Labor Market Upheaval, Default Regulations, and Consumer Debt*
(preliminary and incomplete–do not cite)

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November 27, 2013

Abstract

In 2005, bankruptcy laws were reformed significantly, making personal bankruptcy substantially more costly to file than before. Shortly after, the US began to experience its most severe recession in seventy years. While personal bankruptcy rates rose, they rose only modestly given the severity of the rise in unemployment, perhaps as a consequence of the reform. Moreover, in the subsequent recovery, households have been widely viewed as "develeraging" (Mian and Sufi (2011), Krugman and Eggertson (2012)), an interpretation consistent with the largest reduction in the volume of unsecured debt in the past three decades. In this paper, we aim to measure the role jointly played by recent bankruptcy reforms and labor market risks during the Great Recession in accounting for the use of consumer credit and debt default. We use a setting that features high-frequency life-cycle consumption-savings decisions, defaultable debt, search frictions, and aggregate risk. Our results suggest that the 2005 bankruptcy reform likely prevented a substantial increase in bankruptcy filings, but had only limited effect on the observed path of delinquencies. Thus, the reform appears to have "worked." Second, we find the fluctuations in the separation rate observed over the Great Recession did not significantly affect the dynamics of default; all of the work is done by the large decline in the job-finding rate. In the absence of declines in hiring, our model suggests that BAPCPA would have produced a persistent decline in bankruptcy filings and no response in delinquency. Lastly, we find that bankruptcy reform does matter for consumer credit use in the *long-run*: our model predicts that households will eventually hold higher debt as a result of the recent bankruptcy reform.

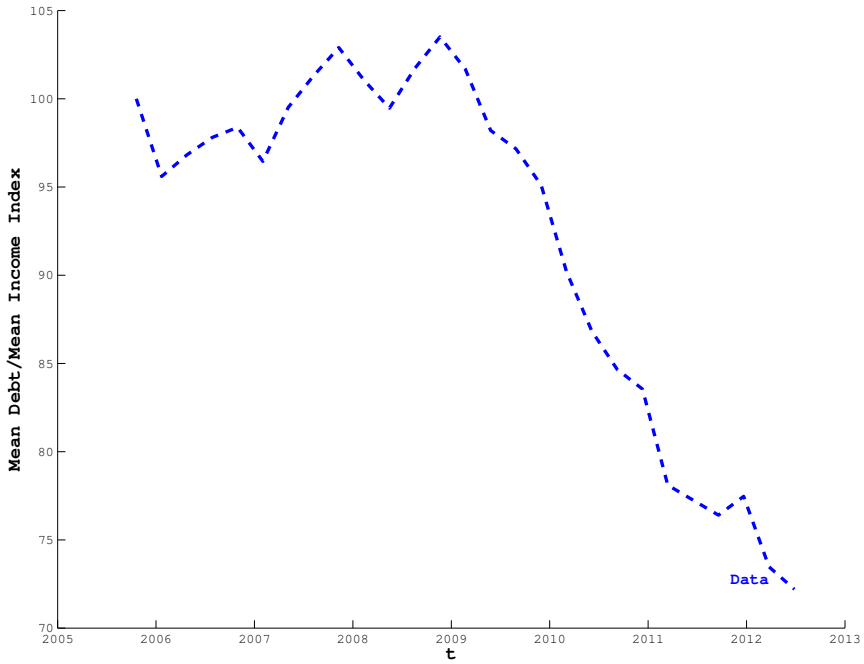
Keywords: Delinquency, Personal Bankruptcy, Unsecured Debt, Job Separation, Job Finding.
JEL Codes: D9, E21, K35

*The views expressed here are solely those of the authors and not necessarily those of the Federal Reserve Banks of Richmond or St. Louis or the Federal Reserve System. Young thanks the Bankard Fund for Political Economy at the University of Virginia for financial support.

1 Introduction

During the Great Recession and in the subsequent recovery, households have defaulted on consumer (non-mortgage) debt at high rates, and have also been widely viewed as "deleveraging" (Mian and Sufi 2011, Eggertson and Krugman 2012, Guerrieri and Lorenzoni 2010). Deleveraging is an interpretation consistent with the largest reduction in the volume of unsecured debt of slightly more than 15 percent ($160 billion in 2013 dollars) in the past several decades.[1] This is seen in Figure 1

Figure 1: Deleveraging

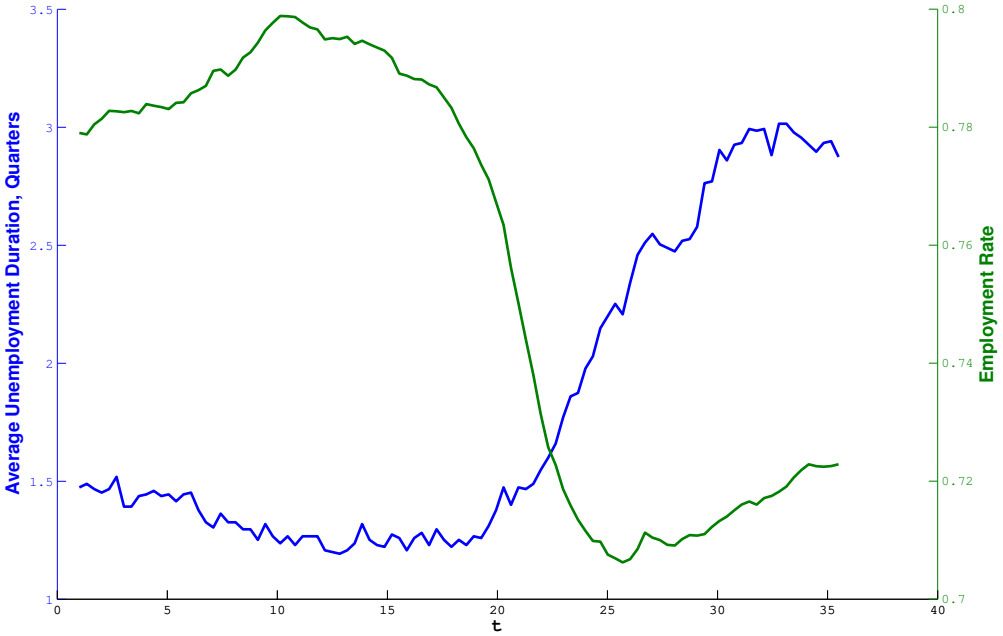


Perhaps the defining characteristic of the Great Recession has been the effect it has had on the labor market experiences of U.S. households. Figure 2 displays the paths taken by two series that convey the increase in volatility experienced by the typical household in an essentially self-explanatory manner.

Lastly, along with household deleveraging and labor market risk, recent years have seen (perhaps naturally) a substantial rise in overall default on unsecured consumer debt. Moreover, the data show a shift in the relative importance of formal bankruptcy and informal "delinquency" as pathways to default. Figure 3 shows how delinquency (measured as a fraction of total consumer

[1] Source: http://www.federalreserve.gov/releases/g19/Current/

Figure 2: Labor Market Upheaval



debt) and bankruptcy rates have evolved over the 8 years. As for default related patterns, an event whose importance we will evaluate is the "The Bankruptcy Abuse Prevention and Consumer Protection Act" (BAPCPA), enacted in late 2005. Importantly, this act altered the relative costs of delinquency and bankruptcy in favor of the former. At an aggregate level, we see from the figure that immediately prior to the enactment of BAPCPA, there was a sharp spike in bankruptcies followed by a sharp collapse. Intuitively, this is related to the advancement of filings prior to the increase in bankruptcy costs by all those close to the margin.

The very large change in labor market risk faced by household during the Great Recession and subsequent recovery, and the immediate precedent of the 2005 bankruptcy reform, together created conflicting forces that certainly complicate any purely empirical analysis of the data described above. This is especially true of any more narrow analysis of the effect of the fairly novel bankruptcy reform. In particular, the relative costliness of delinquency fell as a result of the reform, while the share of households faring poorly in the labor market rose, both of which could, all else equal, be expected to increase default rates while shifting the form of default away from formal bankruptcy. At the same time, those households not experiencing immediate misfortune in the labor market faced stronger incentives to increase their net asset position to deal with greater ambient labor market risk. For some, this would come from lowering debt, i.e., "deleveraging", while for others,

precautionary balances would grow. At the same time, costlier bankruptcy, all else equal, could be expected relax supply-side constraints and encourage household borrowing, just as would the increased proportion of households trying to smooth through labor-market-related misfortune in a recession. As a result, it is entirely possible that deleveraging during the Great Recession might well have been *more* substantial, were bankruptcy reform not enacted shortly prior to it.

In this paper, our aim is to answer the following question: How much did changes in labor market risk (as measured by job separation and finding rates), along with recent bankruptcy reform, alter the paths of bankruptcy, delinquency, loan pricing and unsecured credit use over the Great Recession? In particular, to what extent can these forces help us understand observed deleveraging? In other words, how do the forces of job separation and job finding that yield the paths seen Figure 2 matter for the credit market outcomes seen in Figures 3 and 1?

Recent empirical work suggests that it might well have done so. Morgan (2012) estimates an empirical model of aggregate bankruptcy filings using income and unemployment aggregates. His findings suggest that the filing rate observed after the recession was substantially lower than would have been predicted by the behavior of aggregates alone. In other words, the regime does appear to have changed.[2]

We proceed by extending the life cycle model of Athreya *et al.* (2012) to allow for aggregate fluctuations in labor market risk. The resulting model is novel in being the first, to our knowledge, to allow for bankruptcy, delinquency, and business cycles simultaneously.[3] We first calibrate our model to represent the economy before BAPCPA, corresponding to the year 2004. We then compute the model's predictions for the paths of labor market and credit market variables in response to BAPCPA being announced one period in advance and then enacted, along with the observed movements in hiring and separation rates. To execute the latter experiment, we parameterize the model match the dynamics of employment and unemployment duration by exploiting the mechanical relationship between these objects and the job finding and job separation rates. We then ask what would have happened if BAPCPA had not been implemented

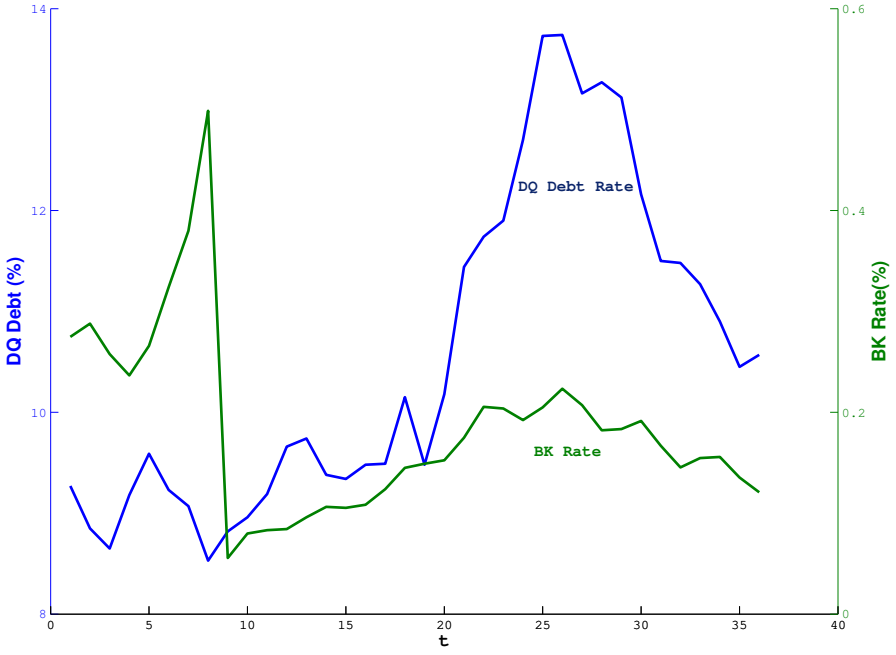
Our model's main implication is that BAPCPA likely prevented a substantial increase in bankruptcy filings, but had only limited effect on the observed path of delinquencies. Thus, the reform appears to have "worked" – in the narrow sense that it did not encourage households to find alternative routes to default and still reduced default overall, given the path of aggregate labor market outcomes. Our results suggest also that the level of defaults would fall in absolute terms if the labor market had not experienced substantial negative shocks over the same time frame.

We then isolate the effect of the two different types of labor market shocks in our model: shocks to the job finding rate, and those to the separation rate. We do this through two counterfactual exercises where we shut off, in turn, variation in either the job offer rate and the separation rate. Our main finding here is that the fluctuations in the separation rate observed over the Great Recession did not significantly affect the dynamics of default; all of the work is done by the large decline in

[2]He also finds that the ratio of Chapter 7 "liquidation" bankruptcies to Chapter 13 "reorganization" bankruptcies reverted very quickly to it's pre-reform levels. This suggests that the reform did not lower chapter 7 bankruptcy–whereby unsecured debts are fully discharged–by merely diverting borrowers into Chapter 13.

[3]Our model of delinquency is related to, but distinct from, the recent model of Benjamin and Mateos-Planas (2012), who focus on steady states, and Gordon (2013) who studies only bankruptcy but with aggregate shocks. Chatterjee and Gordon (2012) also have an alternative debt relief procedure, but it involves voluntary wage garnishment.

Figure 3: Defaults in Credit Market



the job-finding rate. In the absence of declines in hiring, our model suggests that BAPCPA would have produced a persistent decline in bankruptcy filings and no response in delinquency.

The remainder of the paper is organized as follows. In section 2, we present the main model. Section 3 describes the model paramaterization of the steady state. Section 4 explains the main mechanisms at work in the model. Section 5 presents the results for the transition during the Great Recession. Section 6 concludes.

2 Model

Our baseline model starts with our earlier work in Athreya et. al. (2012). The environment features a continuum of finitely lived households who face idiosyncratic risks that they are unable to completely insure. A central aspect of our representation of this risk is that households face both wage and employment uncertainty, and follows recent work of Low, Meghir, and Pistaferri (2010). For the high frequencies (quarterly) over which we aim to understand debt and default dynamics, such a distinction is essential: for short periods, individuals may simply not be able to match with employers (firms), and in these instances, the loss of income may lead them to find delay in payment useful, with longer runs of misfortune leading to formal bankruptcy. Our model

of the labor market also allows for quits as a source of separation.

Households live for a finite number of periods, and are born into the model as adult workers (when they are 22 years old), they work until retirement (age 62), and exit the model with certainty at age 72. Households have access to a risk-free savings instrument, and may borrow. Borrowing confers two options on individuals. First, they may elect, ex-post, to formally repudiate all debt by obtaining a formal discharge in bankruptcy court from all debt obligations. Under formal bankruptcy, filing households must pay a formal cost of filing to reflect use of legal resources, as well as transactions costs associated with diminished access to various forms of payments and short-term credit (such as rental of housing and consumer durables). They also are allowed to face other costs associated with the procedure, potentially including "social stigma" or other penalties. Second, borrowers may simply cease debt payment without receiving a formal discharge. In this case, debtors pay costs, but also have their debts renegotiated to reflect the household's ability to refinance loans with other lenders. In what follows, capital letters are used for functions, lower case letters for variables, and Greek letters for parameters.

2.1 Endowments and Market Arrangement

Each model period represents one quarter of real time. The relatively high frequency of this model creates some problems with respect to tractability, which in turn will lead to impose some simplifications with respect to our model of labor income risk and transitional paths for exogenous variables.[4] However, it is essential to capture the high-frequency risks that agents face, and to not restrict borrowers to durations of debt that are far longer that the duration of time between the receipt of various shocks to labor income. Similarly, with respect to delinquency, it is clear that borrowers have the option to fall behind on debt repayments to an extent that is similar (e.g., "90 days past-due") to durations that are not simply equivalent to permanent default.

Households vary in their formal educational attainment, e, their age a, both of which affect their productivity n when working. Education also affects the likelihood of reemployment when unemployed. To reflect varied match quality between workers and firms, match-specific productivity varies, and is denoted by m. Given these parameters, wages $w(e, a, n, m)$ are given by

$$\ln(w_a(e)) = x_a(e) + n_a + m_a,$$

where x_a is the deterministic age income profile and n_a is a random walk:

$$n_a = n_{a-1} + \zeta_a$$

with $\zeta_a \sim N\left(0, \sigma_\zeta^2(e)\right)$ and $m_a \sim N\left(0, \sigma_m^2(e)\right)$. Workers are matched with firms with productivity that depends on a match-specific component that changes only when the worker changes firm. Note that firms do not differ in their productivity. Rather, workers at any moment in time belong in a particular match that determines (in part) their productivity. New draws of match quality come

[4] Most seriously, storage requirements are intense. Given the life-cycle nature of the model, we must track the decision rules of households throughout their lives. Due to the short length of a period relative to agent lifetimes, we must store a large number of decisions rules (in our setting, agents live for over 200 model periods). And due to the rich set of shocks that affect agents, the cardinality of our state space is very large.

from a normal distribution with mean 0 and variance σ_m^2. To simplify notation we refer simply to (a, n, m) as $(\mathbb{I})$. Households may also suffer shocks that lead to disability in which they permanently cannot supply labor. In this case, they receive transfers that will be specified further below.

Under our specification, disposable earnings of a household of age a, with productivity n, firm-worker match-specific component m, who are not currently obtaining disability insurance are given by

$$\mathbf{y}(\mathbb{I}, p) = p\left(w(\mathbb{I})h\left(1-\tau\right) - F\left(e\right)\right),$$

where h is the fixed number of hours, τ is the proportional tax rate that used to finance all the social programs, and $F(e)$ is the fixed cost of commuting to work. Labor is subject to search frictions, whereby a job offer arrives with probability $\lambda^E(e)$ if the household is employed and $\lambda^N(e)$ if the household is unemployed. When an offer is available, workers decide to work or not, and this decision is denoted by $p = 1$ or $p = 0$, respectively. If a new work opportunity arises, workers decide whether to switch jobs or not. When employed, all worker-firm matches are subject to exogenous separation at rate $\delta(e)$. Additionally, workers can quit (to pursue other employment opportunities, among other things).

There is a social safety net that partially insures workers against the risk of unemployment and the risk of permanent loss of productivity. The former arises from search frictions, and the latter is arises as individuals face the risk of becoming disabled, in which case their productivity falls to zero. Households receive unemployment payments the first period they are unemployed, only if they did not quit, and continue to receive work offers (stochastically); UI benefits are a fraction ϑ of wages up to a maximum cap Ξ. Disability is an absorbing state, and individuals that are eligible decide whether to apply for disability insurance or not. An individual is eligible to apply for disability if he is older than 50 years old, unemployed, and didn't apply for disability the last period – the success rate of applications is given by $\chi \in [0, 1]$, and disability insurance is asset-tested at breakpoints (a_1, a_2, a_3) with declining benefits. Lastly, individuals are eligible receive food stamps, modeled simply as an increment to income, rather than a voucher for a specific consumption good; Γ is the maximum food stamp benefit. We summarize all government transfers by the function $T(\mathbf{y})$.

2.2 Preferences

The period utility function is

$$U(c, p) = \frac{\left(c\exp\left(\varphi p\right)\right)^{1-\gamma}}{1-\gamma}.$$

where $c \in \mathbb{R}_+$ stands for consumption. $\varphi < 0$ captures the disutility of labor supply. Households have a constant discount factor $\beta < 1$ and $\gamma \geq 0$ is the coefficient of relative risk aversion. Households of age a survive to age $j+1$ with probability $\varsigma(e, j)$.

2.3 Value Functions

Let $l \in \{U, O, H\}$ denote the current labor market status of a household. The value function of a household that is unemployed $(l = U)$, or does have a job offer $(l = O)$, or is currently in disability insurance $(l = H)$ is

$$V^l(b,\mathbb{I},u,s) = \max\left\{\underbrace{B^l(b,\mathbb{I},u,s)}_{\text{bankruptcy}}, \underbrace{D^l(b,\mathbb{I},u,s)}_{\text{delinquency}}, \underbrace{P^l(b,\mathbb{I},u,s)}_{\text{solvency}}\right\}.$$

First, we present the case in which the household files for bankruptcy. The function $B^O(a,n,m)$ is the value of lifetime utility for a household with a job offer from a firm with match-specific component m, whose age is a years old, has productivity n, and that files for bankruptcy.

$$B^O(a,n,m) = \max_p U\left(\mathbf{y}(\mathbb{I},1) + T(\mathbf{y}) - \Delta\left(1\right),1\right) - \psi_B + \beta\mathbb{E}\left[V^{l'}(0,a+1,n',m',p,0)|l,n,p\right]$$

The first part on the right hand side is the period utility. The first term inside the utility function is current consumption, which in this case is simply income plus transfers minus the cost of filing $\Delta\left(e\right)$ (which depends on employment status as some costs can be waived). The second term in the utility function equals 0, if the household chooses not to work, and 1, if the household works. The second cost of bankruptcy on the right hand side is ψ_B will be set to reflect all other costs through a single nonpecuniary term. The last part on the right hand side is the expected discounted utility from the next period. In this case the expectation is over (n',l',m'). The expectation over the next period productivity is conditional on this period productivity because there is persistence in productivity. The expectation on the next period labor status is conditional on this period status l and p because households that work this period are more likely to have an offer the next period than unemployed households. Finally, the expectation is also over m' because workers receive an offer with probability $\lambda^E\left(e\right)$ from other firms with match-specific component m'. Importantly, notice that in case of filing for bankruptcy the household starts next period with zero debt.

The function $B^U(a,n,u,s)$ is the value of lifetime utility for a household filing for bankruptcy without a job, whose age is a years old, productivity is n, and has flags representing eligibility for unemployment insurance and disability insurance u and s, respectively.

$$B^U(a,n,u,s) = \max_d U\left(UI(\mathbb{I})u + T(UI) - \Delta\left(0\right),0\right) - \psi_B + \beta\mathbb{E}\left[V^{l'}(0,a+1,n',0,s(1-d))|l,n,0,sd\right]$$

Notice that the income of this household comes from food stamps T, and unemployment insurance UI only if $u=1$. The last part in the right hand side represents the expected discounted lifetime utility from the next period. The expectation is taken over (n',l',m'). Importantly, the expectation over the labor status next period l' is conditional on $s \times d$. This is the case because households that are eligible to apply for disability insurance, $s=1$ that decides to apply, $d=1$, may enter the disability status H from tomorrow or stay unemployed, in which case $s' = s(1-d) = 0$; while households that are not eligible $s=0$ or decide not to apply $d=0$ can be either get a job offer, with probability λ^U, or stayed unemployed. Notice that both households that receive unemployment payments this period, $u=1$, and those that are not eligible this period, $u=0$, will not be eligible the next period, $u'=0$, because unemployment insurance payments are available only for one period. Again in this case, because the household files for bankruptcy, we have that $b'=0$.

The last possible labor market status for a household filing bankruptcy is being in disability insurance. The function $B^H(a,n)$ represents the value of lifetime utility for a household filing for

bankruptcy that is in disability insurance with productivity u and age a.

$$B^H(a,n) = U\left(DB(\mathbb{I}) + T(DB) - \Delta\left(0\right), 0\right) - \psi_B + \beta V^H(0, a+1, n)$$

In this case the household receives disability payments DB and food stamps T. The discounted lifetime utility from tomorrow and on is very simple: disability is an absorbing state and the income will be constant forever. As in the previous cases, since the household files for bankruptcy we have that $b' = 0$.

For the cases of credit status equal to delinquency (D) and solvency (S) the transitions regarding the labor market are exactly the same as in the case of bankruptcy. Thus, we will explain only the part that has to do with the credit status. Further, to simplify notation, hereafter we do not explicitly write the variables that are used to condition in the expectation.

The three possible labor market status (O, U, H) for the case of delinquency are presented below.

$$D^O(a,n,m) = \max_p U\left(\mathbf{y}(\mathbb{I},p)(1-p\eta) + T(\mathbf{y}), p\right) - \psi_D + \beta \mathbb{E} V^{l'}(h^O(\mathbb{I}), a+1, n', m', p, 0)$$

$$D^U(a,n,u,s) = \max_d U\left(UI(\mathbb{I})u + T(UI), 0\right) - \psi_D + \beta \mathbb{E} V^{l'}(h^U(\mathbb{I},u,s,d), a+1, n', 0, s(1-d))$$

$$D^H(a,n) = U\left(DB(\mathbb{I}) + T(DB), 0\right) - \psi_D + \beta V^H(h^H(a,n), a+1, n)$$

Notice that there are only three differences with the case of bankruptcy. First, instead of a fixed cost of filing, there is a fraction of income that is garnished, η, only in the case in which the household works. The second difference is that the utility cost of delinquency is ψ_D. Finally, notice that in this case the households start the next period with debt $b' = h$. The household takes the function h as given. In the section that describes the credit market we explain how it is determined.

Finally, we present the value functions for a household that decides to make his debt payments. The key difference with the previous case is that the current stock of debt, b, is also a state variable, and households choose the next period debt, b':

$$P^O(b,a,n,m) = \max_{p,b'} U\left(\mathbf{y}(\mathbb{I},p) + T(\mathbf{y}) + b - b' q^E(b',\mathbb{I}), p\right) + \beta \mathbb{E} V^{l'}(b', m', p, 0)$$

$$P^U(b,a,n,u,s) = \max_{d,b'} U\left(UI(\mathbb{I})u + T(UI) + b - b' q^U(b',\mathbb{I},u,s,d), 0\right) + \beta \mathbb{E} V^{l'}(b'', 0, s(1-d))$$

$$P^H(b,a,n) = \max_{b'} U\left(DB(\mathbb{I}) + T(DB) + b - b' q^H(b',\mathbb{I}), 0\right) + \beta V^H(b', a+1, n)$$

The key difference in this case is that the consumption today has an extra term, $b - b' q^l(b', \mathbb{I})$, that represents that extra funds available after repaying the debt, b, and borrowing b'. In the next period, this household will have debt obligations b'.

Before presenting the pricing in credit market, it is useful to define the policy functions describing the households decision regarding repayment of obligations. Let $\mathbf{1}^{l,m}(b, \mathbb{I}, u, s)$ be a policy function that is 1 if the household in state $l \in O, U, H$ make repayment decision $m \in P, B, D$, and zero otherwise.

2.4 Loan pricing

Pricing of credit in this model arises from the condition that lenders earn zero expected profits on any loan. Households issue one-period bonds with face value b, and may decide next period hence whether to (i) repay the loan as promised, (ii) file for bankruptcy and obtain a discharge from debt, or (iii) refuse to pay and have the new face value of debt reset according to the rule $b^H(b, \mathbb{I})$, as explained below.

The price function in the case of saving, $b \geq 0$, is given by

$$q\left(b', \mathbb{I}\right) = \frac{\varsigma\left(e, j\right)}{1+r}, \tag{1}$$

where r is the risk-free rate. However, when households borrow, $b < 0$, the price function will be the solution to a functional equation. In particular, this function will solve

$$q\left(b', \mathbb{I}\right) = \varsigma\left(e, j\right) \frac{\mathbb{E}[Q_{pay} + Q_{dq}]}{1+r+\phi}, \tag{2}$$

where ϕ is a transaction cost of intermediation that applies only to borrowing, and

$$Q_{pay} = \mathbf{1}^{O,P}(b', \mathbb{I}', u', s') + \mathbf{1}^{U,P}(b', \mathbb{I}', u', s') + \mathbf{1}^{H,P}(b', \mathbb{I}', u', s')$$

$$\begin{aligned} Q_{dq} = & \frac{\mathbf{1}^{O,D}(b', \mathbb{I}', u', s')}{b'} \left(q^O\left(b^O\left(b', \mathbb{I}'\right), \mathbb{I}', u', s'\right) b^O\left(b', \mathbb{I}'\right) + \eta \mathbf{y}(\mathbb{I})\right) + \\ & \frac{\mathbf{1}^{U,D}(b', \mathbb{I}', u', s')}{b'} q^U\left(b^U\left(b', \mathbb{I}'\right), \mathbb{I}', u', s'\right)\right) b^U\left(b', \mathbb{I}'\right) + \\ & \frac{\mathbf{1}^{H,D}(b', \mathbb{I}', u', s')}{b'} q^H\left(b^H\left(b', \mathbb{I}'\right), \mathbb{I}', u', s'\right)\right) b^H\left(b', \mathbb{I}'\right). \end{aligned}$$

Next period the lender recovers one good in each state $\mathbb{I}'$ in which the borrower chooses to repay (the first term). The last term collects the states tomorrow in which the borrower goes delinquent and is not working tomorrow; the lender adjusts the existing debt to $b^H\left(b', \mathbb{I}\right)$ and values it at the market price $q\left(b^H\left(b', \mathbb{I}\right), \mathbb{I}'\right)$. The second term describes the value of the contract in states in which the borrower goes delinquent tomorrow and is working ($p\left(\mathbb{I}'\right) = 1$), permitting additional resources to be recovered through wage garnishment. States in which the household goes bankrupt are not included, because the lender receives nothing in those states.

As in Athreya *et al.* (2013), lenders optimize, and therefore adjust the existing debt to maximize the value of expected repayments:

$$b^l\left(\mathbb{I}\right) = \underset{h}{\operatorname{argmax}} \left\{q^l\left(h, \mathbb{I}\right) h\right\}; \tag{3}$$

as h increases q decreases (since the probability of a bankruptcy or continued delinquency increases), so the lender is trading off the face value of the debt for the likelihood of repayment (reflected in q). Athreya *et al.* (2013) contains a brief discussion how the absence of commitment to terms would lead lenders to always adjust debt according to (3).

3 Calibration, Steady State

Our baseline model parameters are given below in Tables 1, 2, and 3. Table 1 flows from Low, Meghir and Pistaferri (2010) and collects parameters that are assigned directly–i.e., they are not calibrated to help us match any target. Because our model differs in terms of the credit market from their model, the implied path of labor market variables will not coincide exactly with those obtained in that paper, but it turns out that the differences are minor.

Table 1

		High Edu.	Low Edu.
Education distribution	Υ	0.568	0.432
Std. deviation of permanent shock	σ_ζ	0.106	0.095
Std. deviation of firm-worker shock	σ_m	0.229	0.226
Job separation rate	δ	0.023	0.040
Job arrival rate in unemployment	λ^N	0.709	0.657
Job arrival rate in employment	λ^E	0.623	0.579
Fixed cost of work	F	$\$1,213$	$\$1,088$
Disutility of working	φ	-0.620	-0.550
Total hours of work	h	500	500
UI replacement ratio	ϑ	0.750	0.750
UI cap	Ξ	$\$2,384$	$\$2,384$
DI application success rate	χ	0.500	0.500
Maximum food stamp	Γ	\$800	\$800
DI threshold 1	a_1	$\$1,203$	$\$1,203$
DI threshold 2	a_2	$\$7,260$	$\$7,260$
DI threshold 3	a_3	$\$16,638$	$\$16,638$

Tables 2 gathers non-calibrated parameters central to default and borrowing, such as the risk-free interest rate, transactions cost of finance, and the direct costs of bankruptcy (fees, etc.). These correspond to standard values in the literature–a risk-free savings rate of 1.5 percent when annualized, and a transactions costs that is approximately 3 percent annually as measured by Evans and Schmalensee (1998), for example.

Table 2

Risk-free interest rate	r	0.375%
Lending cost	ϕ	0.75%
BK filing fee for $p = 1$	Δ	$\$1,200$
BK filing fee for $p = 0$	Δ	\$600
Risk aversion	γ	2.0

As noted previously, we allow the filing fee to depend on employment status because it is possible for households to avoid paying some fees during filing (such as filing *pro se* or receiving *pro bono* legal aid), while other fees can be waived for need.

Table 3 collects the three parameters that are calibrated in the model, and Table 4 lists the main calibration targets.

Table 3

Discount factor	β	0.957
Non-pecuniary cost | BK	ψ_B	1.786
Non-pecuniary cost | DQ	ψ_D	0.104

Overall, the model does well, and because of our use of the detailed wage and social insurance setting of Low, Meghir and Pistaferri (2010), we are assured that the model represents risks and safety nets in a comprehensive manner as well. We note though that defaulters are older at the median than in our model, and that a larger proportion of households borrow in the model relative to the data. We also note that, in utility terms, bankruptcy is more costly than delinquency; as noted in our other work, this condition is necessary for both types of default to coexist in equilibrium because delinquency generates a smaller continuation value. Of course, the household will pay the cost ψ_D every period of delinquency, rather than only once as with ψ_B, so the expected duration of delinquency matters for determining which option is ultimately more costly.

Table 4: Data and Simulated Moments

	Data	Model
Share of debt in 90+ DQ, %	8.9	7.8
Bankruptcy rate, %	0.26	0.26
Mean (assets/income)	4.07	3.09

4 Understanding delinquency and bankruptcy decisions

To understand behavior in the transitions of interest, we first describe decision rules. For convenience of exposition, we show results for the various realizations of the match quality shock m–but the results are essentially identical when using the other wage shock in the model, n. We begin with by comparing three agents, all of whom are 33 years old, and all of whom have high education. This is shown in the three panels that comprise the left-hand column of Figure 4. A first point is that this type of borrower, if they have high match-specific quality ($m = m_{hi}$) finds bankruptcy better than delinquency in the sense that she transitions to it without passing through delinquency. This is shown by the dashed red line. To understand the decision of a borrower with respect to repayment, though, it is essential to know the relative benefits associated with repayment, delinquency and bankruptcy. We therefore first examine, in the middle panel, the implied interest rate arising from a delinquency. If the renegotiated amount h is smaller than the initially-owed face value of debt, this rate is negative, and reflects debt forgiveness. If h is bigger than b, lenders have imposed a "penalty" rate on the debt. As is clear, for low debts, irrespective of the wage shock, we see that delinquency generates a penalty rate of interest. Moreover, while debt forgiveness occurs only when debts are larger, it too occurs most when households are in bad shape with respect to income. The

figure shows clearly that the amount of debt forgiven rises as the m shock gets worse. In essence, borrowers with poor future income prospects get better deals out of delinquency: it is the lender's best response given the an income-poor borrower's retention of the option of bankruptcy–in which the unsecured lender would receive nothing at all.

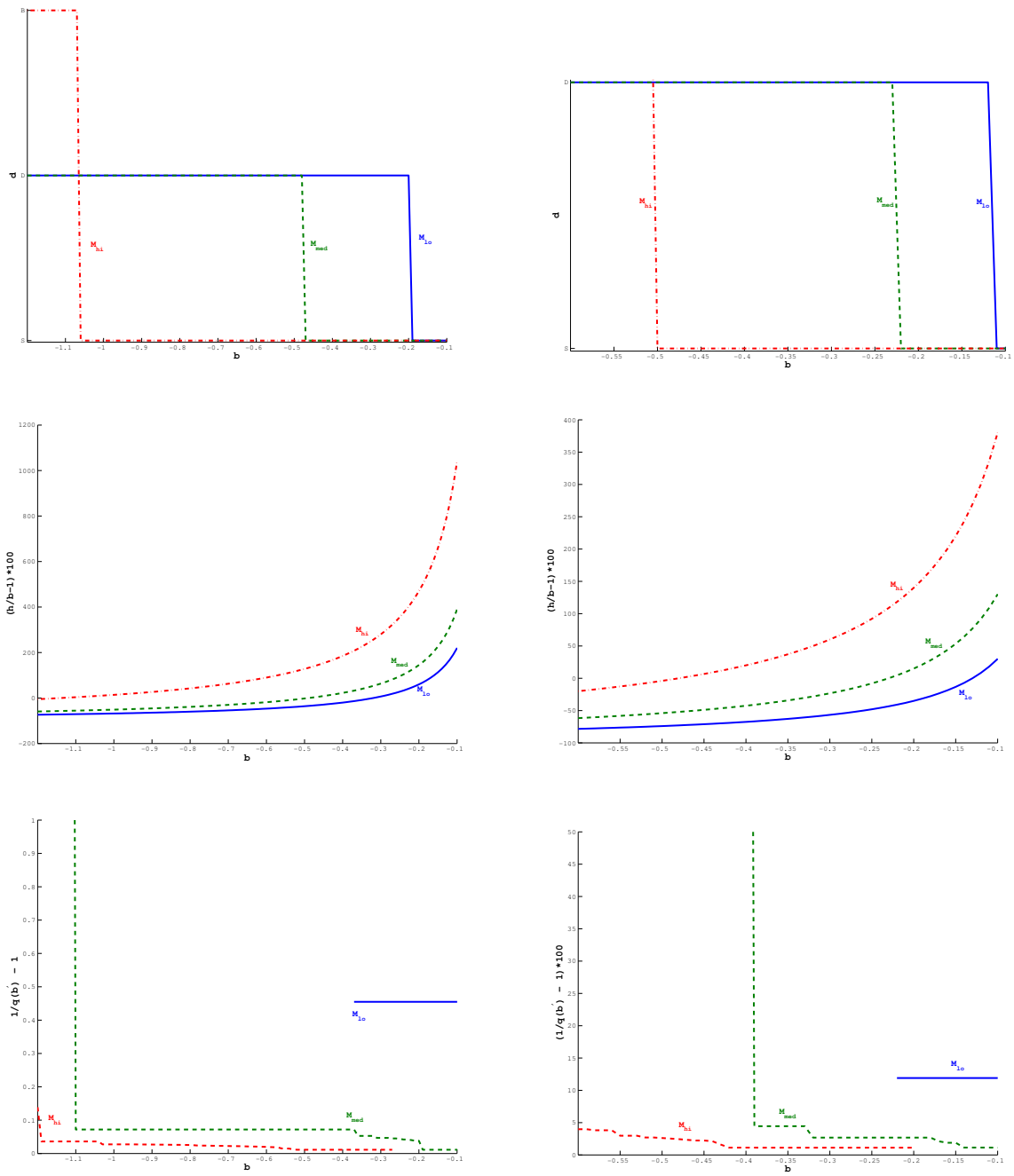
Thus far, we have spelled out the terms in delinquency for all debt levels. But in order to make a decision on repayment, borrowers must compare this with the terms they would receive if they simply tried to roll over the debt instead of invoking either bankruptcy or delinquency. The bottom panel of Figure 4 displays the interest rates required to roll over current debt. In general, we see that the interest rises with the face value of debt that is due. However, notice the terms offered to the agent with the low m shock. She is offered a constant rate to a point (roughly -0.4 units), after which she will prefer to use delinquency–since it also yields debt forgiveness. She does not immediately invoke delinquency because it carries costs–which is why when the blue line in the middle panel intersects the x-axis at a debt level smaller than where the borrower chooses delinquency (see top panel).

We know from the top panel that delinquency is also not chosen by the borrower with a good wage, i.e., someone whose m=m_{hi}. For this type of borrower, we see from the middle panel that the terms arising from delinquency are not ideal–offering essentially no debt forgiveness, and instead saddling him with a penalty rate of interest for virtually all debt levels. Of course, the fact that this borrower is enjoying good fortune in the labor market makes refinancing debt cheap–as shown by the dashed red line in the bottom panel of Figure 4. This is why this agent repays debts, and then directly transitions to bankruptcy without ever passing through delinquency. By contrast, for an agent doing poorly in the current period, and for debt levels in excess of a given amount (in this case, roughly =-0.4 units), there is no face value that the borrower can issue that, once lenders have appropriately discounted the debt, yields a flow of resources into the current period sufficient to roll over the debt. This is why the blue line in the bottom-left (and right) panels end. The model therefore implies that whether delinquency precedes bankruptcy or not depends on the path of shocks rather than simply being an intermediate step used by all who eventually repudiate debt through bankruptcy.

By comparison to the well-educated borrower, the more poorly educated borrower, seen in the right top panel of Figure 4, *never* invokes bankruptcy, choosing always to instead obtain debt relief via delinquency. This difference in default behavior is driven by the relatively better renegotiation all agents, irrespective of their current match quality m, get in delinquency. After all, for any given vector of productivity shocks (m, n), a borrower with low education faces both lower future income, and lower explicit costs of formal bankruptcy. In order to compare the payoff to delinquency, compare the two panels in middle row of Figure 4 with each other. We see on the right-hand side that when educational attainment is low, even a high m borrower receives debt forgiveness via delinquency, and enough so that they do not use bankruptcy even at debt levels that are much higher relative to their income than for their well-educated counterparts. Their well-educated counterpart, seen on the left-hand side panel, receives far less benefit from delaying repayments.

While we have shown how the forces that govern income (educational attainment, and the shocks m and n) alter debt and repayment decisions in clear ways, it is useful to document the

Figure 4: Understanding the decision between BK and DQ (high (left) and low (right) edu, age 33)



borrowing and repayment decisions in terms of the more standard labor market indicators of short- and long-term unemployment. Figure 5 takes a representative case where borrowers are of age 33 and have high education. First of all, we see that by virtue of their relatively high income, such households do not find default attractive unless they have substantial debts. We see also that a job separation occurring in the current period (the blue line) would yield more debt relief than term unemployment in delinquency. However, for most debt levels, delinquency is not chosen by this set of borrowers. This is because the transition to unemployment in a given period tends to be relatively short term and does not diminish expectations of future income at the outset. At high debt levels, however, the disruption to income tends to lead to bankruptcy as agents find themselves facing high costs of rolling over debts (see the blue line in the bottom panel). By contrast, longer-term unemployed agents find rolling over to become expensive, and then impossible, and hence seek shelter in delinquency at relatively lower debt levels (compare the lines on the top panel of Figure 5), even though the terms they receive in delinquency are worse than an identically placed agent would receive if they had just entered unemployment. In other words, the costs of either form of default are not with paying for most of those experiencing their first period of job separation, even when they would obtain more relief via delinquency than their longer-term unemployed counterpart.

5 The Great Recession

Our goal is to learn about how recent bankruptcy reform and labor market dynamics during the Great Recession influenced consumer credit markets, particularly outcomes related to deleveraging and default via delinquency and bankruptcy. Having described equilibrium steady-state dynamics, we therefore turn next to the transitional dynamics arising from the change in bankruptcy law in 2005 and the subsequent changes in labor market risks faced by households as the Great Recession took hold.

5.1 Calibration, Transitions

To proceed, we will compare the path of the economy under two assumptions – first, that the cost of bankruptcy remain at their pre-BAPCPA level, and second, that they jump to their post-BAPCPA level. Specifically, in line with a variety of estimates (e.g. Morgan (2012)), we increase the filing fee by 50 percent for both employed and unemployed filers.

In both cases, we need to confront individual borrowers with labor market conditions that reflect observed changes in separation and job finding rates under the post-BAPCPA policy environment, generate paths for debt and default, compare these paths to the ones coming from households experiencing the same paths for job separation and finding in the pre-BAPCPA era. The latter is the counterfactual exercise necessary to determine the role played by the reform in the Great Recession.

Recall that we calibrated our model to match the steady state of the model to the US labor market and credit market in 2004. Our strategy is to then announce the passage of BAPCPA in the last quarter of 2005, and it becomes law in the first quarter of 2006. This allows for a single quarter in which the reform is (perfectly) anticipated, and as a result, affects both the terms on

Figure 5: Understanding the decision between BK and DQ (high edu, age 33)

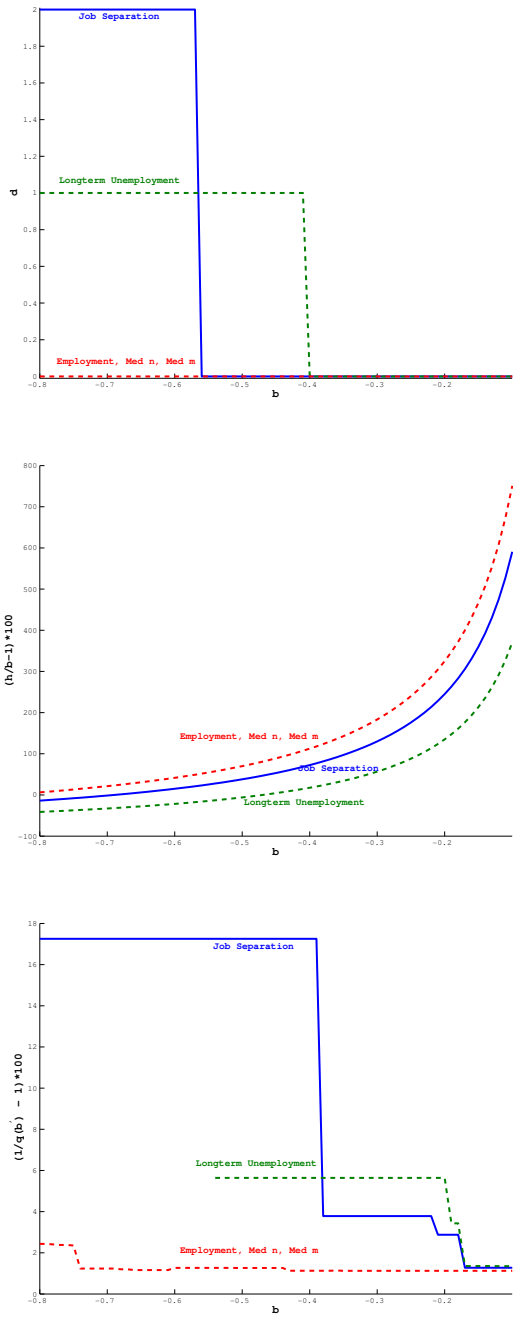
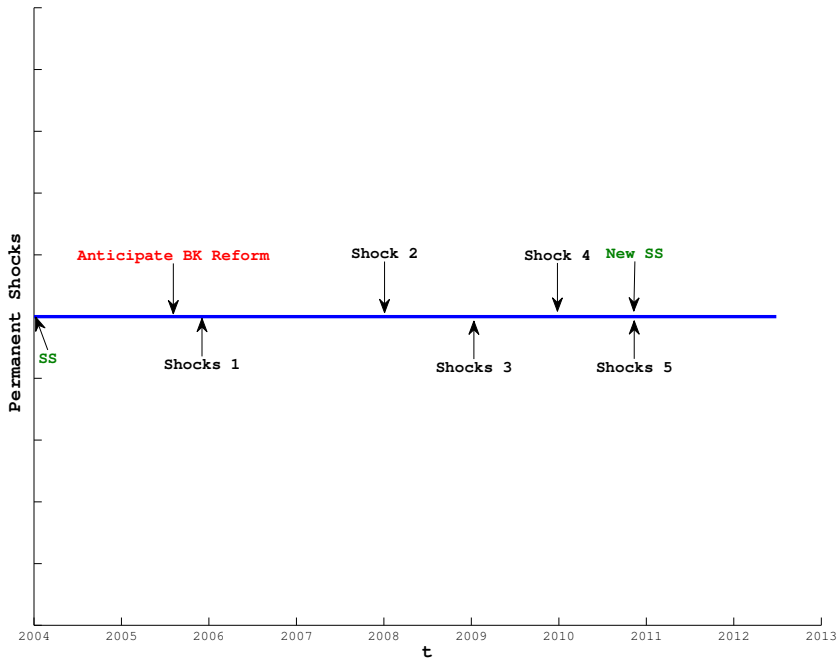


Figure 6: Timeline for Simulating the Great Recession



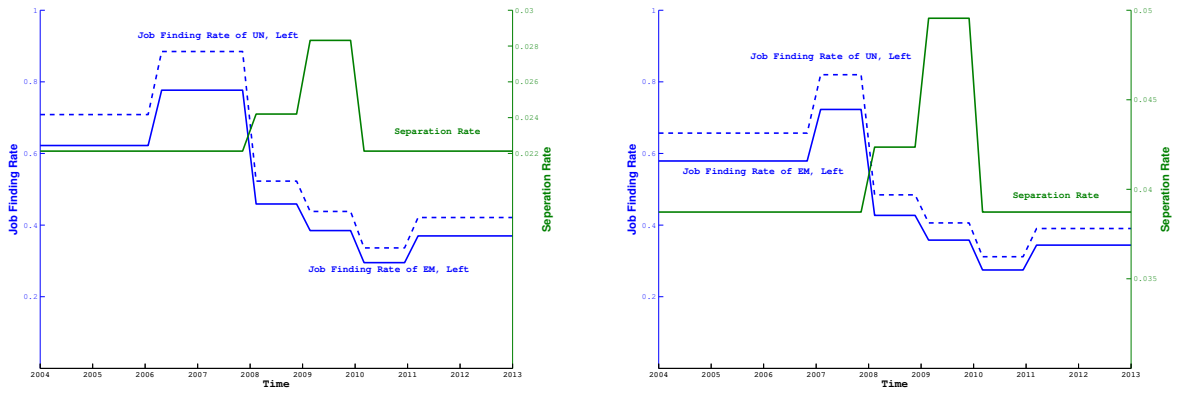
which credit is available, as well as the readiness of those entering this period with significant debt to use bankruptcy over delinquency to default in advance of the change. We then hit the labor market with education-specific shocks to their job finding rate, λ^E, λ^N), as well as to the overall common rate of job destruction, δ. We approximate the time path with a step function that changes five times, at the dates specified in Figure (6).

Figures (7) show the exact paths we choose.

We shut off the shocks in 2011 and permit it to converge to the new steady state (which, due to the assumption of individualized pricing, happens almost immediately).

Households are assumed to believe that all changes are permanent, so that we capture the idea that individuals did not know in advance that unemployment dynamics were going to be different going forward. Solving the model with a stochastic process for the aggregate state is infeasible due to the size of the decision rules (the model now comes close to hitting the memory limits of 64-bit addressing, given the heterogeneity and large number of ages–recall that the model is quarterly–of borrowers)), so the computational justification is simply one of practicality. Substantively, however, results in Athreya *et al.* (2012) show that delinquency is a preferred default option given a transitory decline in income (such as an unemployment shock), while bankruptcy is optimal in response to permanent shocks to wages. Given that it is unlikely that households at the onset of the Great Recession knew their unemployment spells were going to be much longer going forward, this is

Figure 7: Shocks for High (left) and Low (right) Education Type



likely to provide a reasonable approximation.

5.2 Results

To repeat, the way we proceed is to hit the economy with shocks to both job finding and job separation rates. Recall that we assume that at each date that these shocks occur, they are unanticipated, and are expected to be permanent. Recall also that we allow job finding rates to vary with educational attainment, which helps us capture the substantially different labor market experiences of the skilled and unskilled over the period in question.

Feeding the shock processes from Figures (7) into the model, we first simulate the labor market implications of the Great Recession. Figure (8) shows that the model closely matches the large rise in the duration of unemployment observed in the data, which transits from a pre-recession average of 1.5 quarters to a peak of 2.8 quarters.

Figure (9) shows that we also do a reasonable job matching the employment rate; the discrepancies are partly due to the fact that we take the initial calibration to be that from Low, Meghir, and Pistaferri (2010) who are trying to match long-run averages and not the unemployment rate in 2004.

While we can alter the parameters to get this number exactly, the quantitative results of the model would not differ substantially from what we report here. We do capture the large decline in employment, however, although the decline in the model is somewhat smaller than that in the data.

5.2.1 Aggregate Default

Figures (10) and (11) are the key predictions from the model – the dynamics of default during the Great Recession. Looking first at bankruptcy, our model captures the spike in filings driven by the announcement of BAPCPA one period before enactment. We also get a reasonable match to

Figure 8: Average Unemployment Duration

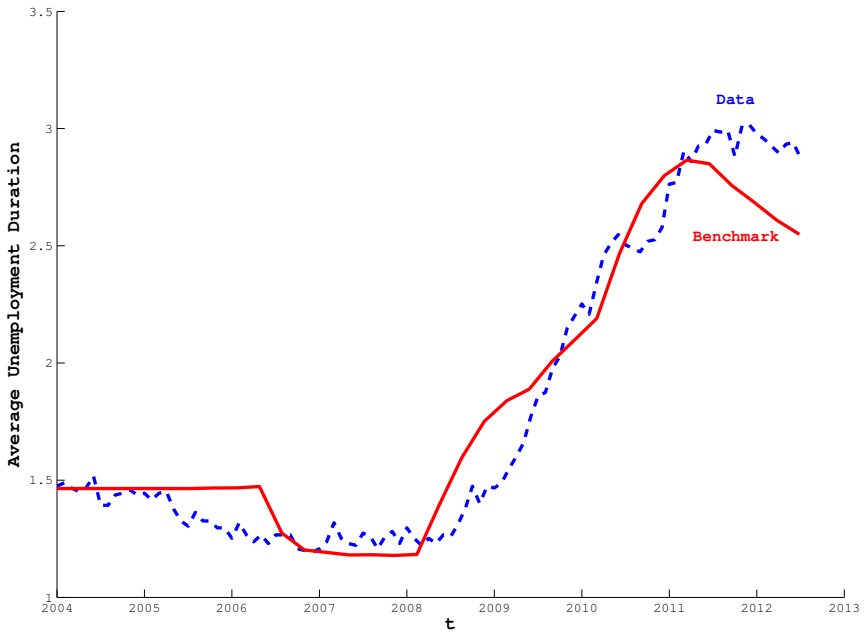


Figure 9: Employment Rate

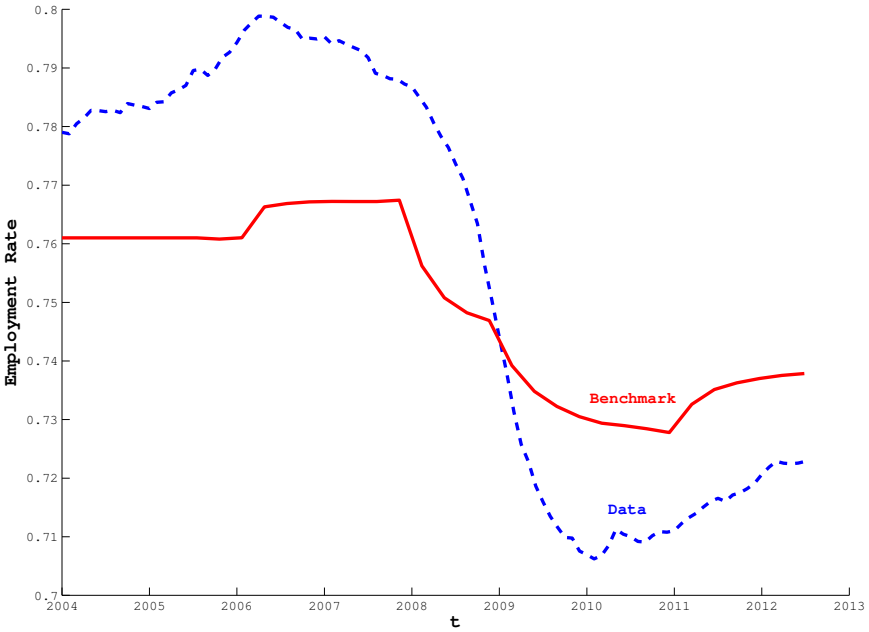
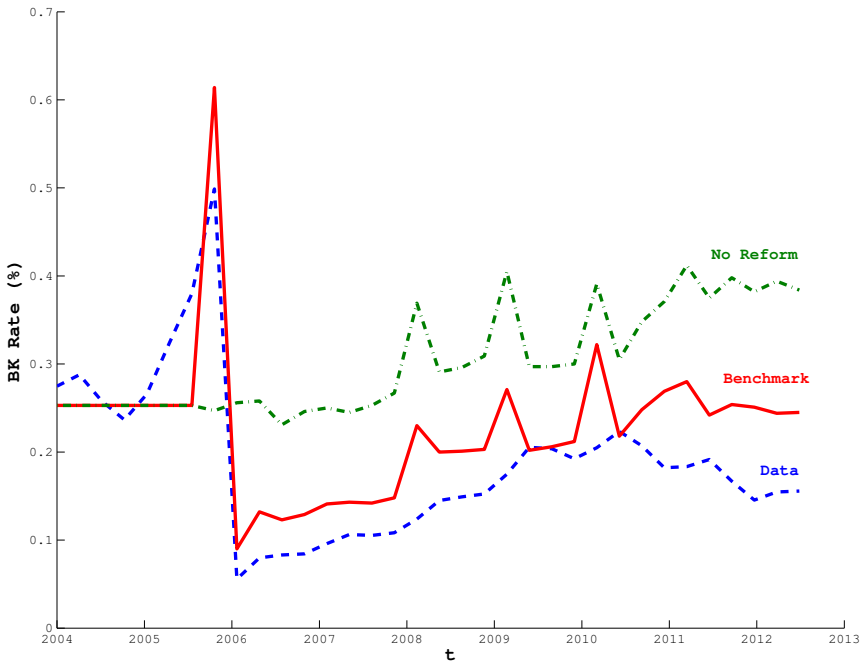


Figure 10: Percentage of Households Filing for Bankruptcy



the subsequent drop and recovery, although the model predicts a persistently higher-than-observed filing rate.

Turning to delinquency, our model matches the data quite well except for the large downward spike in debt in delinquency observed in the last quarter of 2005, coincident with the spike in filings. Mechanically, our model must produce such a spike, since households who have been holding delinquent debt suddenly discharged it through bankruptcy. We suspect that the absence of this spike in the data reflects a discrepancy with how delinquent debt is measured in the data, as it is likely that most if not all of the debt eliminated during the surge in bankruptcy filings was at least 90 days in arrears. Each figure contains a third series, aimed at isolating the effect of the bankruptcy reform. We see that BAPCPA reduced bankruptcy filings during the Great Recession by roughly 15 basis points; we would have observed a slight increase in filings in the absence of the reform over the Great Recession rather than the return to pre-reform levels.

Surprisingly, the model suggests that delinquency should have been almost completely unaffected by the reform. In other words, while BAPCPA did reduce bankruptcies it did not encourage more informal defaults significantly.[5] To better understand the path of delinquency Figure 12

[5]Unfortunately, we cannot assess the importance of our assumption that agents believe the shocks are permanent. We suspect that this assumption is crucial, but as we argued before we also strongly believe it is reasonable given the unprecedented change in unemployment durations.

Figure 11: Percentage of Debt in Delinquency

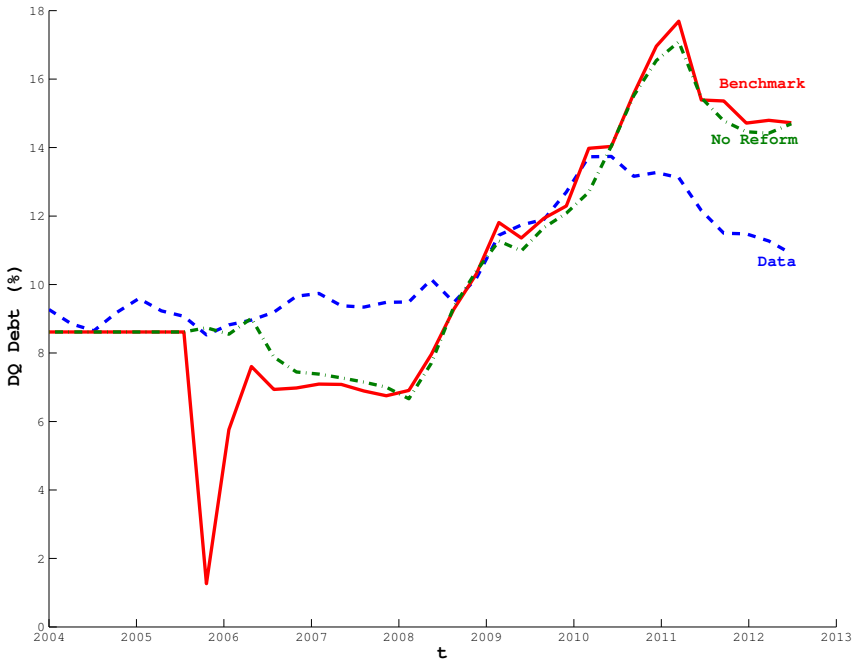
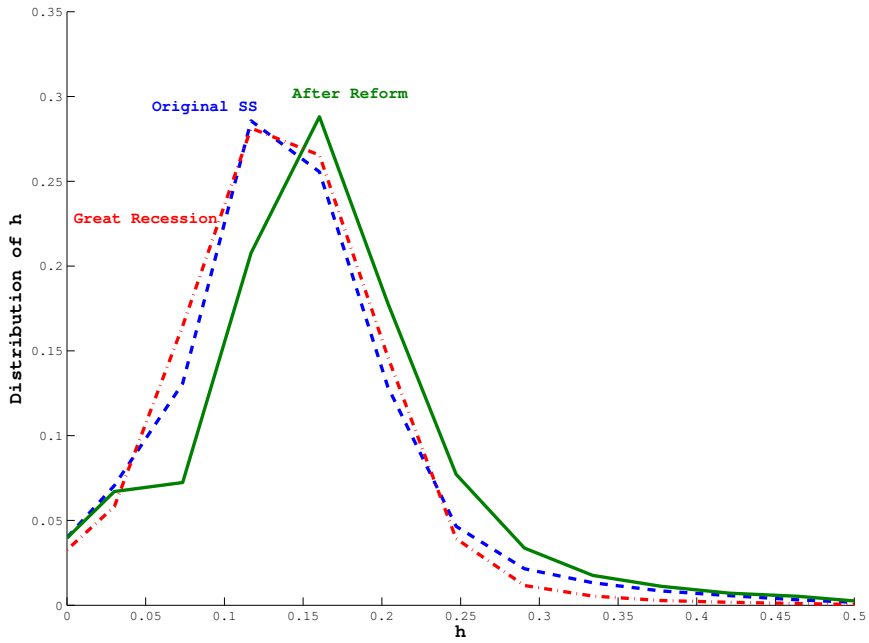


Figure 12: Density of the face value of debt for delinquent borrower



shows how the density of outcomes for the face value of debt for a borrower who enters delinquency changes with the labor market. The main effect of the reform was to shift rightward the distribution of these values: delinquency became a worse deal for borrowers immediately upon announcement of BAPCPA. However, once labor market conditions began to deteriorate in 2008 and 2009, we see that the density shifts back nearly to its original place. In other words, the growth of the set of borrowers who expected low future income dominated the ability of lenders to drive households to less generous debt forgiveness in delinquency. This suggests that, absent the reform, delinquency rates might well have risen given labor market outcomes.

Our next step is to isolate the role of the shocks to the labor market at generating the dynamics of default. Figures (13) and (14) show the effect of shutting down either the shocks to hiring or separation. It is clear from the figures that the job-finding rate shocks $\left(\lambda^E, \lambda^N\right)$ are doing most of the work – shutting off the shocks to δ has little quantitative effect on the model's predictions, while shutting of the firing rate shocks would essentially have eliminated the Great Recession entirely. In addition, default rates would have also remained flat – without the Great Recession our model says that the reform would have been successful at reducing not only bankruptcy rates but default rates overall, and would have done so permanently (Chatterjee *et al.* 2007 also study the BAPCPA reform and conclude that it would have reduced default, but their model lacks an informal option, as does Gordon 2013).

Figure 13: Percentage of Households Filing for Bankruptcy

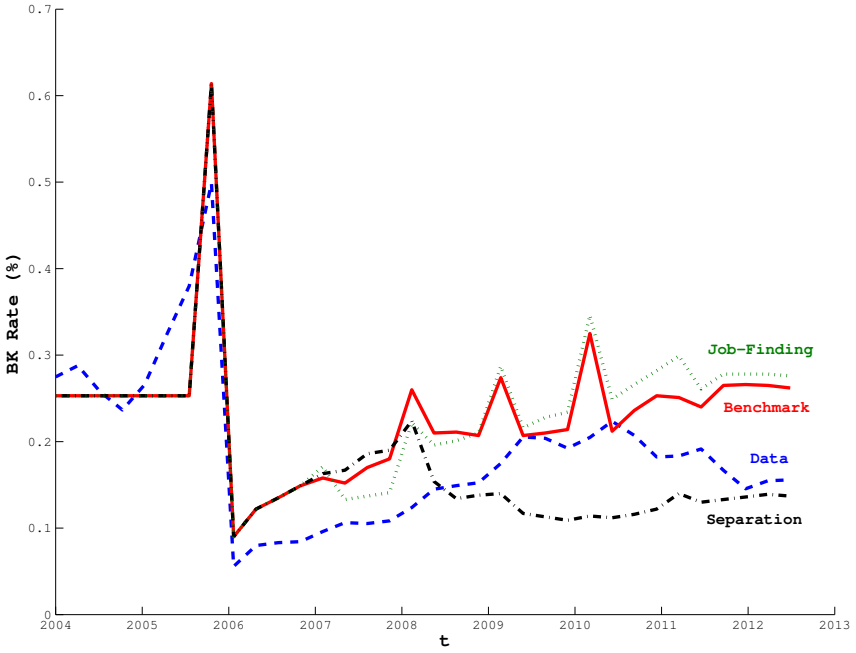
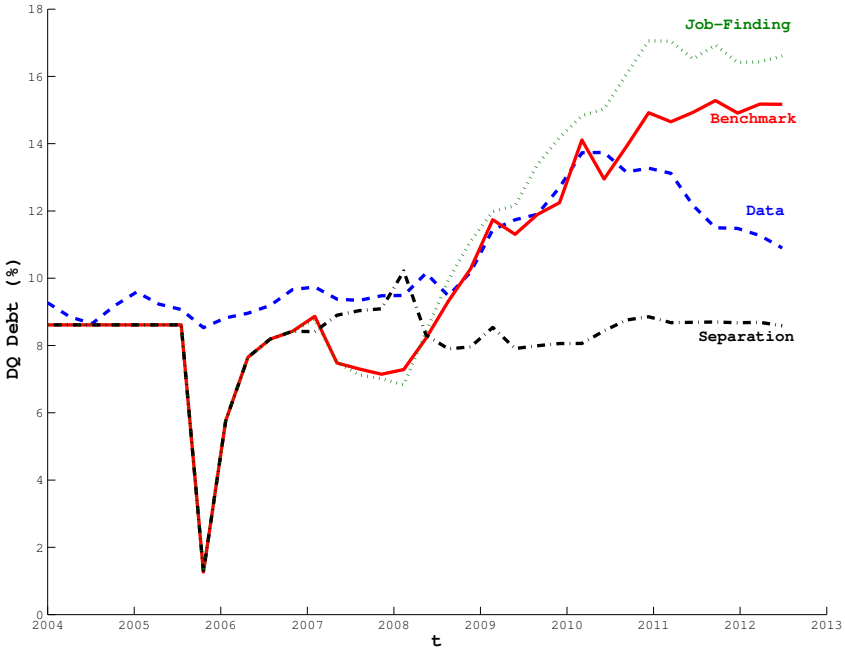


Figure 14: Percentage of Debt in Delinquency



5.2.2 Deleveraging in the Great Recession

At the outset, we noted that the recent recession was associated with the first sustained drop in the absolute level of aggregate unsecured debt holdings in US history (at least since the time series has been recorded). Aside from mortgage debt, it is this form of debt that experienced a dramatic fall of roughly 15%. By contrast, other forms of debt, such as installment credit, remained flat, while student loan debt grew very substantially. Unsecured credit has a special role to play given its availability to those lacking collateral to obtain cheap financing. It is also the main form of credit for younger households, and appears to be an important instrument for smoothing unemployment-related shocks (Sullivan 2006). The fact that the use of this form of credit declined so sharply at a time when the consumption smoothing needs of millions of households rose, and when many had lost substantial capacity to borrow against their owner-occupied homes (via home equity loans), is noteworthy for its implications for consumption smoothing and welfare. So we now address the question of what role BAPCPA and labor market conditions played in determining the terms and use of unsecured debt, with a focus on the extent to which we can account for the overall decline in its use.

Figure 15 plots the model's implications for aggregate debt relative to income. Two points are immediate: the model implies substantially more borrowing initially, during the boom, and a sharper fall in debt to income in the recession. Notice that part of the increase in borrowing before the recession is due to the reform: in the simulation without reform the debt-to-income increases 30 percent instead of 55 percent. The drop in borrowing in similar in both cases, however.

The reason for the likely greater sensitivity of the model to overall conditions is clearly seen in Figure 16. This figure shows the terms available to the median borrower (i.e. borrowers with median values for both match quality and individual productivity). The bankruptcy reform exerts a powerful influence on the cost of borrowing, which increases debt at the outset (between 2005 and 2008). As soon as labor market conditions deteriorate, however, we see that credit contracts (see bottom panel of Figure 16), which then leads to a sharp reduction in borrowing and a sharp increase in default. The top panel of Figure 16 shows how households respond–and in this case, we see that in 2009, for all most all debt levels there is either a sharp deleveraging for high debt levels, or maintenance of the entering debt level for low levels. There is essentially no leveraging taking place for the relatively young household with the median constellation of wage shocks. By contrast, in 2006 agents with substantially more debt maintained or increased their debt. A good deal of this behavior is coming from the worsened terms prevailing in 2009. The dashed red line in the top panel of Figure 16 shows that were households to face 2009 labor market conditions with 2006 prices, they would indeed borrow more.

Figure 17 shows that the same patterns hold for the worst off (low m, low n)–who will be represented relatively heavily among the borrowing population–and for whom borrowing costs rise very substantially (bottom panel) as the recession occurs.

Figure 18 shows how labor market status and deleveraging are connected. In the top panel, we see that desired debt levels plummet for those who have experienced a job separation–the poor prospects for future earnings imply, for these agents, a drop in debt of nearly 50%! Next, notice the role of pricing in this: the dashed red line shows that 2009 conditions would generate substantial *lever*aging, not deleveraging. The bottom panel shows why this is happening: loan prices plummet

Figure 15: Debt-to-Income ratio during the great recession

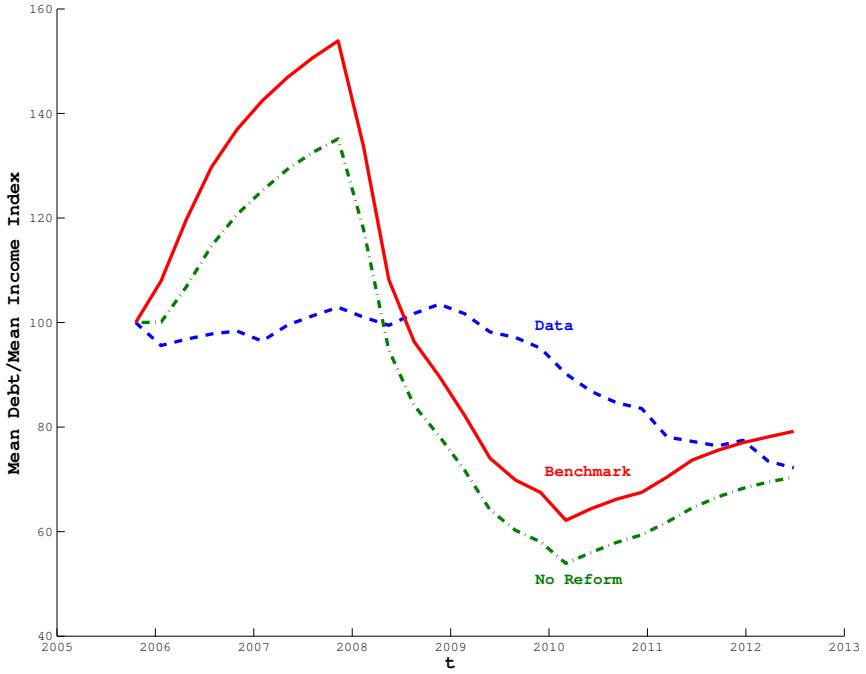
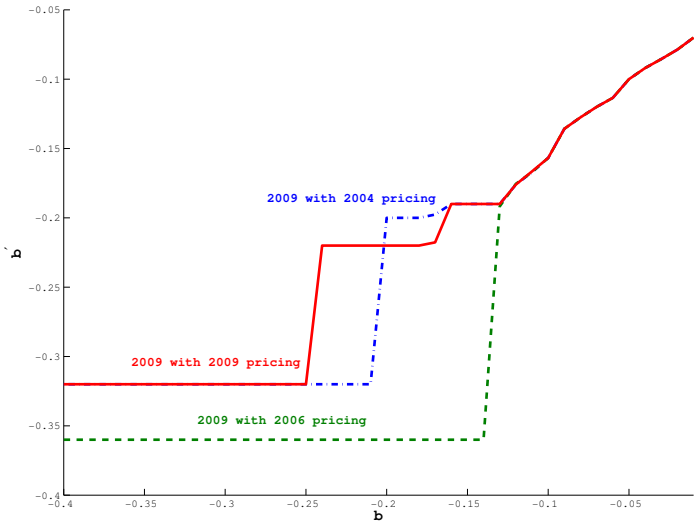


Figure 16: Borrowing, policy functions (households with mid n, mid n, and age 33)



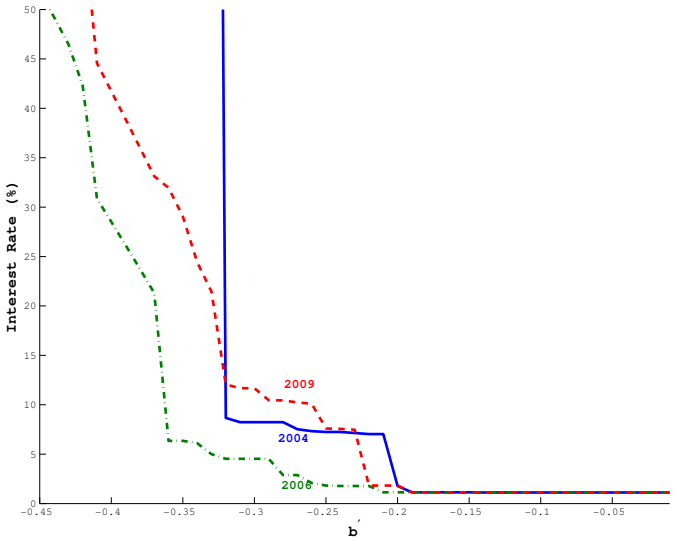
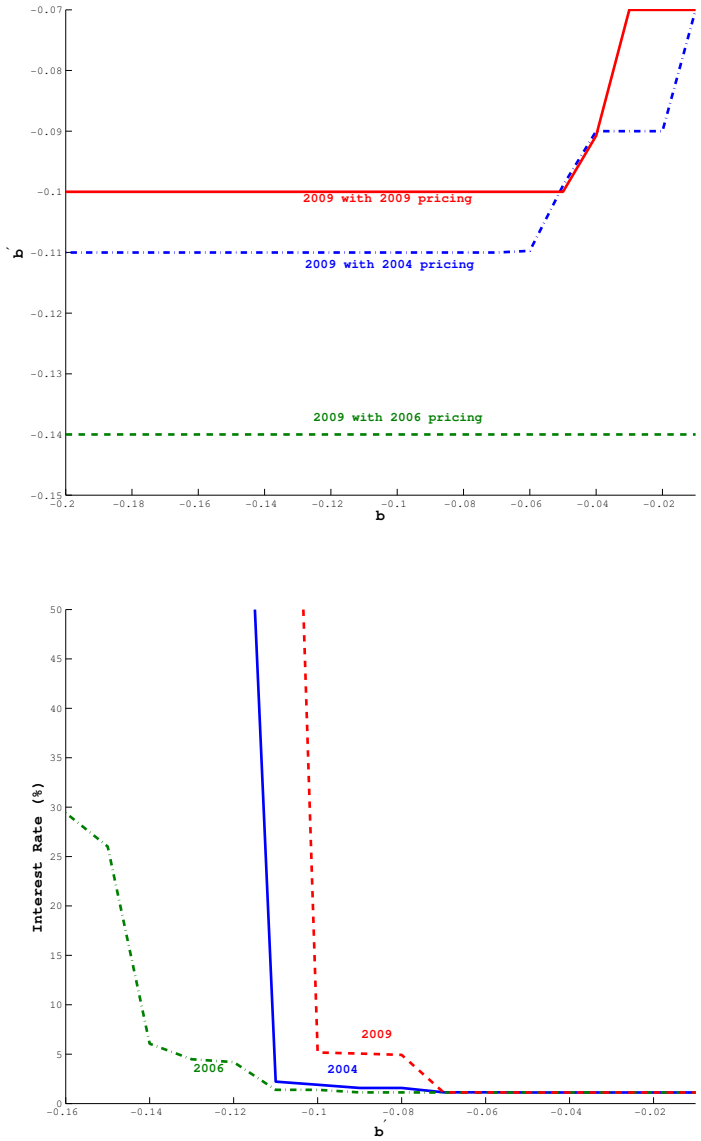


Figure 17: Borrowing, policy functions (households with low n, low n, and age 33)



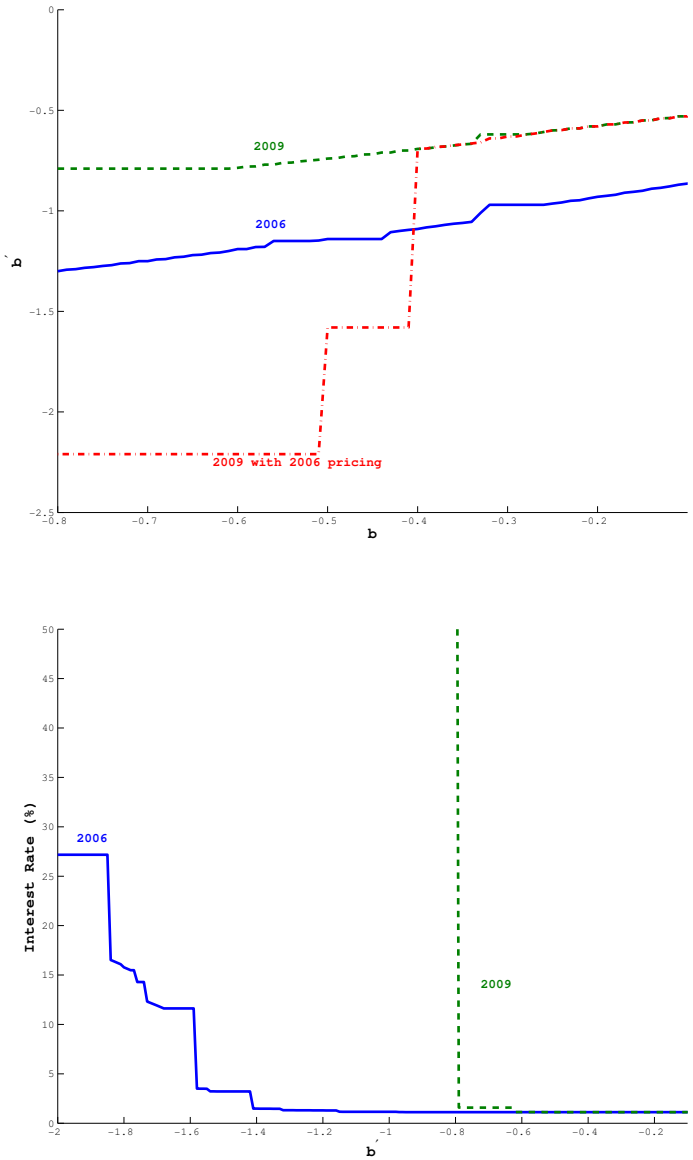
(interest rates rise sharply). Our model suggests that a substantial proportion of households were strongly credit constrained, and that this tightening had much to do with aggregate delevaraging; the credit market tightened at precisely the moment that many households would have liked to borrow more.

6 Conclusions

We have assessed the role of bankruptcy reform and labor market shocks at generating the unusual dynamics of bankruptcy, delinquency, and unsecured debt during the Great Recession. Our central finding is that the reform did lead to substantially less bankruptcy, given the shocks to the aggregate hiring and firing rates, but did not generate substantial increases in delinquency. Declines in hiring rates are the more important labor market shock. The fact that our model is not only consistent with steady state facts but also with dynamic ones gives us more confidence in its ability to assess alternative policies, such as the welfare effects of garnishment (studied in Athreya et al. 2012) or the consequences of usury laws and other interest rate ceilings. [**To be completed**]

We could easily extend our model to incorporate additional changes observed during the Great Recession, such as negative real interest rates and fluctuations in the distribution of wages. In particular, Guvenen, Ozkar, and Song (2013) document that there is countercyclical variation in the skewness of labor income during recessions, which clearly would affect how agents make default decisions. We leave these possibilities for the future.

Figure 18: Borrowing, policy functions (high n, short-term unemployed, age 33)



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