrusts.org/en/research-and-analysis/issue-briefs/2014/12/trial-error-and-success-in-colorados-payday-lending-reforms.

I provide a structural framework to quantify the trade-off between partial insurance obtained through bankruptcy or delinquency and increasing credit prices in the small dollar lending market, both for low-income households and the economy in aggregate. The calibrated model is used to answer the question of whether and how to regulate small dollar loans. Risk-averse households borrow from risk-neutral banks, who accept deposits at the risk-free rate but issue debt at state-contingent prices. Households cannot commit on repaying outstanding debt. Consequently, default arises in equilibrium. In particular, households can use two types of nonpayment to partially insure against idiosyncratic risk: bankruptcy or delinquency. When households cannot afford bankruptcy filing fees, they become delinquent on their debt. Unlike bankruptcy, delinquency does not offer debt relief. Furthermore, delinquent households are subject to collection efforts by their lenders. Delinquency thus provides only limited insurance which means little opportunity to smooth consumption across states.

Contrary to the ongoing policy discussion, the underlying inefficiency in the small dollar loan market does not stem from the size of repayments, but from insufficient risk sharing while in delinquency. In the spirit of Aiyagari (1994), Bewley (1986), and Huggett (1993), households face idiosyncratic risk that is not directly insurable in the market. By introducing some state contingency to debt contracts, default can potentially increase welfare (c.f. Zame, 1993). In the United States, Chapter 7 bankruptcy provides households with an opportunity of debt relief. But filing for bankruptcy involves paying significant filing fees such as lawyer fees and court fees. Low income households, who are typical borrowers in the small dollar loan market, consequently cannot afford to file for bankruptcy. For these households, the only way to insure against income or expenditure risk is to become delinquent. Some households are "trapped" in debt long enough to repay more than they originally owed. That means that the unluckiest households can insure the least.

In order to provide better insurance for low income households, I introduce a bankruptcy advance for those households unable to pay the filing fees. Households using a bankruptcy advance can file for bankruptcy, gain debt relief and only later repay the lump sum costs. Since low income households gain the outside option of walking away from their debt, delinquency becomes less harsh along both the extensive and intensive margin: Delinquencies drop by two thirds, and conditional on delinquency, banks extract less resources. Both effects increase the amount of insurance low income households can access. As a result, these households enjoy a 1% gain in consumption-equivalent welfare. Over all income groups, welfare increases by 0.1% on average with no group becoming worse-off due to the reform.

To evaluate the policy proposal put forward by the CFPB, a repayment plan is introduced in the economy. It is supposed to make repaying small dollar loans easier. Instead of repaying all debt in one large balloon payment, the plan spreads repayment over three periods. When using this plan, households cannot borrow on other small dollar loans. The proposal does not work; I find that households never opt into the repayment plan. In good times, households prefer to repay directly in order to retain the flexibility of choosing future debt or asset positions after learning about future income and unforeseen expenditures. In bad times, the repayment plan is not affordable and low income households still resort to delinquency.

I contribute to the consumer bankruptcy literature along two dimensions: Firstly, I add delinquency as a realistic nonpayment choice when bankruptcy is not affordable. Subject to limited commitment, banks try to optimally extract resources from delinquent borrowers. This mechanism makes delinquency especially harsh on households that do not have the outside option of officially filing for Chapter 7 bankruptcy protection. Secondly, I include per loan fixed cost when banks originate loans in a competitive market. These fixed costs generate realistically high interest rates for small loans.

To my knowledge, this paper is the first to provide a quantitative analysis of the small dollar loan market. There are some papers, however, that attempt to document the impact that payday loans have on households' financial well being. Payday loans are the most prevalent form of small dollar loans. On the one hand, Morgan, Strain, and Seblani (2012) and Zinman (2010) document that payday loans help households to smooth consumption. On the other hand, Melzer (2011) and Skiba and Tobacman (2011) provide evidence that using payday loans makes households less likely to repay outstanding financial obligations. The payday lending market seems to be an alternative to mainstream lending through credit cards and overdraft. Using data from a payday lender matched to credit histories, Bhutta, Skiba, and Tobacman (2015) find that mainly financially constrained households take out payday loans. For a proper welfare analysis, however, it is necessary to structurally model how household choices and equilibrium outcomes influence household utility.

Notwithstanding, there exists a large empirical literature documenting important facts of the payday lending market. Although intended to provide short-term liquidity, payday loan users roll over increasing amounts of debt many times. More than 60% of newly created loans are rolled over at least once, while 15% of loans are rolled over at least ten times (Burke, Lanning, Leary, and Wang, 2013).

Flannery and Samolyk (2005) and Skiba and Tobacman (2007) provide evidence on the importance of fixed cost of loan creation. Even though prices are very high, payday lenders do not earn excess profits when compared to other lenders such as credit card companies. Rather than market power, per-loan fixed cost drive up prices for small short-term loans.

Ernst and Young (2004) calculates that of the total cost in the payday lending industry, 75% are fixed cost while 20% are due to nonpayment.

Despite typically carrying three digit interest rates, small dollar loans are generated employing similar technology as larger unsecured loans. When comparing variable costs, small dollar loan businesses face costs of funds very similar to credit card lenders. In terms of per loan fixed cost, Stango (2012a) highlights that while absolute fixed costs per loan are comparable, fixed costs relative to loan size are much larger in the small dollar lending market simply because of smaller loan sizes. Mechanically, fixed costs per dollar lent decrease in the size of the loan.

Bankruptcy filing costs can be prohibitively high for low-income households. Using the increase in bankruptcy filing costs after the 2005 BAPCPA reform, Albanesi and Nosal (2015) document that low-income households remain delinquent longer and file for Chapter 7 bankruptcy less often. High-income households are not affected by the increase in filing cost. Similarly, Mann and Porter (2009) document that liquidity constraints bar low income households from filing for Chapter 7 bankruptcy. Gross, Notowidigdo, and Wang (2014) show that increased liquidity from tax rebates increases bankruptcy filings.

Households in my model behave rationally and are fully aware of the high costs of small loans. While this assumptions abstracts from problems when borrowers do not fully understand the contracts they are offered, there is little evidence for this. Bertrand and Morse (2011) find that only 10% of borrowers react to information treatments right before taking out payday loans. All other borrowers understand the cost of borrowing and do not adapt loan sizes at all. Using administrative data on an experiment conducted by a large American bank, Agarwal, Chomsisengphet, Liu, and Souleles (2015a) find that borrowers correctly choose the credit contract that minimizes their cost on average.

I set up a quantitative limited commitment model of unsecured debt that features both, official Chapter 7 bankruptcy and delinquency. My model extends quantitative models of consumer bankruptcy, most notably Chatterjee, Corbae, Nakajima, and Ríos-Rull (2007) and Livshits, MacGee, and Tertilt (2007). Most models focus on bankruptcy as the only nonpayment option, while I include the additional option of delinquency. Quantitative models of bankruptcy have been used to analyze many important policy questions: Mitman (2016) analyzes the interplay between bankruptcy and mortgage default regulation. Chatterjee and Gordon (2012) compare the welfare effects of bankruptcy protection vis-à-vis creditors directly garnishing income. Exler (2016) analyses how to reform income garnishment as a part of official consumer bankruptcy in Germany. Bankruptcy also provides insurance to potential entrepreneurs, see Akyol and Athreya (2011) and Mankart and Rodano (2015) for a setup with secured credit.

Athreya, Sánchez, Tam, and Young (2015) are most closely related to my setup. They also allow borrowers to informally default by simply not repaying and, hence, becoming delinquent on outstanding debt. Athreya, Sánchez, Tam, and Young document that a model with formal default through bankruptcy and informal default through delinquency does well in matching observed consumer credit patterns. I depart from their setup in two ways: (1) I introduce fixed cost in loan creation which produce realistic credit prices for small dollar loans. (2) I allow banks to optimally exploit the hold-up situation that arises after a household becomes delinquent. Banks can not only restructure the loan but also charge optimal late fees. This is not only a realistic assumption but also crucial to the amount of insurance delinquency provides. Households with no (or low) outside options are treated more harshly in delinquency than households that might simply file for bankruptcy. Furthermore, Herkenhoff (2012) employs a search framework to analyze partial repayment as a means of informal unemployment insurance. In Herkenhoff's setup, households choose which fraction of debt to repay in order to insure against separation shocks.

The remainder of this paper is structured as follows: Section 2 presents the model. The calibration is discussed in Section 3. Section 4 describes the trade-off between bankruptcy and delinquency and documents that delinquency might "trap" unlucky households in debt. Subsequently, a repayment plan is introduced and the results of this policy experiment are discussed (Section 5). Section 6 describes the effects of introducing a bankruptcy advance. Section 7 concludes.

2 Model

The economy is populated by a continuum of infinitely lived households. Subject to individual earnings and expenditure risk, households maximize utility by choosing consumption and savings. Besides just repaying outstanding debt, individuals can choose to file for Chapter 7 bankruptcy or simply choose not to repay. In the latter case, they become delinquent on their debt.

Financial intermediaries operate in a perfectly competitive market. They offer loan contracts dependent on loan size and household characteristics, subject to variable cost and fixed cost of loan creation. In the case of delinquency, banks maximize expected recovery by optimally choosing to levy late fees and restructure the loan contract.

2.1 Household Problem

The household state is fully described by individual asset holdings (a_t, where $a_t < 0$ is debt), individual earnings (e_t) and individual expenditure shock (κ_t). Earnings consist of a persistent component (z_t, modeled as an AR(1) process) and a transitory component (ε_t, modeled as white noise). See Equation (8) for details. Expenditure shocks represent unforeseen expenditures that strain a household's budget. They represent expenditures as caused by marital disruptions, the replacement of durables and large health care bills. These shocks are assumed to be uncorrelated across time.[5] For brevity of notation, I will summarize the exogenous household states as $s_t = (z_t, \varepsilon_t, \kappa_t)$ such that the full state simply reads (a_t, s_t).

Households choose the sequence $\{c_t, p_t, a_{t+1}\}_{t=0}^{\infty}$ of consumption c_t, repayment mode p_t and next period asset holdings a_{t+1} to maximize the discounted sum of expected utilities $\mathbb{E}\left[\sum_{t=0}^{\infty} \beta^t u(c_t) \mid a_0, s_0\right]$. Here, $u(c) = c^{1-\rho}/(1-\rho)$ is a standard utility function featuring constant relative risk aversion. The problem is presented in recursive formulation, where x' denotes the next period value of a variable x.

In each period, solvent households

1. observe their idiosyncratic earnings e, expenditure shock κ and assets a,
2. optimally choose whether to stay solvent ($p(s,a) = S$), file for Chapter 7 bankruptcy ($p(s,a) = B$) or become delinquent ($p(s,a) = D$) and
3. choose consumption ($c(s,a)$) and savings (i.e. next period's asset holdings, $a'(s,a)$) optimally.

Solvency The value of solvency (V^S) is presented in Equation (1):

$$\begin{aligned} V^S(a,s) &= \max_{c,a'} \left[u(c) + \beta \mathbb{E}_s V(a', s')\right] \\ \text{s.t.} \quad & c + q(a', s)a' = e + a - \kappa, \end{aligned} \tag{1}$$

where $\mathbb{E}_s$ denotes the expectation of next period's value conditional on the current household state s. The budget constraint in solvency simply states that expenditures (consumption plus next period wealth) cannot exceed earnings (e) plus initial wealth (a) minus the

[5] This specification is standard in the consumer bankruptcy literature, see Livshits, MacGee, and Tertilt (2007, 2010). Unforeseen expenditures are frequently quoted as an important reason for default. Not paying unsecured loans (e.g. through filing for bankruptcy) thus partially insures households against these risks.

expenditure shock (κ). $q(\cdot)$ denotes the bond price households are offered for saving or borrowing. $q(\cdot)$ represents the inverse of one plus the interest rate.

Bankruptcy If choosing to file for Chapter 7 bankruptcy, households have to pay lump-sum costs F and additionally suffer utility cost ζ_B. Since individuals can neither save nor borrow in the period of filing for Chapter 7 bankruptcy, they simply consume their endowment minus monetary filing costs. In the period following bankruptcy, all debt is forgiven ($a' = 0$) and there are no further repercussions. Hence, next period's value reads $V(0, s')$. The value from filing for bankruptcy protection thus is

$$V^B(a, s) = u(e - F) - \zeta_B + \beta \mathbb{E}_s V(0, s'). \tag{2}$$

Assuming that individuals do not face negative consequences following a Chapter 7 bankruptcy abstracts from possible effects of bankruptcy on a household's credit report. This is not a strong assumption, as Bhutta, Skiba, and Tobacman (2015) show that credit scores typically are not affected by filing for bankruptcy (but rather by previous failures to repay). Even low income bankrupts are not excluded from unsecured lending: Cohen-Cole, Duygan-Bump, and Montoriol-Garriga (2009) document that specialized lenders target unsecured credit at lower income households just after Chapter 7 bankruptcy. Additionally, Han and Li (2011) document that households still use small dollar loans after filing for bankruptcy. These loans are generated using sub-prime credit scores that do not respond to bankruptcy flags, either (Bhutta, Skiba, and Tobacman, 2015).

All remaining negative consequences of declaring bankruptcy are assumed to be captured by ζ_B. It is supposed to represent stigma of filing for bankruptcy and other adverse effects outside the model such as difficulties when renting an apartment or signing up for phone contracts.

Filing costs F represent out-of-pocket expenses necessary to cover lawyer fees and court fees and have to be paid upfront when filing for Chapter 7. Due to these fees, filing for bankruptcy is very painful if not infeasible for low income households. Even if filing fees do not exceed labor income, the utility of forgone consumption for low income households is very high (due to the concavity of the utility function). Explicitly modeling lump-sum filing cost hence allows me to capture the fact that low income households are less likely to file for bankruptcy and rather stay delinquent. This observation is documented by Albanesi and Nosal (2015). Albanesi and Nosal find that increased monetary filing cost after the 2005 bankruptcy reform reduced Chapter 7 bankruptcies. This drop in bankruptcy filings leads to an increase in delinquencies. The effect is found to be most dominant for low income households.

Delinquency If households choose to neither repay outstanding loans nor to officially file for bankruptcy, they become delinquent on their debt.[6] In that case, creditors can restructure the outstanding loan and charge a late fee. Since I assume limited commitment, households cannot be forced to pay these fees, though. If households decide not to pay ($\nu(s,a) = 0$), households suffer collection efforts that create a utility loss. Payment of late fees arises endogenously, if households are better off paying the proposed fees than suffering collection efforts.

There are many legal ways for lenders to employ collection in order to inflict utility costs on borrowers: letters threatening legal consequences, calls to the debtors, the debtors' employers or the debtors' family members or in-person visits. Furthermore, payday lenders in particular threaten to cash the borrower's post-dated check that was signed at origination. This would inflict further financial stress in the form of overdraft fees with the borrower's bank, for example. Additionally, one might argue that some lenders also employ collection efforts outside the law.[7]

V^D defines the value of delinquency as

$$\begin{aligned} V^D(a,s) = \max_{c,\nu} &\left[u(c) - (1-\nu)\zeta_D + \beta \mathbb{E}_s V(\alpha(a',s'),s')\right] \\ \text{s.t.} \quad & c = e - \nu L(s) \\ & \nu \in \{0,1\}. \end{aligned} \tag{3}$$

In delinquency, households choose how much to consume and whether to pay late fees ($\nu(a,s) = 1$) or not ($\nu(a,s) = 0$). If households do not pay late fees $L(s)$, they suffer collection efforts that induce a utility cost of ζ_D.

[6] To my knowledge, there is only one other paper that formally models delinquency. I depart from Athreya, Sánchez, Tam, and Young (2015)'s setup in allowing banks to recover as much as possible of any delinquent loan. In my setup, banks optimally levy late fees and restructure delinquent loans, subject to limited commitment on the household side. This is crucial when analyzing possible policy reforms since banks take advantage of the missing outside option of Chapter 7 bankruptcy for low income households. See Section 2.2 for more details.

[7] See Hunt (2007) for an overview of debt collection practices in the US. Drozd and Serrano-Padial (2015, Appendix 1) provide detailed information on the influence of information technology on collection. The CFPB collects complaints about collection efforts that are perceived to exceed the legal boundaries set by the Fair Debt Collection Practices Act. For the full data, see `https://data.consumerfinance.gov/dataset/Consumer-Complaints/s6ew-h6mp`.

In contrast to bankruptcy, delinquent debt is not written off by law. Since lenders are free to restructure delinquent debt contracts, next period's debt holdings are set to $\alpha(a', s')$. The intermediaries' problem of optimally setting $L(s)$ and $\alpha(a', s')$ is described in Section (2.2).

Complete Household Problem The full household problem at the beginning of each period can be presented as

$$V(a, s) = \max_{p \in \{S,B,D\}} V^p(a, s). \tag{4}$$

After observing the period's state (a, s), households choose the payment mode $p(\cdot)$ that maximizes $V(a, s)$. Households choose between solvency ($p = S$), filing for bankruptcy ($p = B$) and delinquency ($p = D$). The corresponding Value Functions V^S, V^B and V^D are presented above, in Equations (1), (2) and (3). Note that, in certain states, some repayment modes might be infeasible. In particular, solvency is not feasible if income is sufficiently low or expenditure shocks are sufficiently high. Additionally, if income is lower than the lump-sum Chapter 7 filing costs, bankruptcy yields an empty budget set. I set the utility of empty budget sets to $u(c \leq 0) = -\infty$. In these cases, delinquency ($p(\cdot) = D$) is the only feasible alternative.

2.2 Banking Sector

The banking sector is assumed to be perfectly competitive with free entry and exit. Hence, banks price loans competitively, expecting zero profit for each contract offered. They can refinance externally, at the risk-free interest rate r. For each loan size and household state, banks form expectations over the probability of repayment and possible losses either because borrowers file for bankruptcy or because households become delinquent.

Debt Pricing Function The pricing function is a function of the loan size and the household state when taking out a one-period loan. Both, a' and s, govern the probability and size of repayment. Savings, on the other hand, are not risky and earn the risk free rate:

$$q(a', s) = (1 + r)^{-1} \quad \forall a' \geq 0. \tag{5}$$

When creating loans, financial intermediaries face two types of transaction costs: fixed cost δ and variable (proportional) cost γ. These cost capture fixed per loan expenses such as labor cost of initiating a loan contract as well as variable operating expenses such as billing, payment processing and administration (c.f. Agarwal, Chomsisengphet, Mahoney, and Stroebel, 2015b).

To my knowledge, this paper is the first paper in the consumer bankruptcy literature to introduce per loan fixed cost into debt pricing models. In the absence of market power, fixed cost are important to realistically capture the high prices observed for small loans.[8] In standard models without fixed cost, interest rates only increase if default risk increases. In other words, credit spreads can only arise due to nonpayment risk. In order to capture the observed interest rates for small loans, nonpayment risk would thus have to be very large. In reality however, nonpayment risk only constitutes 30% of credit spreads that are observed in the data (Skiba and Tobacman, 2007).

Let $\bar{q} = (1 + r + \gamma)^{-1}$ denote the lender's (constant) marginal cost of generating loans. Then, a risk-free loan of size $\tilde{a}'$ would face the price

$$q(\tilde{a}', s) = \bar{q} - \frac{\delta}{\tilde{a}'}.$$

That means that households would receive a loan of size $q(\tilde{a}', s)\tilde{a}' = \bar{q}\tilde{a}' - \delta$ and repay the face value of $\tilde{a}'$ next period. Consequently, if $q(\cdot) \to 0$, the implicit interest rate on that loan approaches infinity. Vice versa, if $q(\cdot) \to 1$, the implicit interest rate on that loan approaches 0.

In equilibrium, bankruptcies and delinquencies occur and repayment is not certain. When banks take borrowers' nonpayment decisions into account, risky loan prices evolve according to

$$\begin{aligned} q(a', s) = \bar{q} \Bigg(& \mathbb{E}\left[\mathbb{I}_S\left(a', s'\right) \mid s\right] \cdot 1 \\ & + \mathbb{E}\left[\mathbb{I}_B\left(a', s'\right) \mid s\right] \cdot 0 \\ & + \mathbb{E}\left[\mathbb{I}_D\left(a', s'\right) \frac{R(a', s')}{|a'|} \mid s\right] \Bigg) \quad - \quad \frac{\delta}{|a'|}, \end{aligned} \tag{6}$$

[8] See Ernst and Young (2004) and Flannery and Samolyk (2005) for empirical evidence on the competitiveness of the small dollar lending market and further evidence on the importance of per loan fixed cost in the small dollar loan market.

where $\mathbb{E}\left[\theta\left(a', s'\right)^p \mid s\right]$ denotes the conditional probability of a household in state s that receives a loan of size a' to choose repayment mode p next period.

In the case of solvency ($\mathbb{I}_S(\cdot) = 1$), banks are repaid in full, hence the first line in Equation (6) is multiplied by 1. When filing for bankruptcy ($\mathbb{I}_B(\cdot) = 1$) though, banks retrieve nothing, hence these cases are multiplied by 0. Finally, when households become delinquent ($\mathbb{I}_D(\cdot) = 1$), banks recover $R(a', s')$, as will be described in Problem (7). For a loan of size a', financial intermediaries thus expect to recover the fraction $R(a', s')/|a'|$ in delinquency.

Optimal Recovery in Delinquency If households become delinquent on a loan, banks can charge late fees $L(s)$ and restructure the loan to hold a face value of $\alpha(a, s)$ next period. When charging fees, banks take into account the limited commitment of households which can always choose not to pay. Hence, the utility cost of nonpayment restricts the amount of fees banks can charge in a given period.

When restructuring, banks are free to reduce the face value of the loan, subject to the households' repayment behavior. That means banks can, on the one hand, decrease the payable amount to incentivize households to repay. On the other hand, banks can keep the payable amount as is in order to make repayment less likely and extract more resources from debtors through fees. Restructuring loans amounts to banks optimally adapting the size of outstanding debt, subject to the risky loan price schedule. Hence, banks set late fees (L) and reset the outstanding loan to size α to maximize expected repayment. They solve the problem

$$\begin{aligned} R(a, s) = \max_{L, \alpha} \;& L + q \cdot (-\alpha) \\ \text{s.t.} \quad & u(e - L) \geq u(e) - \zeta_D \\ & q = q(\alpha, s') \\ & \alpha \geq a'. \end{aligned} \tag{7}$$

Problem (7) states that, conditional on delinquency, banks maximize current and expected future returns. In choosing late fees and next period's face value optimally, banks are subject to limited commitment on the household side in two ways: Firstly, households can choose to not pay any fees and rather suffer the utility cost ζ_D resulting from collection efforts. Hence, banks can only levy fees up to an amount that makes households indifferent between paying and not paying ($u(e - L) \geq u(e) - \zeta_D$). Secondly, setting next period's face value, banks take into account that household can always choose between repayment, bankruptcy or delinquency. Banks thus discount next period's face value α with the risky rate $q(\cdot)$. As described above, $q(\alpha, s')$ reflects the household's expected repayment behavior in the following period, given the reset face value and the observed household state.

Finally, I assume that banks are not allowed to increase outstanding debts, hence $\alpha \geq a'$. Otherwise, for some incomes, it might be optimal to set $\alpha \to -\infty$ in order to ensure delinquency and thus late fee payment in all future states of the world (except when bankruptcy becomes available due to a steep increase in income). This is neither legal nor observable in reality, hence I restrict restructured debt α to be weakly less than the original amount owed.

Small Dollar Loans are issued employing the same technology as other unsecured loans. Since these loans are typically smaller than other unsecured credit, per loan fixed cost have a larger effect on their price. Loans carrying APRs in excess of 30% or loans not exceeding the amount of \$1,000 are interpreted as Small Dollar Loans. This definition will be discussed in detail in Section 3.2.

2.3 Equilibrium

Given a risk-free rate r and an income process e, a financial market equilibrium is the set of value functions V, V^S, V^B and V^D, policy functions $c(\cdot)$, $a'(\cdot)$, $p(\cdot)$, conditional repayment probabilities $\mathbb{E}\left[\mathbb{I}_p\left(\cdot\right) \mid s\right],\ p \in \{S, B, D\}$, a recovery function $R\left(\cdot\right)$ and a debt pricing function $q(\cdot)$ such that:

1. Households maximize V, V^S, V^B and V^D, where $c(a, s)$, $a'(a, s)$, $p(a, s)$ are the resulting optimal policy functions.

2. The bond price $q(a', s)$ is determined in a competitive market with free entry, taking as given the expected default behavior $\mathbb{E}\left[\mathbb{I}_p\left(a', s'\right) \mid s\right]$ and the expected recovery in delinquency $\mathbb{E}\left[R\left(a', s'\right) \mid a', s\right]$.

3. The measure of households over states (a, s) is constant.

3 Calibration

The model has 16 free parameters of which nine are set exogenously. The remaining seven parameters are jointly determined in order to match important data moments. These moments describe the United States' economy after the recent financial crisis.

3.1 Direct Specification

In order to capture the typical short duration of small dollar loans, the period length of the model is set to quarters. Households' coefficient of relative risk aversion is set to a standard value of $\sigma = 2$.

The income process $e = \hat{e} \cdot y$ represents idiosyncratic income that households earn. It has a constant component $\hat{e}$ that represents the median endowment in the economy. Additionally, y represents idiosyncratic income risk that households face. It is defined as the residual of regressing household income on observables such as age and education. Following standard assumptions in the literature, it is composed of a persistent AR(1) process $z_{i,t}$ and transitory white noise $\varepsilon_{i,t}$. For household i at time t it is given by

$$\begin{aligned} \log(y_{i,t}) &= z_{i,t} + \varepsilon_{i,t} \\ z_{i,t} &= \varrho z_{i,t-1} + \eta_{i,t}, \end{aligned} \tag{8}$$

where $\varrho \in [0,1]$, $\varepsilon \sim \mathbb{N}(0, \sigma_\varepsilon^2)$ and $\eta \sim \mathbb{N}(0, \sigma_\eta^2)$. Using data from the PSID, Storesletten, Telmer, and Yaron (2004) estimate the auto correlation coefficient ϱ and the standard deviations of ε and η. I convert their values to quarterly values. To that end, I assume that Storesletten, Telmer, and Yaron's annual process is the result of aggregating a quarterly income process. I report the quarterly values in Table 1. Median quarterly income is set to $\hat{e} = \$7,200$ as reported by the Social Security Administration (SSA).[9]

Table 1: Exogenous Parameters

Parameter		**Value**	**Source**
Period Length		Quarters	
CRRA Consumption	σ	2	standard
Median Wage	$\hat{e}$	\$7,200	SSA (2014)
Wage Autocorrelation	ϱ	0.99	Storesletten, Telmer, and Yaron (2004)
Persistent Wage Var	σ_η^2	0.007/3.86	Storesletten, Telmer, and Yaron (2004)
Transitory Wage Var	σ_ε^2	0.04/4	Storesletten, Telmer, and Yaron (2004)
Risk Free Rate	r	0.5%	≈ 2% p.a., World Bank (2015)
Fixed Cost	δ	\$25	Flannery and Samolyk (2005)
Variable Cost	γ	0.7%	Agarwal et al. (2015b)
Bankruptcy Cost	F	\$2,500	Albanesi and Nosal (2015)

[9] See `https://www.ssa.gov/oact/cola/central.html`.

The risk-free interest rate at which banks can refinance externally is set to $r = 0.5\%$ quarterly. This roughly translates to an annual real interest rate of 2%.[10] Transaction cost for creating loans are set to $\gamma = 0.7\%$, which corresponds to roughly 3% p.a. and is in line with the operational cost of 3.4% estimated by Agarwal, Chomsisengphet, Mahoney, and Stroebel (2015b). Lending fixed cost are set to $\delta = \$25$, as documented by Flannery and Samolyk (2005).

Out-of-pocket expenses when filing for bankruptcy (F) are set to $\$2,500$, following the analysis by Albanesi and Nosal (2015). These expenses comprise of court fees and lawyer fees, both of which are unavoidable if a household files for Chapter 7 bankruptcy.

3.2 Simulated Method of Moments

After setting nine parameters exogenously, seven parameters remain to be determined jointly. There are three utility parameters: the discount rate (β), the harassment cost in delinquency (ζ_D) and stigma cost of bankruptcy (ζ_B). Following Livshits, MacGee, and Tertilt (2010), I assume the expenditure shock to take two non-zero values. Hence, there are four additional parameters: two parameters governing the size (κ_1, κ_2 and two parameters governing the respective realization probabilities ($P(\kappa_1)$, $P(\kappa_2)$). These parameters (summarized by θ) are set to minimize the percentage deviations between model moments and data

$$\min_{\theta} \sum_{i} \left(\frac{M_i(\theta)}{D_i} - 1 \right)^2 . \tag{9}$$

Here, $M_i(\theta),\ i = \{1, \ldots, 7\}$ represent seven model moments as a function of the seven free parameters θ. $D_i,\ i = \{1, \ldots, 7\}$ represent the corresponding data moments. The model and data moments are reported in Table 2; Table 3 presents the parameter estimates.

The debt to income ratio for unsecured debt relative to quarterly household income of roughly 35% is slightly overestimated by the model. On the other hand, the fraction of households holding debt is underestimated. The model captures equilibrium delinquencies and bankruptcies well, with 1.2% of households being delinquent in any given quarter and 0.3% of households declaring bankruptcy per quarter.

Following the empirical evidence presented in Ernst and Young (2004), Skiba and Tobacman (2007), and Stango (2012a), my model features one lending technology to generate unsecured credit. I use two definitions to define small dollar loans: Firstly, Small Dollar Loans are defined as all loans featuring APRs higher than 30%. Credit cards, which provide the main source of unsecured debt in the US, almost always have rates lower than 30%.

[10] See `http://data.worldbank.org/indicator/FR.INR.RINR?locations=US`

Table 2: Data Fit

	Model	Data	Source
Avg. Debt/Income	35.6%	28.9%	SCF (2013)
Fraction of HH in debt	19.1%	37.7%	SCF (2013)
Delinquencies	1.2%	1.7%	FRBNY/Equifax
Bankruptcies	0.3%	0.3%	SCF (2013)
Small Dollar Loan APR (1)	128%	300%	Skiba et al., 2007
(2)	121%		
Credit Card APR (1)	12.7%	17.5%	Stango et al., 2016
(2)	12.5%		
Default Premium	33.1%	30%	Skiba et al., 2007

Note: All moments represent quarterly values. SCF (2013) are the author's calculation. Average debt to income is the average of each household's ratio of unsecured debt holdings relative to quarterly household income. Fraction of households in debt is the fraction of households that hold any positive amount of unsecured debt. See Appendix A for more details on the calculation of these moments. The default premium is defined as the credit price spread due to default risk (in contrast to the spread due to lending costs). FRBNY/Equifax is the Federal Reserve Bank of New York's "Consumer Credit Panel / Equifax" data as estimated by Athreya, Sánchez, Tam, and Young (2015).

Using a large administrative data set, Stango and Zinman (2016, Table 2) documents that 90% of revolving credit card balances feature APRs of less than 28%. Hence, a cut-off of 30% seems reasonable. Secondly, all loans smaller than $1,000 are defined as small dollar loans. According to Skiba and Tobacman (2008), payday loans generally do not exceed this size. When calibrating the model, I will show statistics using both definitions:

(1) **APR:** All loans featuring APRs higher than 30% are defined as small dollar loans.

(2) **Size:** All loans smaller than $1,000 are defined as small dollar loans.

In the calibration, I target the APR-based definition (1). I also report the APRs generated when using definition (2) in order to show that I am indeed capturing small loans that carry interest rates in excess of 30%.

Featuring realistic fixed cost of loan creation, the model is able to partially capture high APRs observed in the small dollar lending market according to both definitions presented above. Even though my framework falls short in terms of magnitude, it provides a much better fit than setups without any fixed cost in lending. These setups typically produce very low interest rates for the smallest loans.

Also due to fixed cost of loan creation, the model is able to match the default premium of credit prices very well (33% vs. 30% in the data). The default premium is defined as the fraction of credit spreads that arises due to nonpayment risk rather than operating cost. In models without any fixed cost in lending, risk based credit spreads account for nearly 100% of credit spreads, since only variable lending costs (i.e. costs of funds) drive a small wedge between the risk free rate and the borrowing interest rate.

Finally, credit card interest rates are matched reasonably well according to both definitions. They remain slightly too low, though.

Table 3: Estimated Parameters

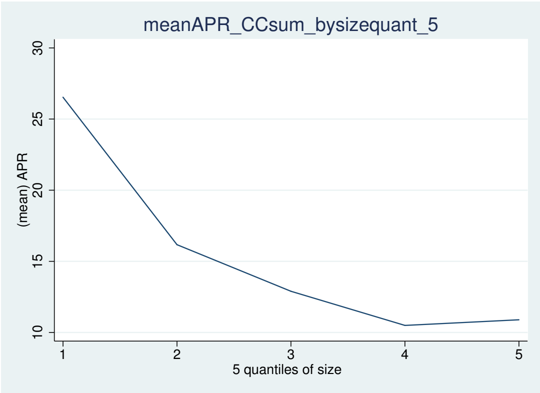
Parameters	θ	
Discount Factor	β	0.975
Harassment Cost Delinquency	ζ_D	7.2
Stigma Cost Bankruptcy	ζ_B	7.4
Expenditure Shocks	κ_1	\$16,935
	κ_2	\$58,070
	$P(\kappa_1)$	3.5%
	$P(\kappa_2)$	0.6%

The endogenous parameters to to generate these moments are shown in Table 3. The discount factor is $\beta = 0.975$. Utility cost in delinquency and bankruptcy are 7.2 and 7.4. In terms of dollar values, these correspond to the utility loss induced by reducing a median income household's assets from \$0 to $-$\$30.000. Since households in the lowest income bin have much higher marginal utility, this amount is only $-$\$2.800 for them.

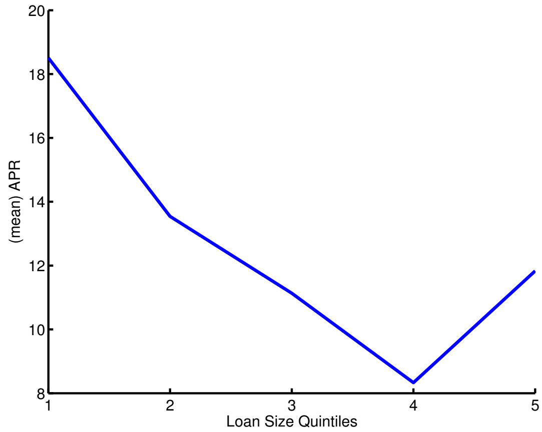
The expenditure shocks estimated in the simulated method of moments are smaller but more likely than those estimated in Livshits, MacGee, and Tertilt (2010). Since these shocks are assumed to be i.i.d., the expected realization per period is simply $\sum_{i=1,2} P(\kappa_i)\kappa_i$. In my calibration, households are on average hit by unforeseen expenditures that amount to 13% of median income whereas households in Livshits, MacGee, and Tertilt on average have to cover 40% of median income. This is mainly because Livshits, MacGee, and Tertilt feature a very large health shock that exceeds the large shock in Table 3 by an order of magnitude.

3.3 Untargeted Moments

This section compares the model to data along non-targeted dimensions. I document cross-sections of credit prices with respect to loan size and borrowers' income. Fixed cost of loan



(a) Data (SCF, 2013)



(b) Model

Figure 1: Average Credit Prices (APR), by loan size

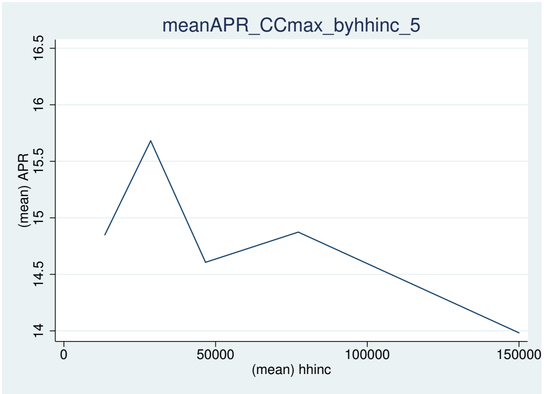
creation generate credit prices that match the cross-section of the data well. The model can thus be used to derive reliable implications when analyzing two potential policy reforms in the following sections.

Even though not directly targeted in the calibration, the model produces realistic price schedules for small dollar loans. Fixed cost of loan creation drive up interest rates for small loans, even in the absence of default risk. In standard models without fixed cost of loan creation, only default risk can increase interest rates on loans. This usually leads to small loans carrying counterfactually low interest rates. Since default risk is low for small loans, interest rates are low for small loans, too.[11]

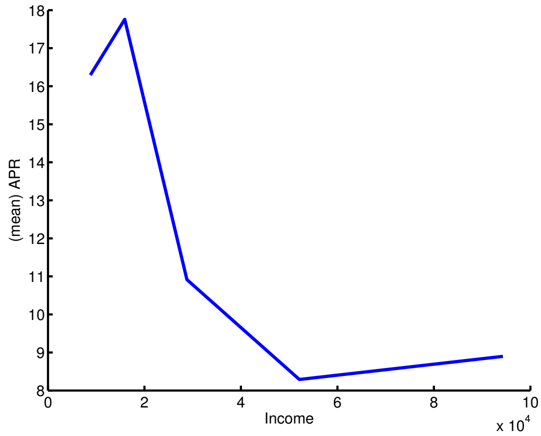
Using data from the SCF (2013), Figure 1a depicts a decreasing relationship between interest rates and unsecured loan size. I not only represent credit card debt in this figure but also all "other loans" reported in the SCF that are unsecured and not for business purposes. "Other loans" are any kind of loans a household hold besides credit card debt, mortgage debt or home equity lines of credit. Households may hold more than one loan, since each loan size–APR bundle is treated as one observation.[12] Average interest rates only increase for very large loans. This is very closely replicated in equilibrium, as shown in Figure 1b. Despite not being targeted in the calibration, the model clearly exhibits decreasing interest rates over the four lowest quintiles with an increase for largest loans. Besides this qualitative feature, the model also does well in predicting the level of interest

[11]For a theoretical derivation of increasing prices in the size of loans, see Chatterjee, Corbae, Nakajima, and Ríos-Rull (2007, Theorem 6).

[12]See Appendix A.4 for more details on how these figures are created.



(a) Data (SCF, 2013)



(b) Model

Figure 2: Average Credit Prices (APR), by income

rates quantitatively, relative to loan size. Only for loans in the first and fourth quintile, the model underestimates interest rates.

Also when analyzing realized interest rates relative to income, the model replicates important facts. Figure 2a depicts average loan prices in the data, measured by the APR, plotted against income quintiles. Low income households face much higher average cost, with a peak at the second quintile. When income increases, costs of credit decrease. Figure 2b depicts the model counterpart that exhibits the same features. Low income households tend to take smaller loans. Hence, fixed cost and higher nonpayment risk drive up prices for low income households.

The SCF oversamples high income households to precisely capture debt and asset holdings in the U.S. There is evidence that it does not contain complete information on the balance sheets of very low income households, though (Ratcliffe et al., 2007). The SCF recently introduced a question regarding the use of payday loans. When analyzing the balance sheet of households that report to use payday loans, these payday loans are rarely represented. Not being mentioned in the “other loans” category, small dollar loans are clearly underreported. Consequently, there are very few observations of very high interest rates in the SCF, even though small dollar loans are clearly used in reality.[13]

[13]See Appendix A.5 for additional information on the marginal interest rates that households face.

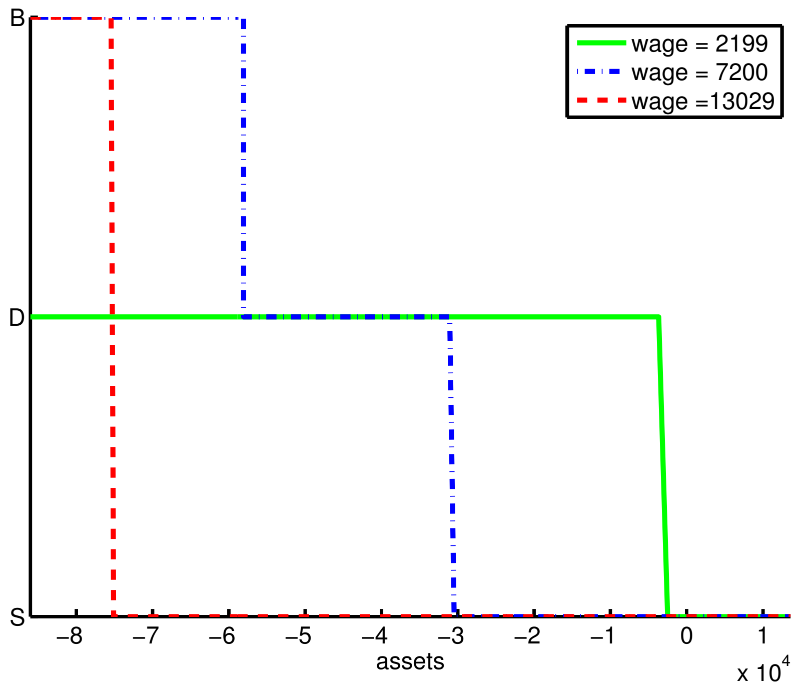


Figure 3: Repayment Decision, large expenditure shock

4 Delinquency as Insurance Device

This section highlights the trade-off of households that become delinquent or declare bankruptcy. Bankruptcy, on the one hand, might be prohibitively expensive in the period of filing for bankruptcy but offers total debt relief in the following period. If available, Chapter 7 bankruptcy thus insures households against adverse shocks. On the other hand, delinquency is more affordable in the short run (at least for low income households) but households enjoy no or only partial reduction of debt. I document that delinquent households might thus be "trapped" in debt long enough to repay more than they originally owed. Delinquency consequently provides low insurance or even anti-insurance. These findings will help to understand why the proposed repayment plan does not yield any welfare gains (c.f. Section 5) whereas a bankruptcy advance makes households better off (c.f. Section 6).

4.1 Household Default Decisions

To understand the fundamental trade-off between delinquency and Chapter 7 bankruptcy, it is instructive to examine household default decisions more closely. Figure 3 depicts repayment decisions of low income, median income and high-income households that face

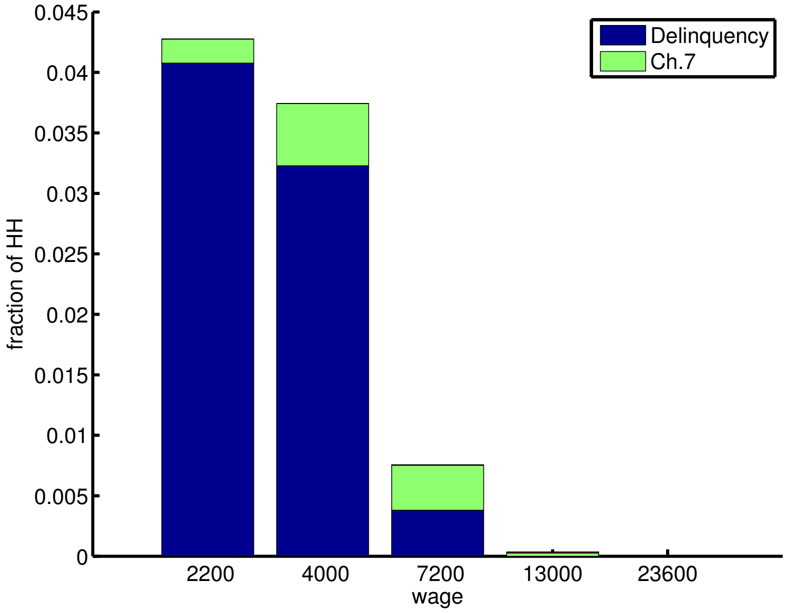


Figure 4: Average Repayment Decision

a large expenditure shock. The policy functions $p = \{S, D, B\}$ are plotted as a function of asset holdings minus the expenditure shock.[14] High-income individuals can afford repayment for very high levels of debt. Consequently, these individuals file for bankruptcy ($p = B$) only when debt is very high and otherwise stay solvent. Since they can easily pay out-of-pocket expenses from current income, these households avoid delinquency and directly file for Chapter 7 bankruptcy.

Median income households cannot afford to repay such high levels of debt. Hence, they choose bankruptcy for lower levels of debt. Since out-of-pocket expenses of declaring bankruptcy are significant for these households, they choose delinquency ($p = D$) over bankruptcy when debt is moderate. Only when debt levels are sufficiently high, these individuals choose bankruptcy in order to forgo collection efforts by banks.

Low-income households, on the other hand, do not file for bankruptcy. When solvency becomes too expensive, these households become delinquent. Filing fees prove prohibitively high for these households, which de facto excludes them from Chapter 7 debt relief.[15]

The policy functions presented in Figure 3 clearly showed that low income households are effectively excluded from filing for Chapter 7 bankruptcy. This exclusion clearly materializes in the simulated equilibrium, too. Figure 4 presents repayment decisions as realized in equilibrium by income groups. Not surprisingly, higher income households are more

[14]Negative asset levels correspond to debt holdings.

[15]See Figure 12a in Appendix B for the debt pricing function that results from this repayment behavior.

likely to be solvent. While a significant fraction of low income households does not repay, they rarely file for Chapter 7 bankruptcy. Due to prohibitively high filing fees, these low income households rather become delinquent. As income increases, delinquency is substituted by filing for bankruptcy.

Table 4: Non-Payment by 30% Lowest Income Households

Non-Payment Decision	Model	Data
Delinquency	85%	75%
Bankruptcy	42%	64%

Note: This table depicts the share of delinquency and bankruptcy decisions by households with the lowest 30% of income relative to total delinquency and bankruptcy decisions. Calculated from the Federal Reserve Bank of New York's "Consumer Credit Panel / Equifax" data set (as seen in Athreya, Sánchez, Tam, and Young, 2015).

The cross-section of delinquency and bankruptcy filings with respect to income are not targeted in the calibration. The model nevertheless correctly predicts delinquencies to be more prevalent than bankruptcies for low income households. Table 4 compares the share of delinquencies and bankruptcy filings by households in the lowest 30% of the income distribution to the data. While fitting delinquencies quite well, the model underestimates bankruptcy filings by low income households.

4.2 Delinquency as a "Debt Trap"

In the absence of state-contingent contracts, households use bankruptcy and delinquency to insure against adverse shocks. When choosing bankruptcy, households gain full debt relief in the next period. Debt relief tomorrow comes at a cost today: Bankrupts have to pay out-of-pocket fees F and they suffer utility cost ζ_B.

When choosing delinquency, households do not necessarily receive full debt relief in the next period. But, in the current period, cost of delinquency do not contain lump-sum expenditures. Delinquent households repay late fees L which depend on the household's state. Since banks make households indifferent between suffering collection or paying late fees, the total utility cost (relative to consuming the endowment) are simply the utility loss due to collection, ζ_D. Late fees can be directly backed out of the banks' problem in Equation (7). $L = e - u^{-1}\left(u(e) - \zeta_D\right)$ makes the household indifferent between consuming $e - L$ without utility cost or consuming e and facing a utility cost of ζ_D.

The difference in instantaneous utilities between delinquency and bankruptcy is

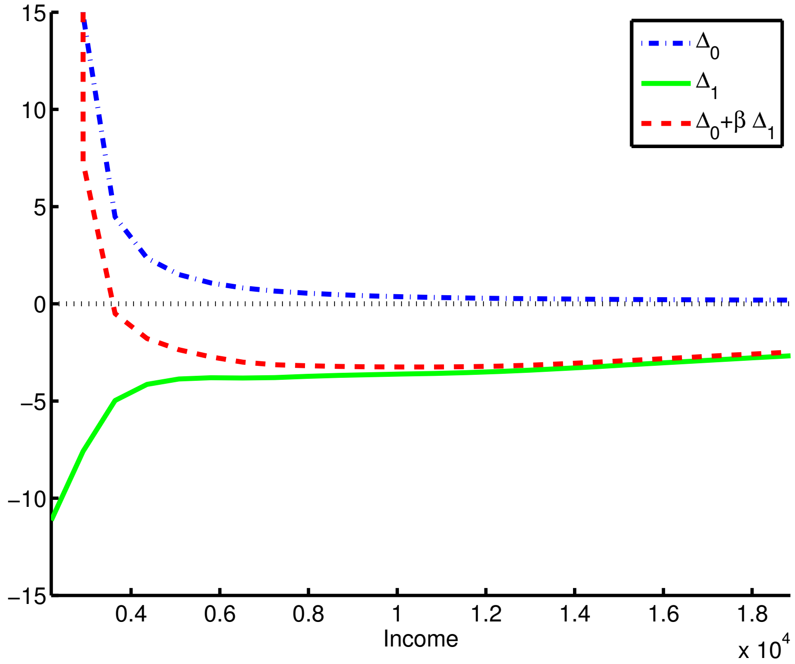


Figure 5: Delinquency vs. Bankruptcy

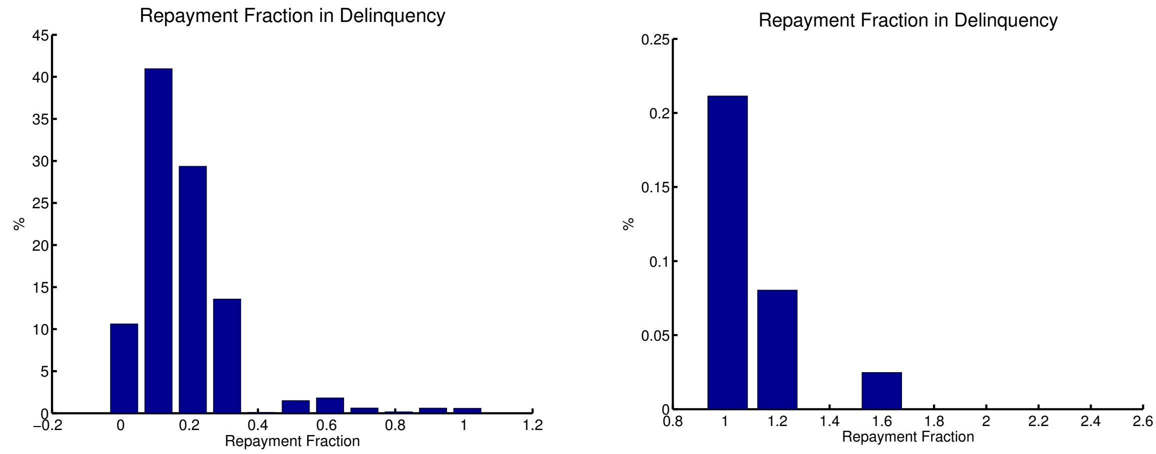
$$\Delta_0 = u(e) - \zeta_D - (u(e-F) - \zeta_B) = \mathcal{U}(e, F) + \zeta_B - \zeta_D, \tag{10}$$

where $\mathcal{U}(e, F) = u(e) - u(e - F)$ denotes the utility loss when paying lump sum filing fees F with income e. Hence, the difference in instantaneous utilities between delinquency and bankruptcy (first term in Equation (10)) can be interpreted as the difference between the utility cost of bankruptcy $\mathcal{U}(e, F) + \zeta_B$ and the utility cost of delinquency ζ_D (second term in Equation (10)).

If $\Delta_0 > 0$, delinquency is preferable relative to bankruptcy in the current period. In a sense, it is a more affordable option to not repay outstanding debt. Thus, instantaneous utility from delinquency is higher than utility from bankruptcy, or equivalently, the utility cost of delinquency are lower than the cost of bankruptcy. Due to standard assumptions on the utility function (see the discussion following Equation (4)), utility cost of bankruptcy become infinitely large if filing cost F approach income:

$$\mathcal{U}(e, F) \to \infty \quad \text{for} \quad e - F \to 0, \ e > F.$$

If $\mathcal{U}(\cdot) \to \infty$, so does $\Delta_0 \to \infty$. In other words, delinquency becomes increasingly favorable as bankruptcy becomes infeasible (and instantaneous utility of bankruptcy di-



(a) Distribution, all

(b) Distribution, only fractions > 1

Figure 6: Repayment Fractions in Delinquency

verges to $-\infty$). In these cases, bankruptcy is not available for households to insure against adverse shocks.[16]

In the period after delinquency or bankruptcy, expected values differ, too. While bankruptcy offers complete debt relief ($a' = 0$), households in delinquency get partial or no debt relief ($a' = \alpha \leq 0$). The difference between expected future utilities of delinquency and bankruptcy thus is

$$\Delta_1 = \mathbb{E}_s \left(V(\alpha, s') - V(0, s') \right). \tag{11}$$

Since V is a well-behaved value function, the expected future value of bankruptcy with debt relief is higher than that of delinquency: $-\infty < \Delta_1 \leq 0$. This is simply because V is bounded and because $\partial V / \partial a > 0$.[17]

To sum up, households trade-off current period expenditures with future debt relief. Better insurance in bankruptcy (i.e. higher debt relief tomorrow) comes at higher cost (i.e. higher out-of-pocket expenditures today). Figure 5 depicts the trade-off between differences in filing fees in the current period (Δ_0) and differences in next period's debt relief (Δ_1) as a function of income. As is apparent in the figure, low income households have very high (or infinite) utility cost of filing for bankruptcy in the current period and hence prefer delinquency ($\Delta_0 + \beta\Delta_1 > 0$). This trade-off reverses for high income households.

[16] On the other hand, if $F \to 0$ or $e \to \infty$, lump sum fees become unimportant i.e. $\mathcal{U}(e, F) \to 0$. Then, the instantaneous utility difference converges to the difference in direct utility cost: $\Delta_0 \to \zeta_D - \zeta_B$.

[17] The last inequality can be strict, if $\exists \alpha : \ q(\alpha, s)\alpha < 0$.

Since low income households cannot afford to file for bankruptcy in order to insure against adverse events, they have to resort to delinquency. Households are "trapped" in debt in that they do not receive debt relief in delinquency, but rather end up paying late fees over multiple periods of time. Figure 6a depicts the distribution of realized repayment fractions in delinquency. That is the discounted sum of all late fee payments and possible repayments upon leaving delinquency. When leaving delinquency, households might repay zero if they file for bankruptcy or α when they end up repaying their delinquent loan. Most households repay roughly 20% of the original loan, compared to nothing in bankruptcy. Note, though, that there are some households that end up repaying up to 160% of the original loan amount in late fees, as depicted in Figure 6b. Here, only repayment fractions above 100% are shown.

Table 5: Realized Repayment Fractions, Delinquency and Bankruptcy

Repayment Quantile	Delinquency	Bankruptcy
25%	9.3%	3.9%
50%	15.1%	6.2%
75%	20.3%	8.2%
95%	48.1%	10.7%
99%	165.9%	18.6%

Note: In bankruptcy, repayment fractions are measured as fixed cost divided by total debt when declaring bankruptcy, i.e. $F/(-a+\kappa)$. Banks do not receive these payments, but households still pay F in order to gain access to deb relief. These numbers are thus reported for comparability.

When comparing repayment across delinquency and bankruptcy directly, the "debt trap" becomes even more apparent. Table 5 describes the distribution of repayment fractions, both in delinquency and in bankruptcy. Here, the payment fraction in bankruptcy is defined as bankruptcy filing cost, relative to outstanding debt. Even though banks do not receive these payments, this measure describes how much households have to pay in the current period of bankruptcy to get all their debt forgiven. Thus, it makes the amount of insurance offered by bankruptcy and delinquency more comparable. Low repayment fractions indicate a high amount of insurance, while high repayment fractions indicate a lower amount of insurance. Repayment fractions above one indicate anti-insurance: Households that cannot repay their debt through solvency and choose delinquency end up repaying more than was originally owed.

While the median household pays only 6.2% of his outstanding debt when filing for bankruptcy, the median delinquent households repays 15.1%. Households in the top 5% repay 10.7% in bankruptcy while nearly 50% in delinquency. Finally, the top 1% of bankrupts repays less than a fifth of the original debt, while delinquents repay 166%. These unlucky households can neither afford to repay outstanding debt nor afford to file for bankruptcy. Hence, being stuck in a “debt trap”, they remain delinquent for long periods of time.

For low-income households, delinquency is more affordable than bankruptcy. But on the flip side, delinquent households repay more of their debt than households that can afford to file for bankruptcy. Thus, while being more costly in the period of default, bankruptcy offers better insurance for households in bad states. Delinquent households might end up in a “debt trap”, unable to repay their debt or file for bankruptcy. After being hit by a bad income realization or expenditure shock, the most unlucky households repay more than 160% of their original debt.

5 Introduction of a Repayment Plan

This section evaluates a key component of the Consumer Financial Protection Bureau’s (CFPB) “Proposal to End Debt Traps.” The proposal aims to reduce the cost that households face when not being able to repay the full principal and interest in one balloon payment. Instead of keeping households in debt and letting fees accumulate, the CFPB proposes that lender are mandated to offer a repayment plan for short-term small dollar loans. According to this plan, households are able to roll over outstanding debt for three periods at no additional cost. By decreasing loan size consecutively, borrowers opting into the repayment plan repay the full principal over three periods. Additionally, they are protected from any collection efforts. By effectively extending the loan duration, this proposal lowers the APR and is supposed to provide a cheap “off ramp” for indebted households. To ensure that households do indeed repay all outstanding small dollar loans, they are excluded from any additional borrowing while repaying under this plan.

According to the proposed regulation, the repayment plan is to be added to any small dollar loan contract. There is only one way to circumvent this requirement. Instead of offering the repayment plan, lenders could ensure a borrower’s ability to repay. However, evidence suggests that lenders already do screen loan applicants. Lenders receive information on income and expected repayment behavior by screening paychecks and retrieving credit scores from Teletrack.[18] Additionally, the CFPB’s proposed process of determining ability to repay is fairly extensive. In addition to income and repayment behavior, lenders

[18]Teletrack provides credit scores that are specifically targeted at the small dollar loans market. See Skiba and Tobacman (2008) for more details.

would be required to assess basic living cost, recurring expenses and other financial obligations. It is not clear if these requirements could be met without significantly increasing operational cost.

I focus on the introduction of a repayment plan due to three reasons. (1) Higher screening standards increase fixed cost of loan creation further. The resulting prices are likely to prove noncompetitive relative to prices of loans that would just include a repayment plan. (2) Borrowers in the small dollar loans market often are financially strained. They use small dollar loans exactly because they do not have access to other lending with more stringent screening. These borrowers would without much doubt choose loans that feature a repayment plan rather than more extensive screening.[19] (3) The proposed repayment plan extends loan contracts to multiple periods. Multiple effects may arise: On the one hand, payments are delayed, freeing current resources to increase consumption. On the other hand, households lose the flexibility of adapting their borrowing or saving behavior to newly realized shocks in the future. The current framework allows to analyze which effect dominates.

In the model, I represent the CFPB's policy proposal by offering an opt-in repayment plan that fully commits households to repay the outstanding amount over three periods. Households using the repayment plan cannot save or borrow but only consume whatever is left of their income after repaying $\psi = 1/3$ of the outstanding loan amount. Since this proposal is aimed at small dollar loans, I only introduce the repayment plan for loans smaller than $\$1,000$.

In order to keep the state space constant, exiting the repayment plan is modeled stochastically. Exit thus occurs with the probability ψ. The expected duration is equal to the inverse of the exit probability ψ and hence equal to three periods. The value of choosing the repayment plan can be written as

$$V^R(a,s) = u(e - \psi(|a| + \kappa)) + \beta \mathbb{E}_s \left[\psi V(0,s') + (1-\psi) V^R(a,s') \right], \tag{12}$$

using the fact that households consume their endowment after repaying $\psi|a|$. If $\psi(|a| + \kappa) \geq e$, choosing the repayment plan is not feasible. In these cases, repayment would exceed the available income. Instantaneous utility is set to minus infinity.

With probability ψ, households in the repayment plan expect to leave the repayment plan and start over with zero debt: $\psi V(0,s')$. If exit does not occur, households stay in the repayment plan for the next period: $(1-\psi)V^R(a,s')$.

[19] Stango (2012b) finds that borrowers prefer traditional payday loans to short-term credit provided by Credit Unions because payday lenders are less restrictive in the application process.

With the repayment plan available, the full household problem in Equation (4) is expanded by $p(\cdot) = R$ and the corresponding value function of Equation (12).

5.1 Debt Pricing Function

Since households are now free to choose between solvency ($p = S$), bankruptcy ($p = B$), delinquency ($p = D$) or entering the repayment plan ($p = R$), credit prices adapt. The new price schedule is

$$
\begin{aligned}
q_R(a', s) = \bar{q} \Bigg(& \mathbb{E}\left[\mathbb{I}_S\left(a', s'\right) \mid s\right] \cdot 1 \\
& + \mathbb{E}\left[\mathbb{I}_B\left(a', s'\right) \mid s\right] \cdot 0 \\
& + \mathbb{E}\left[\mathbb{I}_D\left(a', s'\right) \frac{R(a', s')}{|a'|} \mid s\right] \\
& + \mathbb{E}\left[\mathbb{I}_R\left(a', s'\right) \frac{\Psi(a', s')}{|a'|} \mid s\right] \Bigg) \quad - \quad \frac{\delta}{|a'|},
\end{aligned}
\tag{13}
$$

where $\Psi(\cdot)$ represents the interest rate losses that banks realize for loans that are repaid through the repayment plan. These losses can be written recursively, taking into account the exit probability ψ. Next period's repayment is thus not only discounted at the risk free rate $(1 + r)$, but also multiplied with the probability of the household remaining in the repayment plan $(1 - \psi)$

$$
\Psi(a, s) = \psi(a, s) + (1 + r)^{-1}(1 - \psi(a, s))\mathbb{E}\left[\Psi(a', s') \mid s\right]. \tag{14}
$$

5.2 (Absence of) Effects

When introducing this repayment plan into the economy, it is never chosen in equilibrium (see Figure (7)). Consequently, there is no effect on welfare.

Households do not choose the repayment plan in good times (i.e. in the absence of adverse income or expenditure shocks). Rather than spreading repayment over multiple periods they prefer to repay directly with the option to take out new loans or to save, depending on the future state. The option value of flexibly choosing the asset position next period exceeds the effect of increasing current consumption and repaying parts of the debt later.

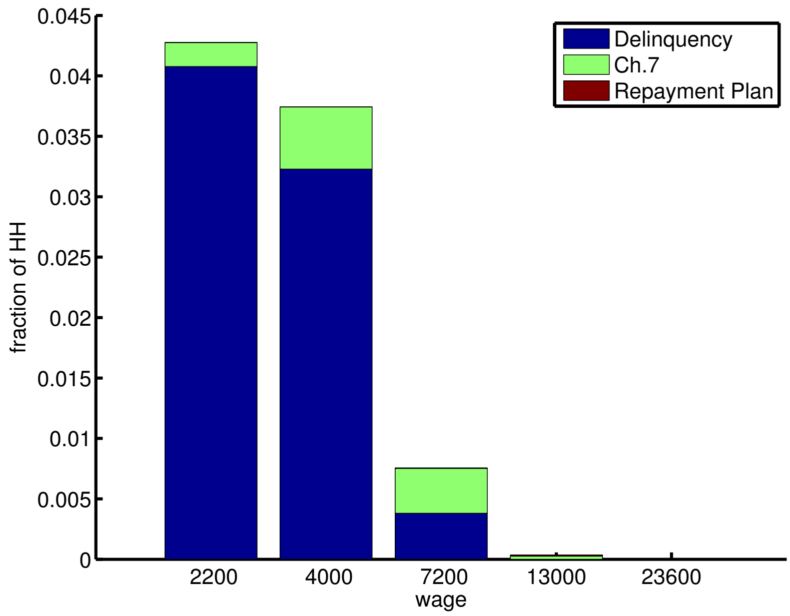


Figure 7: Average Repayment Decision, Repayment Plan available

Households do not choose the repayment plan when hit by an adverse shock that triggered delinquency in the benchmark, either. Large, negative income shocks are persistent and spreading repayment over three periods is not sufficient to make repayment affordable. Additionally, expenditure shocks are simply too large to repay them over three periods. As a result, the proposed repayment plan does not offer a viable alternative in states where borrowers previously chose delinquency. Since outstanding debt has to be repaid over three periods, the plan only offers minimal insurance and is hence dominated by delinquency.

To sum up, the repayment plan is neither chosen in states where households choose solvency in the benchmark, nor in states where households resort to delinquency in the benchmark. This finding is robust to extending the period in which households can repay to up to eight quarters. Longer repayment horizons are not very realistic, given the short-term nature of the original market.[20]

[20] In a future extension, I plan to evaluate income-related repayment schemes. Dye (1986) uses a three period model to theoretically argue that optimal repayment schemes should be based on income. These regimes are prone to moral hazard, though. Allowing for endogenous labor supply, Exler (2016) finds positive garnishment rates to maximize welfare, too.

6 Introduction of Bankruptcy Advances

As shown in Section 4, low income households mainly use delinquency when hit with a bad shock. Compared to bankruptcy, delinquency offers less insurance and households end up paying late fees for multiple periods. The most unlucky households are "trapped" in debt long enough to repay significantly more than originally owed. In the previous section, I showed that a repayment plan does not offer a viable alternative to delinquency.

A more direct policy measure to improve consumption smoothing for low income households is to offer a more affordable option of debt relief. As argued in Section 4.2, the future discounted utility of bankruptcy exceeds that of delinquency because of complete debt relief. Low income households choose delinquency, though, because bankruptcy might be prohibitively expensive in the current period. Many low income households consequently stay delinquent until they experience a steep (and unlikely) increase in wages so that out-of-pocket filing cost can be covered.

In order to increase the amount of insurance that low income households can afford, I introduce a bankruptcy advance to cover bankruptcy filing cost. Using this advance, households gain access to debt relief through Chapter 7 bankruptcy even when income is very low. Under the policy reform, every borrower with below-median income can take out a loan covering all monetary bankruptcy filing cost. The loan is sheltered from bankruptcy and due once the household has left bankruptcy protection. Since the loan does not carry any nonpayment risk, only the risk-free interest rate applies. Households consequently have to repay $(1+r)F$ after filing for bankruptcy using the bankruptcy advance.[21] Additionally, households repay the risk-free interest that accrues. This policy is consequently budget neutral for the regulator.

The value of using a bankruptcy advance is

$$\begin{aligned} V^{BA}(a,s) &= \max_{c} \left[u(c) - \zeta_B + \beta \mathbb{E}_s V(-(1+r)F, s') \right] \\ &\text{s.t.} \quad c = e \end{aligned}$$

and can be simplified to

$$V^{BA}(a,s) = u(e) - \zeta_B + \beta \mathbb{E}_s V(-(1+r)F, s'). \tag{15}$$

[21]This setup is modeled similar to the legal status of student loans which are not written off during Chapter 7 bankruptcy, either. See Ionescu and Simpson (2016) for an example with unsecured credit and student loans.

The policy is means-tested and only households with income that does not exceed median income benefit from the bankruptcy advance. Equation (15) is thus only true for all households with $e \leq \hat{e}$, where $\hat{e}$ is median income in the economy. If income exceeds median income, the policy is not available: I set $V^{BA}(a,s) = -\infty$, if $e > \hat{e}$.

Filing cost are to be payed back in full (including interest). Households choosing a bankruptcy advance enter the following period with debt of $(1+r)F$. Full repayment means that bankrupts cannot directly default on the bankruptcy advance. This ensures that the policy is budget neutral.[22]

The beginning-of-period household problem in Equation (4) is expanded by adding the choice of a bankruptcy advance $p(\cdot) = BA$ and the corresponding value function of Equation (15).

6.1 Debt Pricing Function

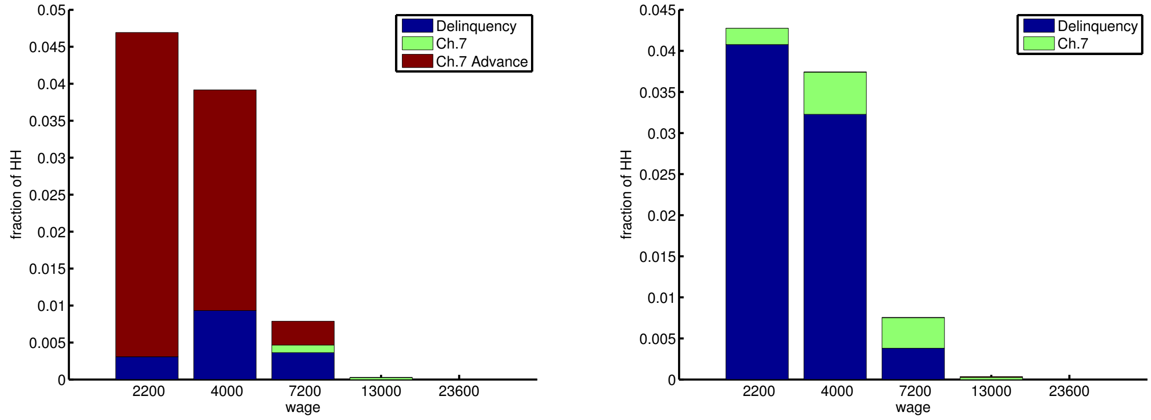
Since households are now free to choose between solvency ($p = S$), bankruptcy ($p = B$), delinquency ($p = D$) or using a bankruptcy advance ($p = BA$), credit prices adapt. The new price schedule is

$$
\begin{aligned}
q_R(a', s) = \bar{q} \Bigg(& \mathbb{E}\left[\mathbb{I}_S\left(a', s'\right) \mid s\right] \cdot 1 \\
& + \mathbb{E}\left[\mathbb{I}_B\left(a', s'\right) \mid s\right] \cdot 0 \\
& + \mathbb{E}\left[\mathbb{I}_D\left(a', s'\right) \frac{R(a', s')}{|a'|} \mid s\right] \\
& + \mathbb{E}\left[\mathbb{I}_{BA}\left(a', s'\right) \mid s\right] \cdot 0 \Bigg) - \frac{\delta}{|a'|},
\end{aligned} \tag{16}
$$

where recovery during Chapter 7 bankruptcy is zero, no matter if households pay the filing fees or use a bankruptcy advance. See Figure 12b in Appendix B for more details and a plot of the debt pricing function.

6.2 Effects

[22] When I solve the model, I do not enforce this restriction directly. Rather, I check that households stay solvent after using the bankruptcy advance for at least one period. 100% of households choosing a bankruptcy advance do so. This corresponds to repaying the government funded advance, even if households refinance parts of the advance with private loans in subsequent periods.



(a) Bankruptcy Advance available (b) Benchmark

Figure 8: Average Repayment Decisions

Household Behavior When entering each period, households now have an additional choice: Instead of traditional Chapter 7 bankruptcy or delinquency, below-median households can choose to get a loan to cover Chapter 7 filing cost. Figure 8a plots the adapted household decisions when a Chapter 7 advance is available. For better readability, Figure 8b presents the equilibrium repayment choices in the benchmark again (c.f. Figure 4).

Households with below-median income enter delinquency significantly less than in the benchmark. In order to get debt relief, they prefer a bankruptcy advance over standard Chapter 7, since filing fees can be repaid after filing for bankruptcy. All low income bankrupts choose to make use of the introduced bankruptcy advance of paying the filing fees up front.

Higher income households, on the other hand, are excluded from the policy reform; their repayment choices resemble the benchmark case more closely. Standard Chapter 7 bankruptcy is slightly reduced because lower income households do not stay delinquent and wait for a higher income realization to be able to file for bankruptcy.

Average Realized Credit Prices Figure (9) presents credit prices realized in the new equilibrium, relative to the benchmark without bankruptcy advances. It depicts average APRs for quintiles of the wage distribution. Since low income individuals have a more affordable option to file for bankruptcy now, banks consider these households to be more risky. Compared to the benchmark, banks recover less through late fees in delinquency and credit for low income borrowers become more costly. Households choose bankruptcy

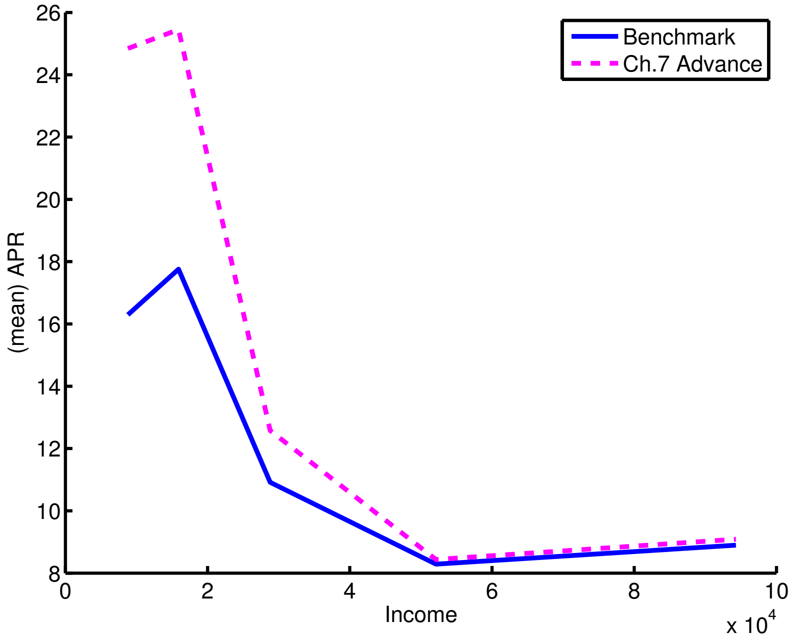


Figure 9: Average Credit Price by Income, Benchmark vs. Bankruptcy Advance available

in more states of the world, yielding complete debt relief and consequently zero recovery for banks. This effect is most pronounced for the lowest income quintile.

Abolishing "Debt Traps" Expected recovery in delinquency is reduced along the extensive and intensive margin: Making bankruptcy available to low income households reduces the number of households in delinquency along the extensive margin. As a result, banks expect zero recovery due to bankruptcy to occur more often. On the intensive margin, bankruptcy advances also change banks' expected recovery conditionally on borrowers being delinquent. Banks cannot keep low income households in debt for long periods and thus cannot charge high late fees to recover as much of the loan as in the benchmark. Since filing fees do not bar low income households from filing anymore, banks have to offer better terms on delinquent balances in order to incentivize at least some repayment. The outside option of filing for Chapter 7 bankruptcy and owe debt of $(1+r)F$ next period thus reduces repayment in delinquency along the intensive margin, too.

Along the extensive margin, delinquencies drop significantly in this policy experiment. Table 6 presents the effects on equilibrium repayment choices of the new policy relative to the benchmark. Bankruptcy filings are divided into standard filings and filings financed by a bankruptcy advance. While solvency is roughly constant, the fraction of households

Table 6: Equilibrium Repayment Decisions

	Bankruptcy Advance	Benchmark	Difference
Solvency	98.4%	98.5%	– 0%
Delinquency	0.4%	1.2%	– 67%
Bankruptcy	1.2%	0.3%	+ 300%
Standard Ch. 7	0.04%	0.3%	– 87%
Bankruptcy Advance	1.15%	0%	

Table 7: Realized Repayment Fractions, Bankruptcy Advance available

Repayment Quantile	Delinquency	Bankruptcy	Bankruptcy Funding
25%	11.0%	3.5%	7.9 %
50%	14.2%	4.1%	10.9 %
75%	18.9%	5.8%	12.4 %
95%	27.3%	7.0%	13.8 %
99%	29.6%	7.4%	37.3 %

Note: In bankruptcy, independent whether paid out of pocket or financed through a bankruptcy advance, repayment fractions are measured as fixed cost divided by total debt when declaring bankruptcy, i.e. $F/(-a+\kappa)$.

choosing delinquency is reduced by two thirds. These households file for bankruptcy instead and aggregate bankruptcy filings quadruple (+300%).

The overwhelming fraction of bankruptcy filings are financed by a bankruptcy advance (96% = 1.15/1.2). While aggregate bankruptcy filings increase, standard bankruptcy cases actually drop to very low levels. Standard Chapter 7 bankruptcy was mainly used by delinquent formerly low income households that received a positive permanent wage shock. Now, these households directly have access to bankruptcy through a government sponsored advance and do not wait to file for standard Chapter 7 bankruptcy later.

Also along the intensive margin, delinquencies become less severe, as depicted in Table 7. Conditional on being delinquent, households repay significantly less. Especially, households that were formerly “trapped” in debt ended up repaying more than they originally owed. Now that households have the outside option of bankruptcy, though, the unluckiest delinquent households only repay less than 30% of original debt through late fees (compared to 165% in the benchmark).

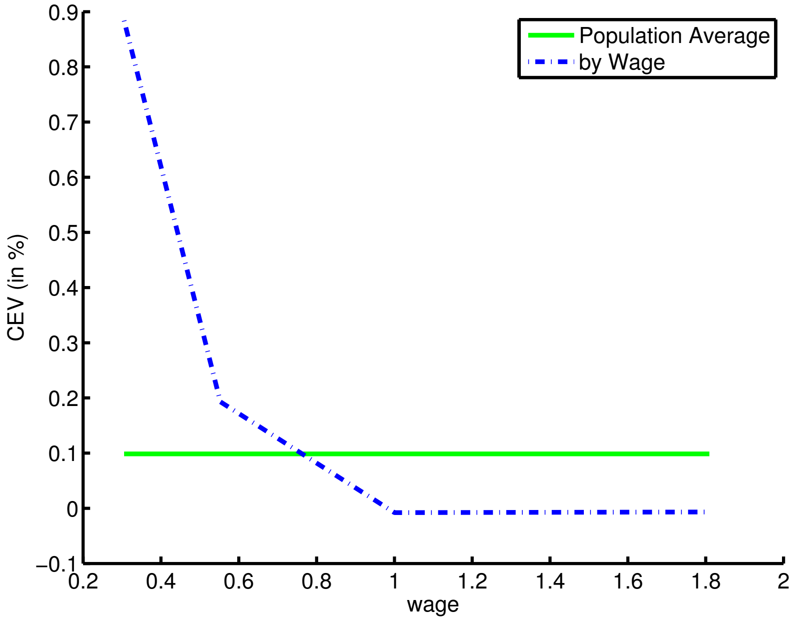


Figure 10: Welfare Effects, Bankruptcy Advance available

6.3 Welfare Effects

Upon the introduction of bankruptcy advances, low income households' welfare improves significantly. When delinquency is used as an insurance against bad income realizations or expenditure shocks, households suffer significant utility cost due to the late fees they pay to avoid collection efforts by banks. Also, there is no way for low income households to receive full debt relief. Hence, households readily use subsidized bankruptcy when it is introduced.

While average welfare increases by 0.1%, low income households gain up to 1% in welfare.[23] These households could not formally declare bankruptcy before, and hence value the policy reform the most. The welfare gains are computed using consumption equivalence variation (CEV). For each household, I calculate the necessary consumption increase in the benchmark to make them indifferent between this benchmark and the policy experiment. Thus, for every household with state (a, s) in the stationary distribution, I solve for ξ such that

$$V_\xi(a, s) = \mathbb{E}\left(\sum_{i=0}^{\infty} \beta^i u(c_i(1+\xi)) \mid a, s\right) \equiv \widetilde{V}(a, s), \tag{17}$$

[23]I do not account for the transition period. Transition effects should be small, though, since there is no aggregate capital stock in my model. Even in the presence of an aggregate capital stock, Chatterjee, Corbae, Nakajima, and Ríos-Rull (2007) find very small transition effects.

where V_ξ denotes benchmark welfare, if consumption is increased by ξ. $\widetilde{V}$ denotes welfare when a bankruptcy advance is available.

Figure 10 reports the population average of the CEV (i.e. $\mathbb{E}(\xi)$) and the average by income (i.e. $\mathbb{E}(\xi \mid e)$). Since high income households are very unlikely to ever become eligible to use a bankruptcy advance, welfare effects for those households are roughly zero. Low income households, on the other hand, face steeper pricing, but gain better access to insurance against bad states. The latter effects dominates and produces up to 1% in welfare gains.

These welfare gains can be realized at no cost to the regulator. All bankruptcy advances are repaid after unsecured debt is written off. Compared to introducing a repayment plan, this policy has positive effects on the economy. Furthermore, there is unanimous support for the reform: Nobody loses when the reform is introduced. While high income individuals are unlikely to be affected, low income households prefer better access to insurance with the reform over lower prices without it. Introducing this reform should be politically feasible since it offers a Pareto Improvement.

7 Conclusion

Fixed bankruptcy filing costs may "trap" low income households in debt. In the face of bad shocks, these households become delinquent on their loans because bankruptcy is unaffordable. Banks have no incentive to offer a discount in order to incentivize repayment. Rather, they maximize expected repayment by repeatedly charging late fees and keeping households in delinquency for long periods of time. For high income households on the other hand, bankruptcy is available as an outside option. Consequently, the most unlucky households can insure the least.

A policy proposal by the Consumer Financial Protection Bureau (CFPB) aims at ending these "debt traps" in the small dollar loan market. The proposed repayment plan is introduced in Section 5. It allows delinquent households to repay outstanding debt over three periods. Without suffering bad income or expenditure shocks, households do not value this option, though. They rather repay directly and reserve the flexibility to adapt future asset or debt holdings to changes in income or unforeseen expenditures. In the face of bad shocks, the repayment plan is not affordable because low income realizations are persistent and expenditure shocks are too large. Consequently, the CFPB proposal is never chosen in equilibrium and has no welfare effect.

Introducing a bankruptcy advance in Section 6 yields significant welfare gains. Under this policy, low income households can file for bankruptcy and repay the filing cost after their unsecured debt is forgiven. With this option available, the burden of delinquency decreases both along the extensive and intensive margin: Households use a bankruptcy advance instead of being delinquent and delinquent households repay less since Chapter 7 becomes a viable outside option.

For the lowest incomes, welfare increases by up to 1% when subsidized bankruptcy is available. The average welfare gain is 0.1% and all households are weakly better off. These effects arise because households have access to better insurance against adverse shocks. The value of insurance dominates the negative effects of increased credit prices.

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A Unsecured Debt in the Survey of Consumer Finance

A.1 Unsecured Debt

The Survey of Consumer Finances (SCF) contains very detailed information on household balance sheets. In order to construct total unsecured debt holdings of a household, I sum up non-business credit card debt (variables X413, X421, X427, X430, X7575), debt owed on lines of credit that is neither secured by housing or vehicles nor a business loan (variables X1108, X1119, X1130) and debt owed on other unsecured loans (variables X2714, X2731, X2814, X2831, X2914, X2931).

Let $\mathbb{X}_i$ define the set of measures of unsecured credit j for each household i as described above. Hence, total unsecured debt for each household i in sample I is

$$D_i = \sum_{X_{i,j} \in \mathbb{X}_i} X_{i,j}. \tag{18}$$

A.2 Debt to Income

The debt to income ratio of each household is constructed using the total unsecured debt measure described above and dividing it by total household income (variable X5729). I follow Livshits, MacGee, and Tertilt (2010) in constructing debt to income ratios using actual outstanding debt instead of net debt positions. Livshits, MacGee, and Tertilt argue that outstanding unsecured debt is more relevant to a households bankruptcy decision than the net position. Many assets (such as housing) are illiquid and cannot be used to repay outstanding debt. Additionally, exemptions shield large parts of household assets.

Let Y_i denote household income $X5729$. Then, the debt to income ration of households is defined as

$$d_i = \frac{D_i}{Y_i}. \tag{19}$$

In the calibration, I target the population average of this ratio:

$$d = \frac{\sum_{i \in I} d_i}{N}, \tag{20}$$

where N is population size.

A.3 Fraction in Debt

In order to calculate the fraction of households in debt (f), I calculate the population average of an indicator that is one if D_i is strictly larger than zero and zero otherwise:

$$f = \frac{\sum_{i \in I} \mathbb{I}(D_i > 0)}{N}. \tag{21}$$

A.4 Cross-Sectional APRs

In order to generate Figures 1a and 2a, I treat any (loan size, APR) pair in the data as one observation. Each household i thus might hold several loans summarized in $\mathbb{X}_i$. In order to generate credit card debt, I sum up all credit card debt and apply the interest rate reported for the highest balance (X7132). More detailed interest rate information is not available for credit cards. All other loans come with individually reported interest rates (X2724, X2741, X2824, X2841, X2924, X2941). Let $\mathbb{R}_i$ denote an individual i's set of interest rates $\{R_{i,1}, R_{i,2}, \ldots, R_{i,j}, \ldots, R_{i,J}\}$.

I then take the conditional mean of the observed APRs by loan size quintiles (Figure 1a) and by household income quintiles (Figure 2a):

$$\begin{aligned} APR_n &= \sum_{i,j} \frac{R_{i,j}\ \mathbb{I}\left(Y_i \in Q_n(Y)\right)}{\mathbb{I}\left(Y_i \in Q_n(Y)\right)} \\ \mathbf{X}_n &= \sum_{i,j} \frac{R_{i,j}\ \mathbb{I}\left(Y_i \in Q_n(Y)\right)}{\mathbb{I}\left(Y_i \in Q_n(X)\right)} \end{aligned} \tag{22}$$

where Q_n denotes the set of incomes and loan sizes in the nth quintile and j indicates each loan held by individual i.

A.5 Marginal Borrowing Cost

To get a further impression on the distribution of interest rates in the SCF, I construct a measure of effective borrowing cost of a household. Here, I assume that households use the cheapest available credit first. As a consequence, the highest observed interest rate for all unsecured loans $\mathbb{X}_i$ (i.e. credit cards and other unsecured loans) measures the interest rate of the marginal loan. In Figure 11, I plot these interest rates for each household, relative to income quintiles.

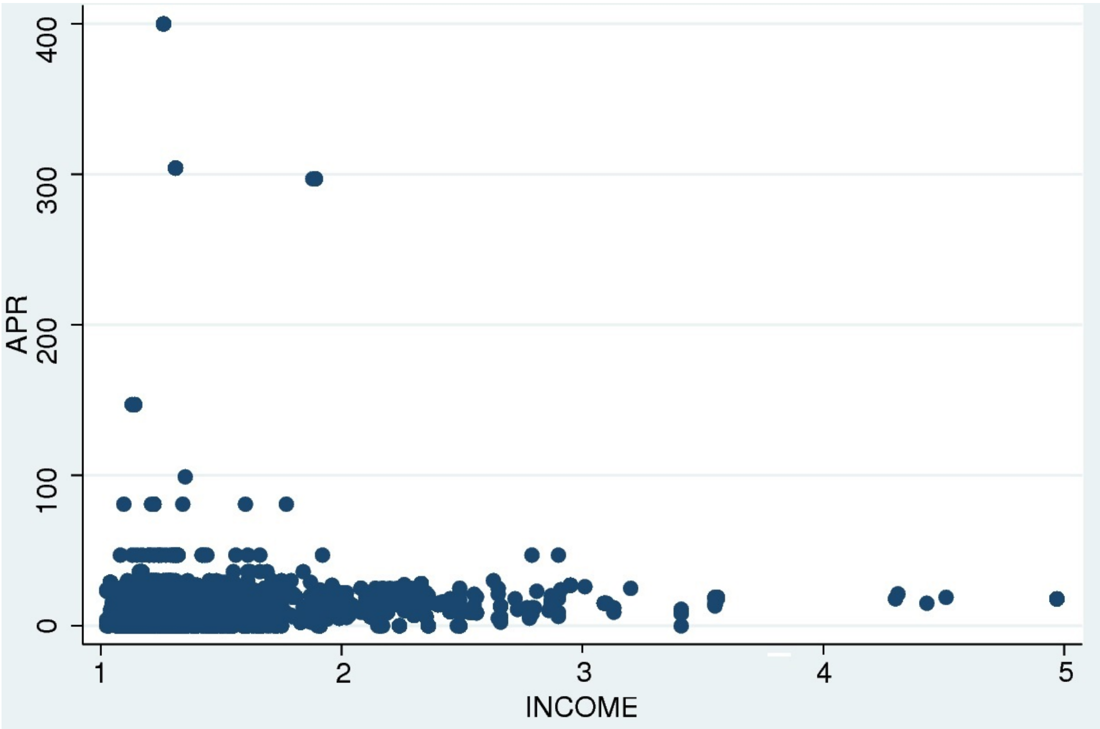


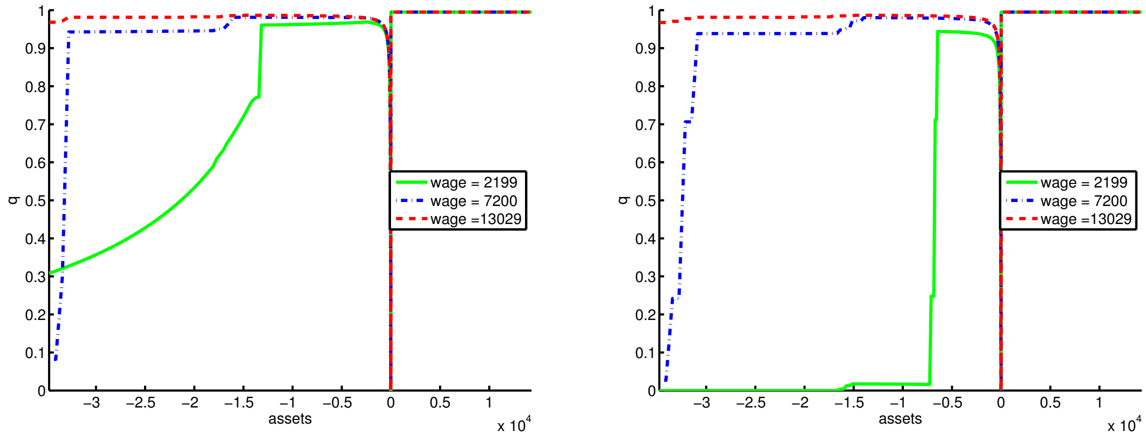
Figure 11: Scatter Plot of Maximum APR in SCF

B Debt Pricing Function

Resulting from the household behavior described in Section 4, Figure 12 depicts the equilibrium credit pricing function that is employed by banks for three different wage realizations as a function of debt. Prices are infinitely large (i.e. $q = 0$) for loans smaller than the fixed cost. The impact of these fixed cost vanishes with increasing loan size. Since low income households stop repaying earlier than high-income households, credit prices for the former deteriorate at lower levels of debt.

In the benchmark however (c.f. Figure 12a), low income households do not file for bankruptcy but rather become delinquent. Consequently, banks can recover some resources through levying late fees once these households are not solvent any more. The drop in q is less pronounced than for median income households who can afford Chapter 7 bankruptcy. Banks expect median income households to file for bankruptcy and correspondingly expect zero repayment for high debt levels.

When bankruptcy funding is available to low income households, low income households do not stay in delinquency and accordingly do not repay late fees. Figure 12b clearly shows the drop in delinquencies and the corresponding drop in expected repayment described in Section 6.2. Low income households not only use bankruptcy advances at lower levels



(a) Benchmark (b) Bankruptcy Advance available

Figure 12: Credit Pricing Function, q

of debt to file for Chapter 7 bankruptcy, but, once they file for bankruptcy, expected repayment is much lower than in delinquency. Thus, q drops at lower levels of debt and q drops more steeply.

In both setups, high-income individuals still repay very high levels of debt. Hence, credit remains cheap (corresponding to q close to one) and only deteriorates for even higher levels of debt.

C Computational Approach

The model is solved numerically by value function iteration on a discretized state space $A \times Z \times \mathcal{E} \times \mathcal{K}$, denoting the set of asset holdings, persistent income realizations, transitory income realizations and expenditure shocks. The income shock processes are discretized using Rouwenhorst's method (Kopecky and Suen, 2010). Total income thus is $e \in Z \times \mathcal{E}$.

C.1 Algorithm

1. Pick structural parameters θ_0 of length J.

2. Let $\widetilde{\theta}_j = \theta_0 + \hat{\jmath}\, d$ for each $j = \{1, 2, \ldots, J\}$, where $\hat{\jmath}$ is the standard unit vector with jth element equal to one and d is the stepsize.

   I. Do Value Function Iteration

      i. Guess V_0 and q_0.

ii. Compute $\mathbb{E}[V_0(a', s') \mid s]$ for all $z \in Z$.

iii. Compute the new value functions V_1^S, V_1^D, V_1^B by maximizing over c, a' for each $p = S, D, B$.

iv. Compute V_1 by solving for optimal p^*.

v. Compute expected repayment in delinquency $R(a, s)$, taking household choices c^*, a'^*, p^* as given.

vi. Compute new implied credit price q_1 taking repayment as given.

vii. If $\| V_1^S - V_0^S \|, \| V_1^D - V_0^D \|, \| V_1^B - V_0^B \| < \epsilon_V$ and $\| q_1 - q_0 \| < \epsilon_q$, end. Else, $V_0 = V_1$ and $q_0 = \mu q_1 + (1 - \mu) q_0$ and go to ii.

II. Calculate model moments

i. Simulate the invariant distribution over $A \times Z \times \mathcal{E} \times \mathcal{K}$.

ii. Calculate model moments $M(\widetilde{\theta}_j)$.

3. Update structural parameters

I. Pick $\theta^* = \arg\min_j \sum_i w_i \left(M_i(\theta_j) - D_i\right)^2$ where $w_i = D_i^{-2}$ to minimize sum of squared relative deviations to data D_i.

II. If $j \in \{1, \ldots, J\}$, update $\theta_0 = \theta^*$ and increase step size d.
Else, $j = 0$. Keep initial θ_0 and decrease step size d.

III. If $d > \epsilon_d$, go to 2. Else, end.