# Unemployment Insurance with Consumer Bankruptcy*

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PRELIMINARY AND INCOMPLETE

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**Abstract**

In the data, bankruptcy rates and Unemployment Insurance (UI) generosity are negatively correlated which suggests these are substitute programs. This observation raises the question of what are the implications of consumer bankruptcy on the determination of UI generosity. I construct a model matching main statistics regarding the US unsecured credit and labor markets including main features of Bankruptcy and UI policies. The model successfully accounts for the negative relationship between bankruptcy rate and UI generosity observed in the data. Through the lens of the model, for a low level of UI, a more generous UI reduces bankruptcy and allows more debt without (substantially) increasing default risk. As UI keep increasing, employment falls and lenders react by contracting credit supply. In this sense, bankruptcy plays an important role in the consideration of UI. From an ex-ante welfare perspective, an increase in the replacement rate from 50% to 60% is welfare reducing when bankruptcy exist but would be welfare increasing without bankruptcy.

**Keywords:** consumer bankruptcy, unsecured credit, unemployment insurance

**JEL Classification Codes:** J65, E24, E44, J22, J31, J64, J65

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# 1 Introduction

Credit and labor market outcomes are connected in many ways. This paper focuses on consumer bankruptcy, labor market risk (earning and unemployment risks) and Unemployment Insurance (UI). This focus is motivated by the fact that 67.5% of bankruptcy filers cite job loss as one of the main reasons for filing according to Sullivan et al. (2000). More recently, Keys (2018) finds that households are three times more likely to file for bankruptcy in the year immediately following a job loss (higher bankruptcy risk then declines but persists up to three years). Not surprisingly, the bankruptcy rate among unemployed individuals is around four times the population counterpart, and the unemployment rate among bankruptcy filers is estimated to be between 13%-16% (Athreya and Simpson (2006) and Bankruptcy Reports from the Institute of Financial Literacy). Still, most people filing for bankruptcy are employed; the employment rate among Chapter 7 bankruptcy filers is around 73% (US Courts, 2007), which highlights the importance of earnings risk in addition to unemployment risk.[1]

Fisher (2005) finds suggestive evidence that bankruptcy protection is a substitute with other government programs, such as UI, in the sense that increases in UI decreases the probability of bankruptcy. This study is based on individual data from the Panel Study of Income Dynamics (PSID). The limitation of the PSID is that the total number of bankruptcy filers is low (just 196 cases). A natural question is whether this result can be observed at some level of aggregation. I use county-level data on the total number of Ch7 filings and State differences in UI generosity and find that Ch7 bankruptcy rates are negatively correlated with UI generosity. Moreover, using contiguous counties that belong to States with different levels of UI, I find that a 10% increase in the total amount of UI that can be collected in a given unemployment spell is associated with a reduction in Ch7 bankruptcy rate of 0.72% for an average of 0.91% (or alternatively, 7 fewer Ch7 filings per every 1,000 individuals).

The main question that this paper addresses is whether the interaction between UI and bankruptcy has any implication on the optimal determination of the generosity of UI. In particular, can an equilibrium model of unemployment and bankruptcy account for the negative correlation between bankruptcy rate and the generosity of UI? What are the mechanisms underlying this relation? How

[1] There are other sources of risk influencing bankruptcy decisions, such as unexpected health expenditures. However, as discussed by Athreya, Tam, and Young (2012), it seems unlikely that bankruptcy is the best way to deal with such events (maybe it should be considered in context of public health policy such as Medicaid).

does bankruptcy policy affect optimal UI?

First, I show that the combination of standard models of unsecured credit and unemployment can account for the main statistics regarding the U.S. unsecured credit and labor markets, including the sub-populations of bankruptcy filers and non-employed. Combining these models allows us to study the joint decision of borrowing, default and labor supply while taking into account the general equilibrium effects of policy changes. This last point is of particular interest for fully assessing changes in the environment of the model such as policy counterfactuals. This combination is not trivial since it implies balancing the life-cycle properties of borrowing and default with the high frequency of unemployment episodes and short duration of UI benefits.[2] I build a life-cycle incomplete market model of heterogeneous agents based on Aiyagari (1994), extended to include unsecured consumer credit, a frictional labor market, Chapter 7 bankruptcy and UI capturing the main features of the UI system.[3] Labor frictions are modeled using a Diamond-Mortensen-Pissarides (DMP) search/matching framework.

The literature on consumer bankruptcy has stressed that default implies a trade-off between consumption smoothing across states of the world versus smoothing consumption over time. On the one hand, it allows debtors to consume more by not repaying their debts in states of low income introducing some contingency into debt contracts. In this way, bankruptcy improves consumption smoothing across states. On the other hand, lenders would increase interest rates to compensate for the default risk, which limits the ability to smooth consumption over time by borrowing. The quantitative literature has found that, when focusing on income risk, the distortions in smoothing consumption over-time dominates. In this sense, bankruptcy can be seen as an expensive transfer among borrowers where ex-ante all borrowers pay higher interest rates on their loans to compensate lenders for those few ex-post unlucky that default.

Considering the consequence of job loss on bankruptcy decisions, one may ask if this is the result of an insufficient provision of UI and whether bankruptcy is the right tool to deal with unemployment risk. UI might be a more appropriate tool to deal with unemployment risk since it implies a redistribution from a relatively larger and higher income group (workers) to a relatively smaller and poorer group (unemployed). But UI also creates moral hazard associated with work

[2]Life-cycle considerations are important for welfare purposes given that, for example, bankruptcy is concentrated among young individuals and they are more interested in borrowing against expected future higher income.

[3]In the model, default happens only through bankruptcy decisions, so the two terms will be used interchangeably.

incentives that limits its use.

In this paper, I argue that specific trade-offs implied by bankruptcy and UI are interconnected. In particular, for low levels of UI benefits, a more generous UI allows agents to borrow and reduces default risk. However, at some point, higher unemployment resulting from higher UI creates a risker default environment in which lenders react by increasing interest rates on loans reducing overall borrowing. Additionally, bankruptcy has non-trivial employment effects, particularly for young households, which in turns reduces moral hazard concerns of the UI.

The model is estimated using Simulated Method of Moments (SMM) to match the main statistics regarding unsecured credit (bankruptcy rate and mean debt-to-mean income) and the labor market (employment rate), including the sub-populations of bankruptcy filers and non-employed. Also, since wages are endogenously determined, the labor productivity process over the life-cycle is such that when simulating a sample of households over their life-cycle, the estimated earning process in the simulated data matches the same estimated process obtained using the PSID.

The model successfully replicates the negative relationship between bankruptcy rate and UI generosity which is consistent with the empirical analysis mentioned before. More importantly, we can use the model to understand what is behind this negative correlation. UI can alleviate the credit distortions of bankruptcy in a limited way. In particular, when considering replacement rates from 30% to 70%, the steady state bankruptcy rate monotonically falls (from 1.53% to 0.73%), but the mean debt to mean income ratio first increases when the replacement rate goes from 30% to 50% and then falls.[4] Initially, a more generous UI allows for more debt without increasing overall default risk. However, as UI keeps increasing, debt relative to income falls in coincidence with the higher unemployment risk that is created when UI increases.

Bankruptcy has important implications when assessing UI changes. For example, bankruptcy flattens the relationship between UI and non-employment rate. Increasing the replacement rate from the current 50% to 60% implies a fall in steady state employment rate of 3.5 percentage points with bankruptcy and 5.5 percentage points without it. Also, it affects the desirability of this change since when bankruptcy is taken into account, higher unemployment will end up increasing the default risk, causing credit rationing and limiting the use of credit markets to smooth consumption. From an ex-ante welfare perspective, an increase in the replacement rate from 50% to 60% is welfare reducing

[4]In simple terms, replacement rate is the fraction of the individual wages that is given as UI benefit.

when bankruptcy exists but would be welfare increasing without bankruptcy (for replacement rates below 50%, higher UI is welfare increasing).

Higher interest rates when default is possible restricts individuals to use credit markets to smooth consumption, causing young and low-productivity workers to reject fewer job offers in order to consume more. This result has important implications for the effect of UI on employment and implies that the distortions created by the bankruptcy policy reduce the moral hazard problem of UI for young households. However, as explained in the previous paragraph, the benefits of lower moral hazard are relevant for low levels of UI. As UI keeps increasing, the labor market distortions created by higher UI spill over into the credit market, contracting credit supply.

I also find that bankruptcy has non-trivial labor market consequences. For example, under the current level of UI, if bankruptcy were not allowed, the overall employment rate in the steady state would be 3 percentage points lower. The biggest effect is on young households, the difference in employment rate if of 13 percentage points on average for households in their 20s.

**Closest related literature**

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This paper is closest to Athreya (2003), Athreya and Simpson (2006), henceforth A&S, Krusell et al. (2010), henceforth KMS, and Gordon (2017). Athreya (2003) and A&S were the first to consider UI and bankruptcy regulation in a unified framework. They focus on the trade-off between social insurance and the moral hazard related to the incentive to search in an infinite horizon model with exogenous labor income.

The present paper extends KMS by allowing borrowing and default, although at the cost of not considering aggregate fluctuations as in KMS. KMS find that the optimal UI is very low or actually zero depending on the calibration. This result is consistent with prior studies regarding optimal replacement ratios such as Young (2004), who finds that the optimal replacement ratio is zero.[5] The reason is that in the class of models considered by these studies, the distortionary costs of a higher UI outweigh its consumption-smoothing benefits.[6] I study whether the credit distortions created by the bankruptcy system increase the consumption-smoothing benefits of UI, providing transfers in a

[5]In Young (2004) a higher level of UI, besides the increase in unemployment, reduces precautionary savings and therefore lowers capital accumulation resulting in lower aggregate output.

[6]See Chetty (2004) for a discussion above actual estimates of the distortionary cost of UI and its consumption benefits.

state where consumption-smoothing is more valuable. Moreover, the additional cost is that higher levels of UI make the relatively riskier group of unemployed workers bigger.

# 2 Institutional Background: Consumer Bankruptcy

## 2.1 Overview of the Legislation

Bankruptcy is a legal procedure through which borrowers can formally default on their unsecured debts. Consumer bankruptcies almost entirely fall under Chapter 7 or Chapter 13 of the US Bankruptcy Code.

Chapter 7 represents around 70% of all consumer bankruptcies. Debtors obtain full discharge of their total qualifying unsecured debts and their current and future earnings are protected from any debt collection action.[7] This chapter is a liquidation-type of bankruptcy since it requires the liquidation of all nonexempt assets in order to repay lenders. However, only 5% of Chapter 7 cases yield assets that could be liquidated to repay creditors, Livshits et al. (2007).

Chapter 13 is a reorganization-type of bankruptcy. Debtors keep their assets and pay back all or a fraction of their debts through a repayment plan. The final amount paid back to lenders will depend on debtor's income, expenses, and type of debt.

The Bankruptcy Abuse Prevention and Consumer Protection Act of 2005 (BAPCPA), sometimes referred as the *New Bankruptcy Law*, was the last major change to the US Bankruptcy Code. BAPCPA increases the barriers for individuals to file for bankruptcy by *(i)* introducing Mean-tests for Chapter 7, *(ii)* adding more complicated paperwork requirements that resulted in higher court and legal fees (50% increase from $921 to $1,377 (U.S.GAO (2008))), *(iii)* requiring mandatory credit counseling, *(iv)* adding a 2 year residency requirements, (v) increasing the waiting period to file again for Chapter 7 from 6 to 8 years (if received discharge the fist time) (vi) adding a cap in state homestead exemption by requiring that in order to fully take advantage of the state homestead exemption (if any), the filer should have bought her/his home within 1,215 days (3.3 years) before filing otherwise a cap of around $160,000 is applied.

In order to qualify directly for Chapter 7, filers' income should be below their state median income for a household of their size. If no, mean-test requires the filer's disposable income to be

[7] Some debts like alimony, student loans, and most tax debts cannot be discharge.

calculated. A filer will not pass the mean-test if its disposable income is beyond a certain threshold. Using administrative data from the US Court (2007) I find that 99% pass the mean-test.

## 2.2 Bankruptcy Exemptions

Exemptions are State and Federal laws specifying types and amount of assets that are protected from liquidation to pay creditors. In Chapter 7 bankruptcy, exemptions are used to determine how much property filers are allowed to keep. In Chapter 13 bankruptcy, debtors keep all property but must pay unsecured creditors an amount equal to value of nonexempt assets so exemptions help keep debtors plan payments low.

Exemptions include homestead, personal property, retirement accounts, public benefits (social Security benefits, unemployment benefits, veteran?s benefits, public assistance, and disability or illness benefits.) among others. In wildcard exemptions can be applied to any property. The amount of exempt assets varies widely across states. Table 6 in the appendix shows different exemptions levels for assets in 2007. For example, some states are very generous providing unlimited homestead exemptions while other did not have it. In addition, some states allow filers to choose between the state or federal exemptions.

States update their exemptions levels form time to time. Table 7 in the appendix shows homestead exemptions levels for 1989 and 2017 and the years when they were updated.

## 2.3 State-level Statistics on Personal Bankruptcy

Data on consumer bankruptcy was obtained from the US Courts website.[8] There is substantial variation in the bankruptcy rates across states. Using annual data from 1991-2017 Table shows the mean and standard deviation for each state. For the sample period, South Carolina has the lowest average Ch7 bankruptcy rate, 0.1%, and Nevada the highest, 0.48%. The overall rage of values for Ch7 goes from 0.04% to 1.04%.

In addition, Figure **??** and Figure **??** in the appendix shows the evolution of bankruptcy rates for chapter 7 and 13 across states from 1991-2017. There is an upward trend in chapter 7 bankruptcy rates from the 90's and a jump in 2005 before the BAPCPA becomes effective. From 2007, chapter 7 bankruptcy rates started increasing again until 2010 and falls thereafter.

[8]Detailed description about how the data was obtained is in the Appendix.

## 3 Institutional Background: Unemployment Insurance

The Federal-State UI programs may provide temporary income benefits to unemployed workers who lose their job. During the time period considered in this paper there were three UI programs: the regular Unemployment Compensation (UC) program, the permanent Extended Benefits (EB) program, and the temporary Emergency Unemployment Compensation (EUC08) program.

According to the Bureau of Labor Statistics (BLS) the composition of total unemployment is given in four categories: job losers (51% historical average), re-entrants (28%), job leavers (11%), and new entrants (10%). The UI program's target population is job losers. The average fraction of unemployed individual receiving UI over total unemployment (recipeincy rate) is around 33% (so the coverage of the UI over the target population of job loser is around 65%).

To measure differences in terms of the generosity of the UI programs among states I use: *(i)* maximun number of weeks that a qualifying unemployed can collect benefits, *(ii)* maximum weakly benefit amount that can be collected, *(iii)* maximum amount that can be collected if exhausted the benefits (i.e., the product of the previous two), and *(iv)* average replacement ratios.[9]

Data on maximum number of weeks that an unemployed can collect UI under different programs was obtained from Farber et al. (2015) for the time period correspondig to Jananuay 2000 to August 2014. I updated this dataset up to 2017. Data for the maximum weakly amount (WBA) and the average replacement ratio was obtained from the US Department of Labor website.

As shown in Figure **??** in the appendix, under the regular UI program and during the period in consideration, most states had 26 weeks as the maximum number of weeks that UI benefits can be collected so there is not much variation under this measure. In fact, only 15 states changed the number of weeks available for regular benefits (see Table 9 in the appendix). There is more variation in terms of the maximum weekly benefits amount of dollars.

## 4 Empirical Analysis

Using county-level data on bankruptcy I study the correlation between Chapter 7 bankruptcy rates and the the generosity of UI. To measure the generosity of the UI, I follow Hsu et al. (2018) and defined UI generosity as the total amount of benefits that can be collected under the regular program

[9] Replacement rate is refered to the proportion of workers wages replaced by unemployment insurance benefits.

(i.e., # of weeks × maximum WBA).

The main result of this section is that bankruptcy rates are significantly negative correlated with the generosity level of UI. I interpret this result as suggestive evidence that Ch7 bankruptcy is a substitute for UI. This motivates the main question of the paper on how unsecured credit markets (and Ch7 bankruptcy in particular) is important when determine the generosity of UI.

### 4.1 County level bankruptcy and UI

I use county-level data on the annual total amount of consumer bankruptcy filings under Chapter 7 and UI benefits from 1991-2007. The negative correlation between bankruptcy and UI is robust of whether I use the entire sample of counties or just bordering counties (exploding policy discontinuities at the State border) and whether some basic controls like the county-unemployment rate and State level of home exemption. I start by first estimating a simple OLS regression.

$$BK_{it} = \alpha + \eta UI_{it} + \phi_i + \phi_t + X_{it} + \varepsilon_{it} \tag{1}$$

Here $BK_{it}$ represents bankruptcy percentage rate (for Ch7) in county $i$ at time $t$. $UI_{it}$ represents the measure of UI generosity. The term $\phi_i$ represents a county fixed effect and $\phi_t$ a time fixed effect. State fixed effect is not included on purpose since I want to exploit State level variation in UI generosity. $X_{it}$ represent a vector of controls which includes county-level unemployment rate and State-level home exemption. Standard errors are clustered at the county-level.

Table 1 summarizes the results. When all counties are considered, a 10% increase in UI is associated with a 0.48% fall in Ch7 bankruptcy rate on a base rate of 0.5% (or alternatively, more than 2 fewer bankruptcy filings per 1,000 individuals).

As explained in Dube et al. (2010), considering all counties can be misleading since states are very different in terms of observable/unobservable both in levels and in growth level. County fixed effect control for these heterogeneities as long as they are constant over time. To address this problem, I also use policy discontinuities at state borders to identify the effect of UI generosity on consumer bankruptcy, i.e., examine difference in UI generosity between bordering counties that belong to different states.

Dube et al. (2010) argue that contiguous border counties represent good control groups if there are substantial differences in treatment intensity withing cross-state county-pairs, and bordering counties are more similar to each other than another randomly chosen county so it is more plausible that unobserved heterogeneity between contiguous counties evolve similarly.

For this exercise, I estimate the following regression:

$$BK_{ipt} = \alpha + \eta UI_{it} + \phi_i + \tau_{pt} + X_{it} + \varepsilon_{ipt} \tag{2}$$

Here $BK_{ipt}$ represents bankruptcy percentage rate (for Ch7) in county $i$ belonging to pair $p$ at time $t$. $UI_{it}$ represents the measure of UI generosity. I focus on the total amount of benefits that can be collected under the regular program (i.e., # of weeks × maximum WBA) since there is more variation under this measure. The term $\phi_i$ represents a county fixed effect and $\tau_{pt}$ a pair-specific time fixed effect. So the comparison is between bordering counties at a given point in time in which county-level variables were demeaned by their average (and controling for other observables in $X_{it}$). Standard errors are clustered at the state level.

The identifying assumption for this local specification is that $E(UI_{it}, \varepsilon_{ipt}) = 0$, that is, within pair differences in the generosity of UI are uncorrelated with the differences in the residual bankruptcy rate in either county. Table 1 shows the results

Table 1: UI and Ch7 consumer bankruptcy (1991-2007)

| | Ch7 bankruptcy rate | | | |
|---|---|---|---|---|
| | All counties | | Bordering counties | |
| $UI_{it}$ | -0.0253** | -0.0297** | -0.069** | -0.069** |
| | (0.0122) | (0.0119) | (0.03) | (0.029) |
| Unempl. rate | | Y | | Y |
| log(home exemption) | | Y | | Y |
| County FE | Y | Y | Y | Y |
| Time FE | Y | Y | | |
| Pair-specific time FE | | | Y | Y |
| N. Obs. | 53,075 | 50,992 | 39,800 | 36,042 |

$UI_{it} = \log(\#$ of weeks $\times$ max. WBA in 2017 dollars). Standard errors are in parenthesis. Significance levels: *10%, **5%, ***1%. Standard errors are clustered at the county level for the full sample and state level for the bordering county sample.

So for the entire sample period, there is statistically significant negative correlation between UI benefits on Ch7 bankruptcy rates. In particular, a 10% increase in the generosity of UI decreases Ch7 bankruptcy rate by 0.72% for an average base rate of 0.91% bankruptcy rate (or alternatively, 7 fewer Ch7 filings per every 1,000 individuals).

# 5 The Model

I consider a life-cycle incomplete market with heterogenous agents à la Aiyagari (1994) extended to include a frictional labor market and default in unsecured consumer credit.[10] Time is discrete and the model period is one quarter. The economy runs forever and is composed by households, firms, financial intermediaries, and the government.

## 5.1 Labor Market

Labor market frictions are modeled as an extended version of the search and matching framework of Diamond-Mortensen-Pissarides. Risk adverse workers differ on their labor productivity, $\varepsilon$, and whether they are matched with a firm. I denote the matched status by $m \in \{0, 1\}$, where $m = 0$ means unmatched, $m = 1$ means matched.

Labor market frictions are summarized by a Cobb-Douglas matching technology that takes as inputs unemployed workers and job vacancies. The match is random and the matching function is $M(u, v) = \chi u^{\eta} v^{1-\eta}$, in which $u$ and $v$ represent the number of unemployed workers and vacancy posted in a given period, $\eta$ is the elasticity of new matches with respect to unemployment and $\chi$ is the matching efficiency parameter. The job-market tightness is defined by $\theta = v/u$.

Only unemployed workers engage in the costless random job search (no on-the-job-search for now) and get matched with a firm with probability $\gamma^m = \frac{M(u,v)}{u} = \chi\theta^{1-\eta},$. Firms are identical and each one pays a fixed flow cost, $\kappa$, to post one vacancy to employ one worker. Vacancies are filled with probability $\gamma^v = \frac{M(u,v)}{u} = \chi\theta^{-\eta}$.

Wages are bilaterally determined between the worker and the firm by splitting what if left of the firm's current period revenue after capital rental payment. In every period, a worker with a job

[10] Life-cycle consideration is particularly relevant in light to the fact reported by Athreya et al. (2018) that the bankruptcy decision is decreasing in age, with around 55% of the filers being between the ages of 25-34 years old, and around 30% between 35-44 years old. These facts highlight the important life-cycle component in the use of credit and bankruptcy to smooth consumption.

offer (matched worker) decides if she/he accepts the job offer or not at the negotiated wage. At the end of each period, employed workers can exogenously be separated with probability $\gamma^s$.

## 5.2 Unemployment Insurance and Social Programs

The Unemployment Insurance policy is modeled to resemble the main features of the United State UI system. Only unemployed households may receive UI benefits. The indicator variable $I^B$ represents the UI qualification status. UI recipients keep their benefits with probability $\pi_k$ next period such that UI benefits are collected on average for 2 quarters.[11] Unemployed workers not qualifying for UI receive social benefits, $z$, to ensured an income floor.

Unemployment benefits are given by the following formula,

$$b(\varepsilon) = \max\left\{\min\left(\theta_R \times w_p(\varepsilon), C_{UI}\right), z\right\} \tag{3}$$

where $\theta_R$ is the replacement rate over a proxy for past wages, $w_p(\varepsilon)$. For simplicity, this proxy is assumed to be equal to the wage that the worker would receive if he were employed. The UI cap $C_{UI}$ is maximum amount of UI benefits that can be collected in a given period.[12]

Retired workers receive social security benefits, $z_R$, that is equal to 34% of averages earnings in the economy.[13] Payroll taxes, $\tau$, are levied on employed workers. The total amount of taxes collected finances the UI benefits plus the social benefit programs for unemployed and retirees.

## 5.3 Credit Market and Financial Intermediaries

Credit market is incomplete. Perfectly competitive financial intermediaries have access to the international credit market in which they can borrow/save at the exogenous risk-free interest rate, $r$.[14] Financial intermediaries trade with households one period non-contingent defaultable discount

[11] This is a simplify way to capture the fact that regular UI benefits are available for at most 26 weeks in most states. The stochastic UI qualification avoids the computational burden of having the number of periods unemployed as another state variable.

[12] The proportion of workers wages replaced by unemployment insurance benefits is referred to as the replacement rate. States varies in how they calculate the amount of benefits but the majority of states benefit formulas stipulate that 50% of the unemployed worker's wages over a recent 52-week period be replaced, up to a maximum weekly benefit amount (US Department of Labor).

[13] This replacement rate for retirees is calculated by dividing the average Social Security Retirement benefits available on the Social Security Administration website.

[14] Chatterjee et al. (2007) show that there is no big gain in determine the risk free interest rate endogenously so the consideration of an open economy does not compromise the results for the question at hand.

aseet with face value $a' \in \mathcal{A}$.[15] Households start with zero units of assets and they can buy (save, $a' \in \mathcal{A}^+ \subset \mathbb{R}^+$) or sell (borrow $a' \in \mathcal{A}^{--} \subset \mathbb{R}^{--}$) from financial intermediaries. I denote the asset space by $\mathcal{A} = \mathcal{A}^{--} \cup \mathcal{A}^+$ which includes zero. Physical capital is owned by the intermediaries who rent it to the firms.

Intermediaries maximize expected profits every period. Perfect competition in the financial market implies that they make zero expected profits on each loan. Each lender holds a sufficiently large number of loans of any given size and there's a continuous of agents, so by a law of large number, realized profits are also equal to zero.[16] Financial intermediaries incur a transaction cost $\iota$ that is proportional to the load size.[17]

The bond price will depend on the face value, $a'$, and household's characteristics that inform lenders about next period default risk. Let $q_t^W(a', \boldsymbol{e})$ be the bond price for an employed and $q_t^U(a', \boldsymbol{e})$ for an unemployed. A borrower receives $q_t(a', \boldsymbol{e})a'$ units of consumption goods in the current period and repays $a'$ next period unless default. Intermediaries receive nothing if the household files for bankruptcy.

The zero expected profit condition implies the following loan price schedule for household as

$$
\begin{aligned}
q_t^W(a', \boldsymbol{\varepsilon}) &= \varphi_t \mathbb{E}_{\varepsilon'|\varepsilon} \left[ (1-\gamma^s) p_{t+1}^M(a', \boldsymbol{\varepsilon}') + \gamma^s p_{t+1}^N(a', \boldsymbol{\varepsilon}') \right] / (1 + r + \iota) \\
q_t^U(a', \boldsymbol{\varepsilon}) &= \varphi_t \mathbb{E}_{\varepsilon'|\varepsilon} \left[ \gamma^m p_{t+1}^M(a', \boldsymbol{\varepsilon}') + (1-\gamma^m)(\pi_k p_{t+1}^N(a', \boldsymbol{\varepsilon}') + (1-\pi_k) p_{t+1}^S(a', \boldsymbol{\varepsilon}')) \right] / (1 + r + \iota) \\
q_t^S(a', \boldsymbol{\varepsilon}) &= \varphi_t \mathbb{E}_{\varepsilon'|\varepsilon} \left[ \gamma^m p_{t+1}^M(a', \boldsymbol{\varepsilon}') + (1-\gamma^m) p_{t+1}^S(a', \boldsymbol{\varepsilon}') \right] / (1 + r + \iota)
\end{aligned} \tag{4}
$$

where $\varphi_t/(1+r+\iota)$ is the price of a risk-free loan that takes into account the surviving probability and transaction cost. The loan prices depend on current employment status so $(q^W, q^U, q^S)$ corresponds to prices for employed, unemployed, and under social benefits. Tomorrow repayment decision are $(p^M, p^N, p^S)$ for matched, unmatched with UI benefits, and unmatched with social benefits.

The price for saving is just $\varphi_t/(1+r)$. Note that the loan pricing function takes the individual unemployment risk into account since it affects their income prospects, e.g., for an employed it takes into account the exogenous separation rate, $\gamma^s$. For an unemployed worker, it takes into account the

[15] Credit market is exogenously incomplete, this assumption can be justified by some underlying informational friction like Townsend (1979) costly state verification that prevent intermediaries to offer contingent loans. As explained in Livshits (2015), the incomplete market framework is adopted since a complete market fails to generate equilibrium default.

[16] Also, losses and gains resulting from death are absorbed by financial intermediaries.

[17] Livshits (2015) argue that this is necessary to match the gapvbetween the average interest rate on unsecured credit and the risk-free rate. This gap is just too big to be explained by the risk premium.

probability $(1-\gamma^m)$ of starting the next period with a job offer and whether keeps the UI benefits (if currently qualifying) in case remains unemployed.

### 5.4 Bankruptcy policy

Default is modeled as Chapter 7 of the United Stated Bankruptcy Code. The government allows households to default on their debt by filing for bankruptcy in which case their current bond holdings are set to zero and current and future income are protected for any debt collection. Households cannot borrow nor save in the period of default, but are not restricted in later periods.

The cost of bankruptcy includes a filing fee that depends on individual employment status, $(\Delta_W, \Delta_U, \Delta_S)$, for employed, unemployed with UI, and unemployed collecting social benefits. This employment status dependency of the filing fee is to capture the fact that these fees are waive in some cases for individuals with low income. Bankruptcy cost also includes a direct utility cost, $\lambda$, which represents other explicit and implicit costs associated with bankruptcy but that are out of the scope of the present paper.

### 5.5 Households

Households are born into the model at the age of 22, they work for 44 years, then retire on they turn 66 years old, and live for 21 years as retiree after which they die on their 87th birthday leaving no bequest. At any period of life, households die with probability $(1-\varphi_t)$. Each household that dies is replaced by a new one with zero assets so that population is constant and normalized to one.

Each working-aged household is endowed with one unit of time for labor and a random labor efficiency $\varepsilon \in \mathcal{E}$. Labor efficiency is strictly positive and independent across households and is given by,

$$\log \varepsilon_t = a_0 t + a_1 t + a_2 t^2 + u_t, \tag{5}$$

$$u_t = \rho_u u_{t-1} + \xi_t, \tag{6}$$

$$\xi_t \sim \mathcal{N}(0, \sigma_\xi^2). \tag{7}$$

So labor efficiency is the sum of a deterministic component and an stochastic one. The deterministic component is a quadratic trend on age that captures experience gains across the worker life cycle. The stochastic component follows an AR(1) process. A newborn household draws its labor efficiency from the invariant distribution associated to this stochastic component.

Households dislike to work and derive utility from consuming the single good available. The expected life time utility of a household takes the time-separable form with the period utility of the form

$$U(c,l) = (c \times \exp\{\phi l\})^{1-\sigma}/(1-\sigma)$$

with $\sigma > 0$ as the coefficient of relative risk aversion, $l \in \{0,1\}$ with $l = 1$ if the household works and zero otherwise, and $\phi > 0$ is the parameter governing the disutility of working.

Each household discounts the utility from future consumption streams by $\beta \in (0,1)$ which is the common discount factor and attaches disutility from filing for bankruptcy, $\lambda$, which as explained before, includes the social stigma of being a defaulter.[18]

## 5.6 Household's Problem

The problem faced by a working-age household is presented below. Retirees face the same problem except that rather than wages they receive social security benefits and don't face employment risk.

Every period, a household decides whether to default or not and how much to consume and save/borrow. Households take the loan price schedule, the bankruptcy system, and the public insurance framework as given. Figure 5 shows the time within a period. At the beginning of each period the state variables $(m, a, \varepsilon, t, I^B)$ are realized. Since there is perfect foresight within the period, a household will know the value of being solvent or not as well as being employed/unemployed.

### Value Functions

Let $\boldsymbol{e} = (\varepsilon, I^B)$. The value functions for matched and unmatched households are denoted by $V_t^M(a, \boldsymbol{e})$ and $V_t^N(a, \boldsymbol{e})$ respectively. The value of being matched is

$$V_t^M(a, \boldsymbol{e}) = \max\{B_t(\boldsymbol{e})\ ,\ S_t(a, \boldsymbol{e})\},$$

[18]See Fay et al. (1998) and Gross and Souleles (2002) for evidence about these non-pecuniary costs of default and the unexplained variability in the probability of default across households even after controlling for many observables. As explained in Athreya et al. (2010) these results suggest the presence of implicit unobserved collateral that is heterogeneous across households, including (but not limited to) any "stigma" associated with bankruptcy along with any other costs that are not explicitly pecuniary in nature.

where $B(\boldsymbol{e})$ and $S(a,\boldsymbol{e})$ denote respectively the value of filing for bankruptcy and being solvent taking into account the optimal job offer acceptance decision in each case.

The value of being bankrupt and solvent are given by:

$$B_t(\boldsymbol{e}) = \max\left\{W^B(\boldsymbol{e})\ ,\ U^B(\boldsymbol{e})\right\},$$
$$S_t(a,\boldsymbol{e}) = \max\left\{W_t^S(a,\boldsymbol{e})\ ,\ U_t^S(a,\boldsymbol{e})\right\},$$

where conditional on going bankrupt, $W^B(\boldsymbol{e})$ and $U^B(\boldsymbol{e})$ represent the value of working and being unemployed, respectively. Similarly, conditional on being solvent, $W_t^S(a,\boldsymbol{e})$ and $U_t^S(a,\boldsymbol{e})$ represent the corresponding value of working and being unemployed.

Since wages are bilaterally determined, I fist define $\hat{W}^S(a,\boldsymbol{e}|w)$ and $\hat{W}^B(\boldsymbol{e}|w)$ as the corresponding values of being employed-solvent and employed-bankrupt at any given wage $w$. This values are given by,

$$\hat{W}_t^B(\boldsymbol{e}|w) = U(c,l) - \lambda + \beta\varphi_t\left[\gamma^s\mathbb{E}V_{t+1}^N(0,\boldsymbol{e}') + (1-\gamma^s)\mathbb{E}V_{t+1}^M(0,\boldsymbol{e}')\right]\ ,$$
$$\text{s.t.}\ \ c = (1-\tau)w - \Delta_W$$

$$\hat{W}_t^S(a,\boldsymbol{e}|w) = \max\nolimits_{c,a'}\ \ \left\{U(c,l) + \beta\varphi_t\left[\gamma^s\mathbb{E}V_{t+1}^N(a',\boldsymbol{e}') + (1-\gamma^s)\mathbb{E}V_{t+1}^M(a',\boldsymbol{e}')\right]\right\}\ .$$
$$\text{s.t.}\ \ c_t + q_t^W(a',\boldsymbol{e})a' = (1-\tau)w + a$$

Let $w^*$ be the equilibrium wage from the splitting rule between the worker and the firm. Then, $W_t^S(a,e) = \hat{W}_t^S(a,e\ ;\ w=w^*)$ and $W_t^B(a,e) = \hat{W}_t^B(a,e\ ;\ w=w^*)$.

Similarly, the value for an unmatched equals the maximum value of being unemployed after the bankruptcy decision is made, i.e.,

$$V_t^N(a,\boldsymbol{e}) = \max\left\{U_t^B(\boldsymbol{e})\ ,\ U_t^S(a,\boldsymbol{e})\right\},$$

where $U_t^B(\boldsymbol{e})$ and $U_t^S(a,\boldsymbol{e})$ given by

$$U_t^B(\boldsymbol{e}) = u(c) - \lambda + \beta\varphi_t\left[\gamma^m \mathbb{E}V_{t+1}^M(0,\boldsymbol{e}') + (1-\gamma^m)\mathbb{E}V_{t+1}^N(0,\boldsymbol{e}')\right]$$
$$\text{s.t. } c_t = b(\varepsilon) - \Delta_U$$
,

$$U_t^S(a,\boldsymbol{e}) = \max\nolimits_{c_t,a'}\left\{u(c) + \beta\varphi_t\left[\gamma^m \mathbb{E}V_{t+1}^M(a',\boldsymbol{e}') + (1-\gamma^m)\mathbb{E}V_{t+1}^N(a',\boldsymbol{e}')\right]\right\}$$
$$\text{s.t. } c_t + q_t^U(a',\boldsymbol{e})a' = b(\varepsilon) + a$$

Note that this case correspond to an unemployed worker collecting UI.

### 5.7 Firms Problem

Firms decide whether to post a vacancy and, if so, how much to produce. Each firm can post one vacancy at most. Let $F_t(\varepsilon)$ be the value of a firm that is matched with a worker and $J^V$ the value of a vacant job. First, define $\hat{F}_t(\varepsilon|w)$ as the value of a filled job at any wage $w$. This function is given by:

$$\hat{F}_t(\varepsilon|w) = \max_k\left\{k^\alpha\varepsilon^{1-\alpha} - w - rk + \frac{1}{1+r}\left\{(1-\gamma^s)\left[\varphi_t\mathbb{E}F_{t'}(\varepsilon) + (1-\varphi_t)J^V\right] + \gamma^s J^V\right\}\right\}.$$

$F_t(\varepsilon)$ is then given by,

$$F_t(\varepsilon) = l \times \hat{F}_t(\varepsilon|w = w^*).$$

Note that from the firms perspective, the value of being matched with a worker is either $\hat{F}_t(\varepsilon|w = w^*)$ or zero if the worker reject to work for $w^*$ (recall $l \in 0,1$ is the indicator variable of worker's employed decision).

The value of a vacancy, $J^V$, is given by,

$$J^V = -\kappa + \frac{1}{1+r}\left\{(1-\gamma^v)J^V + \gamma^v\sum_{t,a,\boldsymbol{e}}\left[\varphi_t\mathbb{E}F_{t+1}(\varepsilon') + (1-\varphi_t)J^V\right]\frac{f_u(t,a,\boldsymbol{e})}{u}\right\}.$$

In order to have a vacant position, a firm has to pay a fixed flow cost, $\kappa$. New matches happen at the end of the period, so production will start in the next period if worker accept it. Firms take into account the aging process as well as the surviving probability of the workers. The population of unemployed workers with characteristics $(t,a,\boldsymbol{e})$ is given by $f_u(t,a,\boldsymbol{e})$ so the current density of the unemployed workers with these characteristics is $\frac{f_u(t,a,\boldsymbol{e})}{u}$. Since there is free entry, firms in equilibrium post vacancies until $J^V = 0$.

### 5.8 Equilibrium

The recursive competitive equilibrium definition is standard. Given risk-free interest rate, $r$, the bankruptcy system, UI and social benefits, a recursive competitive equilibrium consists of:

- loan prices functions $\{q_t^W(a', e), q_t^U(a', e), q_t^S(a', e)\}$
- wage functions $\{w(\epsilon_t)\}$
- value functions for households $\{V^M(a, e), V^N(a, e), V^S(a, e)\}$ and for firms $\{F_t(\epsilon), J^V\}$
- distribution of households $\mathcal{H}$ over $(t, a, e)$ and employment status.
- consumption, saving, default, labor decisions $\{c_t(a, e), a_t'(a, e), d_t(a, e), l_t(a, e)\}$

s.t.

- $\{q(\cdot)\}$ are such that intermediaries make expected zero profits.
- $\{w(\cdot)\}$ is consistent with the sharing surplus rule between a workers and a firms.
- $\{c(\cdot), a'(\cdot), d(\cdot), l(\cdot)\}$ solve the household problem given loan prices and wages.
- firms enter until the value of posting a vacancy is zero, $J^V = 0$.
- The government budget constraint holds.

## 6 Calibration and Estimation

The model period is set to one quarter so the model can capture the high frequency of unemployment events.[19]

The model has a large number of parameters so their values are assigned in a two-step procedure. First, some parameters can be directly observed in the data so their are set to their corresponding data values while others are set to standard values in the literature. Second, parameters that play a key role for the question at hand are formally estimated such that the model replicates as close as possible key empirical moments of the credit and labor markets.

[19] For example, the post-war average unemployment duration is more than 4 months

### 6.1 Parameters determined independently

The coefficient of relative risk aversion is set to 2, which is in the range of values typically used in the literature. The quarterly risk-free interest rate, $r$, is set to 0.3729% (corresponding to 1.5% annually). The transaction cost for making loans, $\iota$, is set such that it implies a 3% annual rate (Athreya et al. (2018)).

In the model, quarterly average earnings is normalized to 1 and represents $16,266 in 2007 dollars. This later values corresponds to the average households earning in the PSID sample used to construct the targets related to earnings (and explained later).[20]

The UI replacement rate, $\theta_R$ is set to 0.50 in accordance to what most states target in their benefits formulas (US Department of Labor). In 2007, the population-weighted average across States of the maximum weekly amount of UI benefits was $407.4. The UI cap, $C_{UI}$, then was set to $\$407.4*13/16{,}266 \approx 0.33$ per quarter.

Social benefits unemployed households not receiving UI are set to match the average household monthly transfer from the Supplemental Nutrition Assistance Program (SNAP) which was $216.1 in 2007 as reported by the US Department of Agriculture. So the income floor, $z$, was set to 0.04. According to the Social Security Administration, the average monthly Social Security Retirement benefits in 2007 was $1,100 (including spouse and children) so retirement social security benefits in the model is $z_r = 0.2$.

The separation rate, $\gamma^s = 0.06$, such that it matches a monthly separation rate of 2.03% estimated by Shimer (2012). The elasticity of the matching function with respect to unemployment, $\eta$, is set to 0.72 following Shimer (2005). The job-market tightness, $\theta$, is normalized to 1. The cost of entry, $\kappa$, is set such that in equilibrium the value of posting a vacancy is zero.

The level of assets in the model represents household's net worth since almost 90% of filers under Chapter 7 have negative net worth (Administrative Office of US Courts, 2007).[21] According to U.S.GAO (2008), in 2007 attorney fee for Chapter 7 bankruptcy was $1,078 and filing fee was $299 so the total pecuniary cost of filing was $1,377. I set then $\Delta_W = 0.085$. Considering that

[20] Annual average household earnings (head of the households + spouse) in the PSID sample is $65,064 in 2007 dollars, $16,266 is in quarterly terms.

[21] If it were possible to measure the value of exceptions, most likely all bankrupts would have negative net worth. In fact, according to administrative records, 99% of the filers estimate that no assets would be available for liquidation (Administrative Office of US Courts, 2007). Also, as pointed out by Athreya et al. (2018), if we subtract home equity from net worth to construct liquid net worth, the share of filers with negative liquid net worth rises to 98 percent.

these fees can be waived in case of very low income, $\Delta_U$ and $\Delta_S$ are set to 50% and 25% of $\Delta_W$, respectively. Also any of these fees is set to zero if that implies negative level of consumption. Table 2 below summarizes the calibrated parameters.

Table 2: Summary of parameters determined independently

| Parameter | Description | Value | Source |
|---|---|---|---|
| $\sigma$ | Coefficient of relative risk aversion | 2.0 | Standard in the literature |
| $r$ | Risk-free interest rate (quarterly) | 0.373% | Athreya et al. (2018) |
| $\iota$ | Transaction cost for loans (quarterly) | 0.742% | Athreya et al. (2018) |
| $\theta_R$ | UI replacement rate | 50% | U.S. Department of Labor |
| $C_{UI}$ | (Normalized) maximum quarterly amount of UI | 0.33 | U.S. Department of Labor |
| $z$ | Income floor (social benefits) | 0.04 | U.S. Department of Agriculture |
| $z_r$ | Retirement social security benefits | 0.20 | Social Security Administration |
| $\gamma^s$ | Job separation rate (quarterly) | 0.06 | Shimer (2012) |
| $\eta$ | Matching elasticity with respect to unemployment | 0.72 | Shimer (2005) |
| $\Delta_W$ | Filing fee | 0.085 | U.S.GAO (2008) |
| $\alpha$ | Capital share | 0.33 | Standard in the literature |

Set of parameters which values can either be observed directly in the data or were set based on the literature. Note that monetary values correspond to 2007 and were normalized such that average quarterly earing in the model is 1.

### 6.2 Estimated parameters

In the second stage, the remaining 9 parameters, represented by $\theta$ in equation 8 and listed below, are estimated jointly using Simulated Method of Moments (SMM), that is, by minimizing a weighted squared sum of differences between model and data moments. The minimum distance estimator solves:

$$\min_{\theta \in \Theta} [M - m(\theta)]' W [M - m(\theta)], \tag{8}$$

where $M$ and $m(\theta)$ are the data-based and model-based moments, respectively. The weighting matrix, $W$ ,is a diagonal matrix with $1/M_i$ in the diagonal element corresponding to row $i$. As described below, the targeted moments are different units of measure (and therefore differs in magnitude) so the estimator minimizes the percentage deviation between data and model moments.

The estimated parameters contained in $\theta$ are:

- Utility cost of default: $\lambda$

- Dis-utility from working parameter: $\phi$

- Discount factor: $\beta$

- Matching efficiency parameter: $\chi$

- Coefficients of the quadratic age trend of the log of labor productivity: $(a_0, a_1, a_2)$

- Parameters related to the stochastic component of the labor productivity: $\rho_u, \sigma_\xi$

### 6.2.1 Targeted moments

The first set of targeted moments are some key statistics of the unsecured credit and labor markets and the second set are main moments that capture the evolution of households earnings over the life-cycle. The first set of moments are:

- In the Survey of Consumer Finance (SCF 2007), the annual bankruptcy rate of 1.18% (Athreya et al. (2018)).

- Annual household employment rate of 80% estimated using the 2007 SCF where a household is categorized as employed if either the head of the household or the spouse or both are employed. Only households where the head is between 22-65 years old are considered.

- Annual average debt-to-income ratio for the population which is 1.64% (Athreya et al. (2018)). Debt is defined as Debt = max(0,-Networth).

- Annual average debt-to-income ratio for the sub-population of bankrupts is 110% (US Courts, 2007).

- Annual bankruptcy rate among unemployed of 4.0% (Athreya and Simpson (2006)).

- Annual employment rate among Ch7 bankruptcy filers of 73% (US Courts, 2007).[22]

The set of moments related to the earning process are calculated using data from The Panel Study of Income Dynamics (PSID) from Heathcote et al. (2010) and ranges from 1967-2002. This data set has been cleaned and processed such that, missing or miscoded observations were dropped, top coded

[22] Note that there's no demographic characteristics in this sample so I cannot constraint the sample for ages 22-65 years old. To get a proxy of the working age population to calculate employment rate I only consider those filers with retirement pensions equals to zero or, if receiving pensions, also have positive labor income.

values are extrapolated using a Pareto distribution, observations with implausible consumption levels or earnings were drop (e.g. positive labor earnings with zero hours work), and wage rate below half of the prevailing federal minimum wage.

In this sample, I calculated total household annual earning as the sum of earnings of the head of the household and his wife.[23] All monetary values are expressed in 2007 dollars. I restrict the sample to households in which the head is between 22-65 years old and in which the combined number of hours worked is above 260. I assume that in the data household earning process is the sum of a deterministic that depends of age and a stochastic component of the following form:

$$\begin{aligned} \log w_{i,t} &= b_0 + b_1 t + b_2 t^2 + z_{i,t} \\ z_{i,t} &= \rho_z z_{i,t-1} + \zeta_{i,t} \\ \zeta_{i,t} &\sim \mathcal{N}(0, \sigma_\zeta^2) \end{aligned} \tag{9}$$

The age coefficients $(b_0, b_1, b_2)$ are obtained by OLS. The shock process parameters $(\rho_z, \sigma_\zeta)$ are identified by method of moments using the variance $E_t(\hat{z}_{i,t}^2)$ and the second-order autocovariance $E_t(\hat{z}_{i,t}, \hat{z}_{i,t+2})$ of the residuals from the regression of log earnings, $\hat{z}_{i,t}$. As explained in Heathcote et al. (2010), the second-order autocovariance is used since after 1995 the PSID became biannual.

The remaining targets for the estimation are:

- Quarterly mean earnings equals to 1 (normalization).
- The estimated age coefficients for the deterministic component of log of annual households earnings in the PSID sample: $(b_1, b_2) = (0.14, -0.0016)$.
- Persistence parameter of the residuals of log earning, $\rho_z = 0.83$.
- The standard deviation of the i.i.d. shock to the residual log eanings, $\sigma_\zeta = 0.41$.

Although the parameters above are estimated jointly to match the targets, there is a close relation between the utility cost of bankruptcy and bankruptcy rates, the discount factor and debt-to-income ratios, disutility from working and matching efficiency with unemployment rates.

Importantly, since wages are endogenous in the model, the coefficients of the age quadratic trend in the labor efficiency are estimated such that the model delivers a hump-shape earning profile over

[23] When a woman is the head of the household (i.e., there's no husband) I just consider hers.

the life-cycle by matching $(b_1, b_2)$. In particular, for each set of parameter, I simulate a sample of 10,000 households over their entire life-cycle, stored the simulated annual earnings and repeat the same estimation procedure done with the PSID data to estimate $(b_0, b_1, b_2, \rho_z, \sigma_\zeta)$.

The estimated parameters come by minimizing equation 8. The discrete nature to default and job acceptance decision as well as the discretization of labor efficiency translate in non-monotonicity of the targeted moments that creates local minimum and requires, first, the use of a global optimization that can take us to the region near the global minimum. Then, a local optimizer is used to polish the estimates. At the moment of this writing, only a preliminary result from the global search were available. The best so far parameter values are shown in Table 3 below.

Table 3: Jointly estimated parameters

| Parameter | | Value |
|---|---|---|
| Utility cost of default | $\lambda$ | 1.75 |
| Dis-utility from working | $\phi$ | -0.416 |
| Discount factor | $\beta$ | 0.93 |
| Matching efficiency | $\chi$ | 0.835 |
| Intercept in $\epsilon$ age trend | $a_0$ | -2.806 |
| Linear coef. in $\epsilon$ age trend | $a_1$ | 0.0865 |
| Quadratic coef. in $\epsilon$ age trend | $a_2$ | -0.00149 |
| Autocorrelation of $u_t$ | $\rho_u$ | 0.947 |
| Std. Dev. of $\xi_t$ | $\sigma_\xi$ | 0.241 |

Table 3: Estimated parameters by SMM.

# 7 Results

In this section I evaluate whether the model can account for the main statistics regarding unsecured credit and labor markets that are targeted. I present some policy counterfactuals regarding steady state comparison between different arrangement of bankruptcy and UI policies.

## 7.1 Model fit

Table 4 shows that the model fits the targets relatively well.[24] The main take-away of this table is that the workhorse unsecured credit model combined with the workhorse DMP search and matching model is enough to account for the main statistics regarding unsecured credit and labor market including the sub-populations of bankruptcy filers and non-employed.

[24] At the moment of this writing, this estimates correspond to a preliminary global minimization of equation 8.

Table 4: Estimation: Data vs. Model Moments

| Name | Data | Model |
|---|---|---|
| Annual bankruptcy rate (2007 SCF) | 1.18% | 1.23% |
| Employment rate (2007 SCF) | 80% | 91.1% |
| Annual debt-to-income ratio (2007 SCF)** | 1.64% | 1.57% |
| Annual debt-to-income ratio for Bankruptcy filers (US Courts, 2007) | 110% | 109.16% |
| Bankruptcy rate for non-employed | 4% | 3.93% |
| Employment rate for Bankruptcy filers (US Courts, 2007) | 73% | 71.75% |
| Mean earnings | 1.0 | 0.97 |
| $b_1$ | 0.14 | 0.16 |
| $b_2$ | -0.0016 | -0.00165 |
| $\rho_z$ | 0.83 | 0.904 |
| $\sigma_\zeta$ | 0.41 | 0.377 |

**Debt=max(0,-Networth)

## 7.2 The employment effect of Bankruptcy

In this section we use the estimated model to answer the following hypothetical question: What would be the employment rate (overall and across age) if households were not allowed to default? In the context of the model, this implies that all debt would be risk-free and the borrowing constraint will be given by the natural debt limit.

As a result of this hypothetical exercise, we have that the overall employment rate is 3 percentage points lower without bankruptcy (or unemployment rate is 24% lower when bankruptcy is allowed). Higher interest rates when default is possible restrict individuals to use credit markets to smooth consumption causing young and low productive workers to reject fewer offers in order to consume more.

Since young households are more likely to borrow against higher future income, most of the effect is on this age-group. Figure 1 shows the employment rate over the life-cycle. For households in their 20s, employment rate is on average 13 percentage points higher with bankruptcy.[25]

[25]Note that I'm not targeting the employment rate across ages but the model yields qualitatively similar pattern than what is observed in the data, especially for young households. Employment rate near retirement seems higher in the model, future version of the model will include a more realistic pension benefit system that will potentially ameliorate this difference.

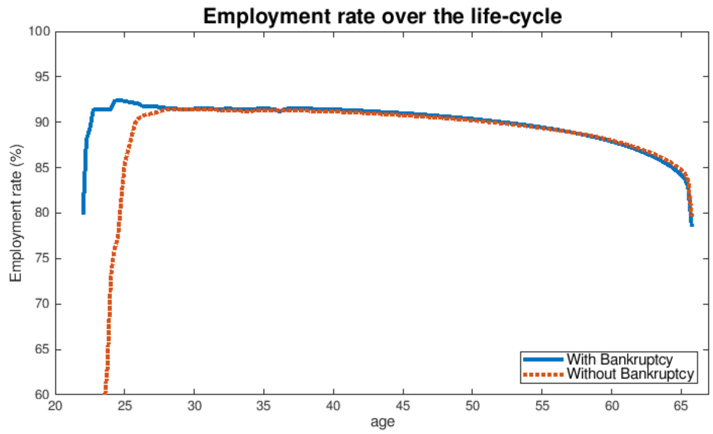


Figure 1: Employment rate across ages for the case when $\theta_R = 50\%$ with and without bankruptcy.

### 7.3 Unemployment Insurance and Consumer Bankruptcy

In the empirical analysis, I proxy the generosity level of UI as the maximum amount that can be collected in a given spell. This measure is plausible under the assumption that this measure is positive correlated with the amount of benefits that a qualifying unemployed receive, i.e., State that offer overall more benefits will tend to have high UI cap, which seems reasonable.

In terms of the model, we can define more generous UI in terms of higher replacement rates or the combination of higher replacement rates an higher UI cap. In the next section I explore the first alternative.

### 7.4 Changes in the Replacement Rate

In this section, I consider different levels of the replacement rate, $\theta_R$, keeping other policy parameters constant in the benchmark case (with bankruptcy) and also for a scenario without the option to file for bankruptcy. Note that keeping the UI cap would mean that increases in $\theta_R$ increases the level of UI benefits only for a fraction of the population (those below the UI cap such as young or low productive). Figure 7 shows the UI benefit schedule for the first 8 productivity levels across age and different values of $\theta_R$.

Two main results arise from this section. First, the availability of bankruptcy reduces the moral hazard concerns of increasing the generosity of UI through higher replacement rates (keeping other components of the UI constant). Second, UI can affect the trade-off implied the bankruptcy system between smoothing consumption across states of the world versus smoothing consumption over time.

In particular, when considering replacement rates, $\theta_R$, from 30%-70%, overall bankruptcy rate falls. However, the mean amount of debt to mean income only increases when going from $\theta_R = 30\%$ to $\theta_R = 50\%$ and then falls. So, a more generous UI initially improves consumption smoothing by allowing more borrowing without adding higher default risk.

Regarding the first result. Increases in the replacement rate reduces employment by more when bankruptcy in not allowed (see Figure 2). For example, increasing replacement rate from $\theta_R = 50\%$ to $\theta_R = 60\%$ implies an increase in non-employment rate of 3.5 percentage points with bankruptcy and 5.5 percentage points without bankruptcy. As explained before, this result comes from the fact that when bankruptcy is allowed interest rates on loans increase to compensate lenders for the default risk which reduces the use of credit to smooth consumption over time. As a result, young low productive workers would reject fewer job offers. In this sense, the credit distortions created by the bankruptcy option, reduces the moral hazard problem of rejecting job offers and collecting UI instead.

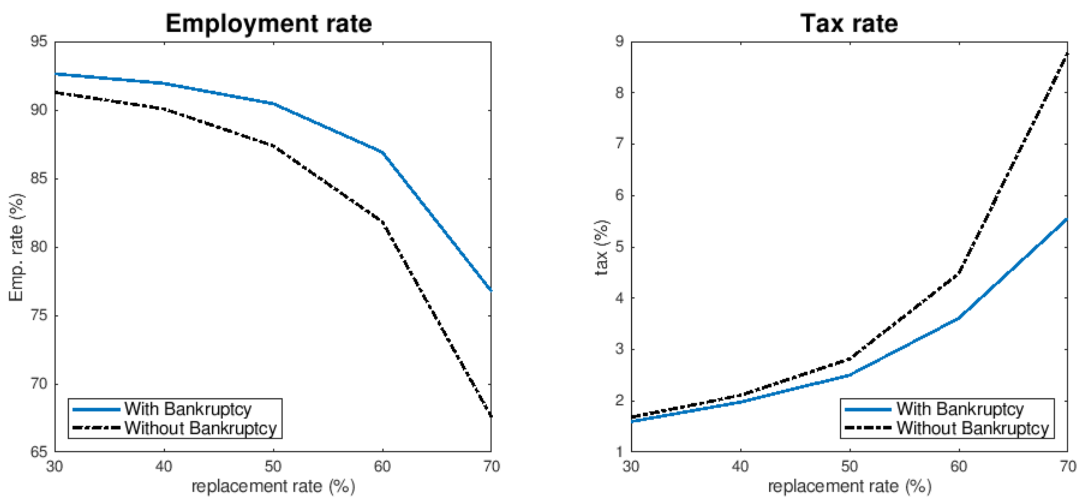


Figure 2: Steady state comparison for employment rate and labor tax across different replacement rates for scenarios with and without bankruptcy. Benchmark case is for $\theta_R = 50\%$.

Also, changes in the replacement rate have non-trivial credit market effects given the bankruptcy system. Figure 3 shows that if $\theta_R = 30\%$ the bankruptcy rate would be 1.53% while if $\theta_R = 70\%$ the bankruptcy rate would be 0.73%. Moving from the benchmark of $\theta_R = 50\%$ to $\theta_R = 60\%$ implies a 15.4% reduction in the bankruptcy rate (from a steady state rate of 1.07% to 0.91%).

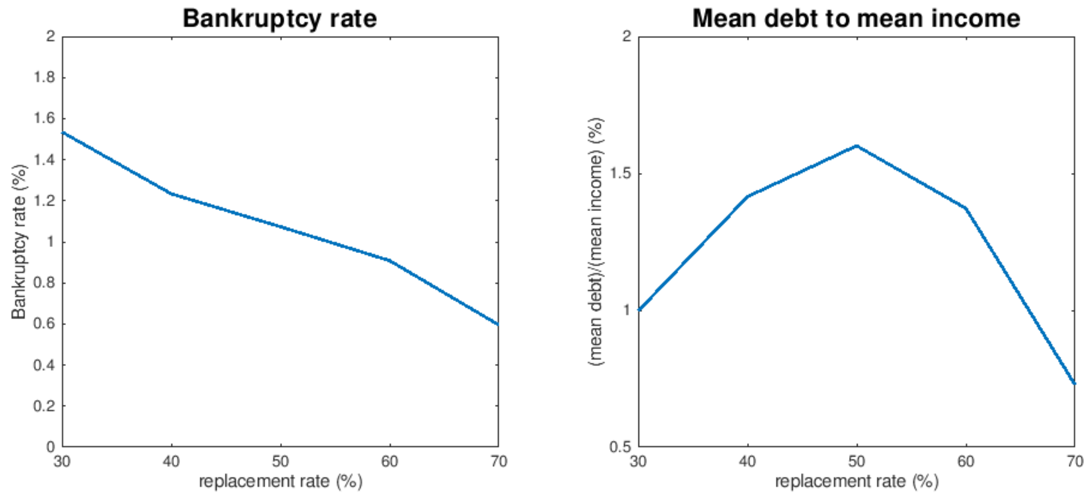


Figure 3: Steady state comparison for bankruptcy rate and mean-debt to mean-income ratio across different replacement rates. Benchmark case is for $\theta_R = 50\%$.

Bankruptcy rate monotonically decreases with $\theta_R$ for the overall population even though the ratio of mean-debt to mean-income is inverted U-shaped. First, this ratio increases when going from $\theta_R = 30\%$ to $\theta_R = 50\%$ and then falls when increasing further to $\theta_R = 70\%$. At first, debt increases since we are transferring resources to a relative low-income state and this allows agents to borrow more without adding much default risk. This transfer is from a relative big and richer group of employed to a relative small poorer group of unemployed, so initially does not necessary translate into higher default risk and credit rationing (alleviating the credit distortion created by the bankruptcy system).

When going beyond $\theta_R = 50\%$, the point is more subtle since average debt relative to average income also fall (Figure 3). This coincides with the more rapidly increase in unemployment which implies that the fall in debt relative to income could, at least in part, be the result of credit rationing due to higher unemployment risk.

For the sub-population of unemployed, bankruptcy rate falls when going from $\theta_R = 30\%$ to $\theta_R = 70\%$. This result implies that, for the range of values considering, increasing the generosity of the UI in this way increases the pool of unemployed but reduces its relative default risk (Figure 8).[26]

The amount of debt relative to income (debt-to-income ratio) that is discharged on average initially increases (from $\theta_R = 30\%$ to $\theta_R = 40\%$) but then starts falling. The initial increase results

[26] Bankruptcy rate for the subpopulation of unemployed relative to overall bankruptcy rate also falls.

from the overall rise in borrowing. When considering the benchmark case with $\theta_R = 50\%$, an increase in the replacement rate to $\theta_R = 60\%$ would reduce the average amount of debt discharged with respect to income by 13.3% in the steady state. [Compare this reduction in debt discharged with the cost for financing the UI rise...]

[Talk about overall consumption/income inequality and across ages...]

Finally, Table 5 shows that ex-ante welfare is lower at any level of replacement rate considered when bankruptcy is available. As commonly found in the quantitative literature, the cost in terms of smoothing consumption over time associated with bankruptcy outperform any of its benefits.

An interesting result is in terms of the desirability of increasing the replacement rate from the benchmark of 50% to 60%. This increase is welfare reducing when bankruptcy is allowed but welfare increasing when bankruptcy is not available. So, the consideration of bankruptcy does have important implication when thinking about optimal design of UI.

Table 5: Expected utility of newborns

| | $\theta_R = 30\%$ | $\theta_R = 40\%$ | $\theta_R = 50\%$ | $\theta_R = 60\%$ | $\theta_R = 70\%$ |
|---|---|---|---|---|---|
| With bankruptcy | -75.7635 | -74.4336 | -73.8571 | -75.4759 | -76.2014 |
| W/o bankruptcy | -54.9086 | -54.5389 | -53.9281 | -52.9751 | -51.0336 |

### 7.5 Changes in maximum amount of UI per quarter

In Figure **??** it can be seen that there is an almost zero correlation between bankruptcy rates and the maximum amount of UI benefits. This result is not surprising since the UI cap affects directly only those (relative high wage) households for which the cap is binding (or near the cap).

The model is able to capture this almost flat relationship between bankruptcy rate and the UI cap. In the model, increasing the UI cap almost does not have consequences for overall bankruptcy rates but slightly increases overall debt-to-income. However, there are interesting distributional consequences since bankruptcy rate for the sub-population of unemployed weakly decreases. Also, the debt-to-income ratio for bankrupts slightly increases initially and then falls (Figures 11 and 12). So, even though in the aggregate does not seems much going on (except for overall debt-to-income), changes in the UI reduces the average of debt-to-income discharged under bankruptcy.

### 7.6 Changes in maximum expected duration of UI benefits

Keeping other components of the UI formula constant, I now turn to study changes in the average amount of quarter that the UI can be collected. Figure 14 shows that increasing the duration of UI benefits has small negative effect on overall bankruptcy rate but increases average debt to average income ratio. Also, the mean debt-to-income ratio for the sub-population of bankruptcy filers increases with the UI duration.

### 7.7 Accounting for the State differences in Unemployment and Bankruptcy rates

When considering the cross States differences, Figure 4 shows that there is a slightly positive correlation between (historical averages) unemployment and bankruptcy rates, i.e., States with higher average unemployment rate tend to have higher average bankruptcy rates as well. However, this correlation is not significant.

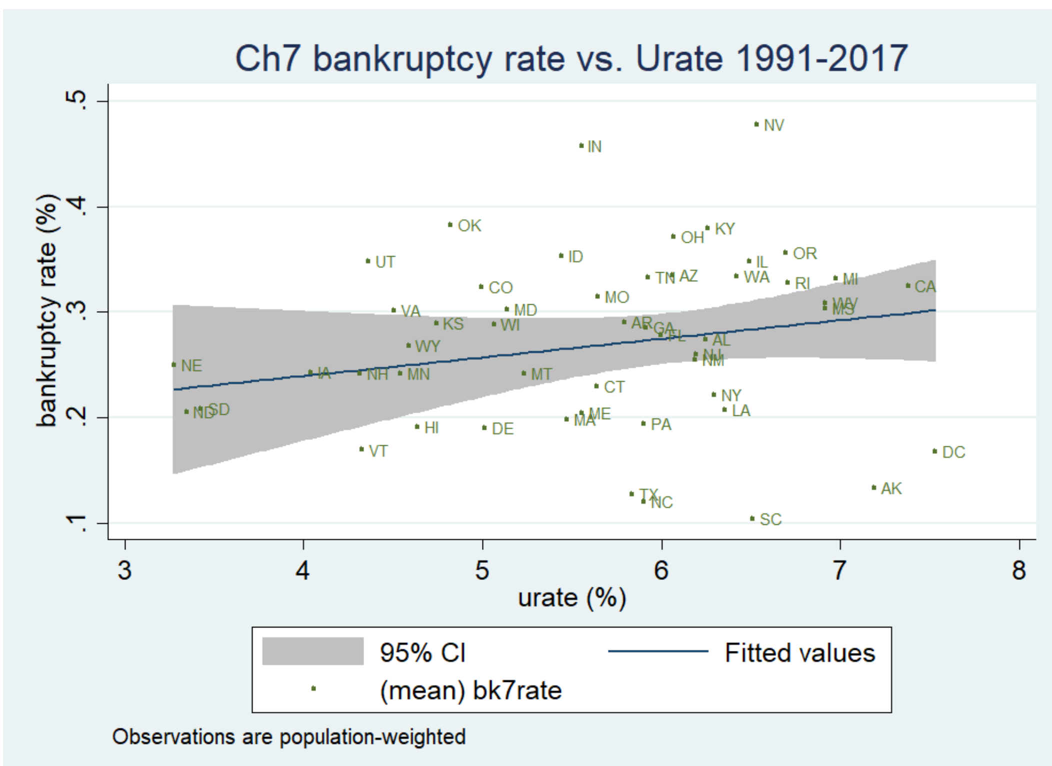


Figure 4: Correlation between unemployment and bankruptcy rates across States.

We use the model to interpret this result and find that the positive correlation can arise by differences in earning risk. Higher standard deviation of labor productivity accounts for the positive correlation between unemployment and bankruptcy rates as can be seen in Figure 6.

Differences in labor market condition such as differences in matching efficiency and job separation rates imply that unemployment rate and bankruptcy rate would be negative correlated everything else equal.

First, consider changes in the efficiency of the matching technology ($\chi$). Higher $\chi$ increases matching probability with reduces unemployment. Since equilibrium unemployment is lower borrowing increases which in turn increases bankruptcy (See Figures **??** and **??** in the appendix). The implication of this result is that if we consider similar areas where the only difference is the labor friction, areas with lower unemployment with tend to have higher levels of debt and higher bankruptcy rates.

Second, the model predicts that higher exogenous job separation rates, $\gamma^s$ implies higher unemployment rate and as a result credit rationing which results in lower debt and lower bankruptcy rate.

Another thing to look up is difference in terms of the generosity of the bankruptcy system. In the model, most of the bankruptcy cost comes from the utility cost. Changes in this cost of default also generate negative correlation between bankruptcy and unemployment rates (Figure **??**).

In summary, the model predicts that the long-run positive correlation between unemployment and bankruptcy rates across states are explained by long-run differences in income risk. This positive correlation is not significant, however, due to differences in labor market conditions and bankruptcy generosity predict a negative correlation between bankruptcy and unemployment.

# 8 Conclusion

[IN PROGRESS...]

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# Appendix

## 9 Figures

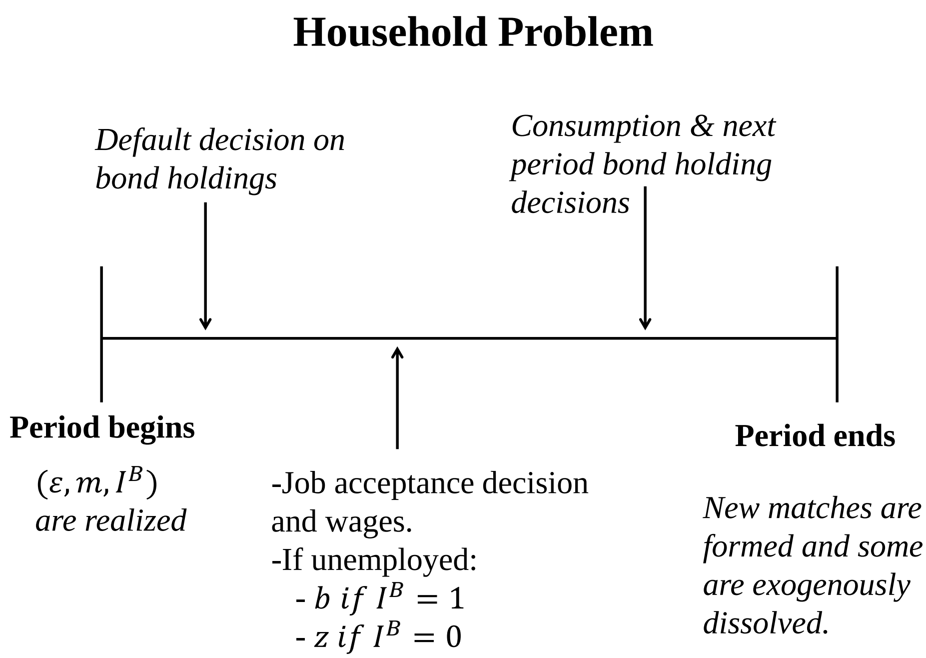


Figure 5: Timing within a period. Note that since all the uncertainty is resolved at the beginning of the period this timing is actually irrelevant and is just an artifact to present the model in an organized way.

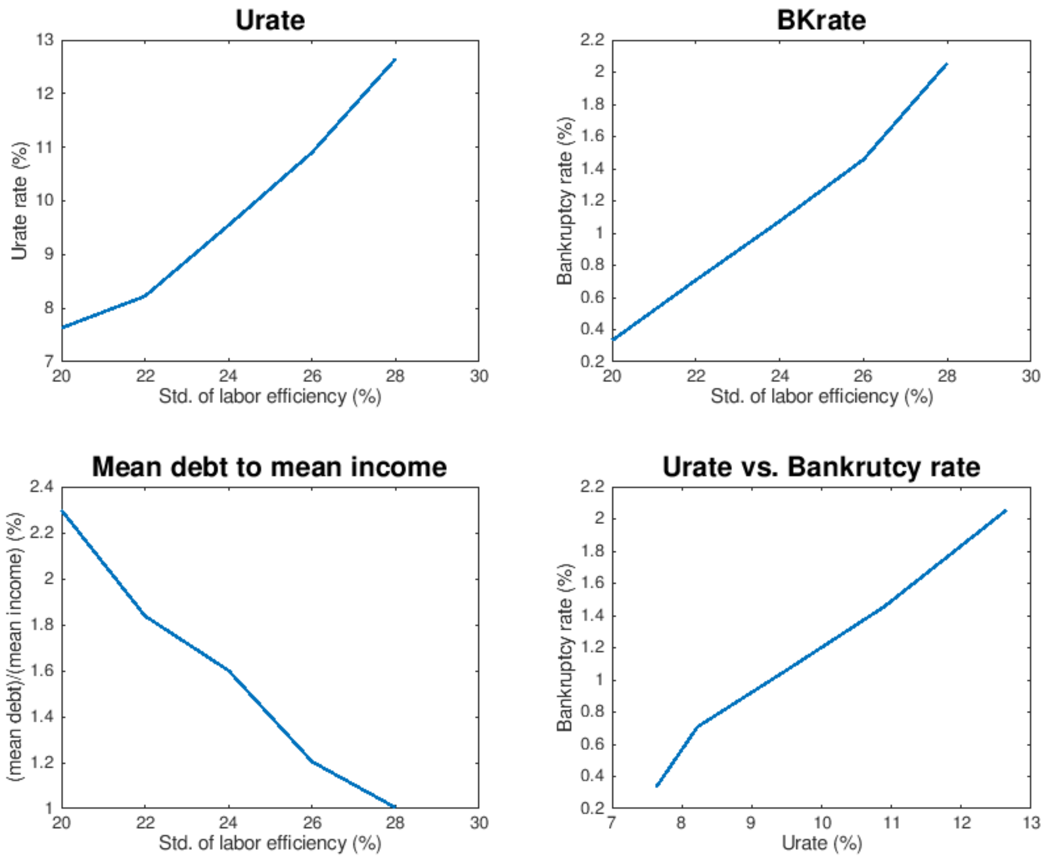


Figure 6: Steady state comparison for different levels of standard deviation of labor productivity (The implied log wage standard deviation are 0.40, 0.43, 0.47, 0.51, and 0.55).

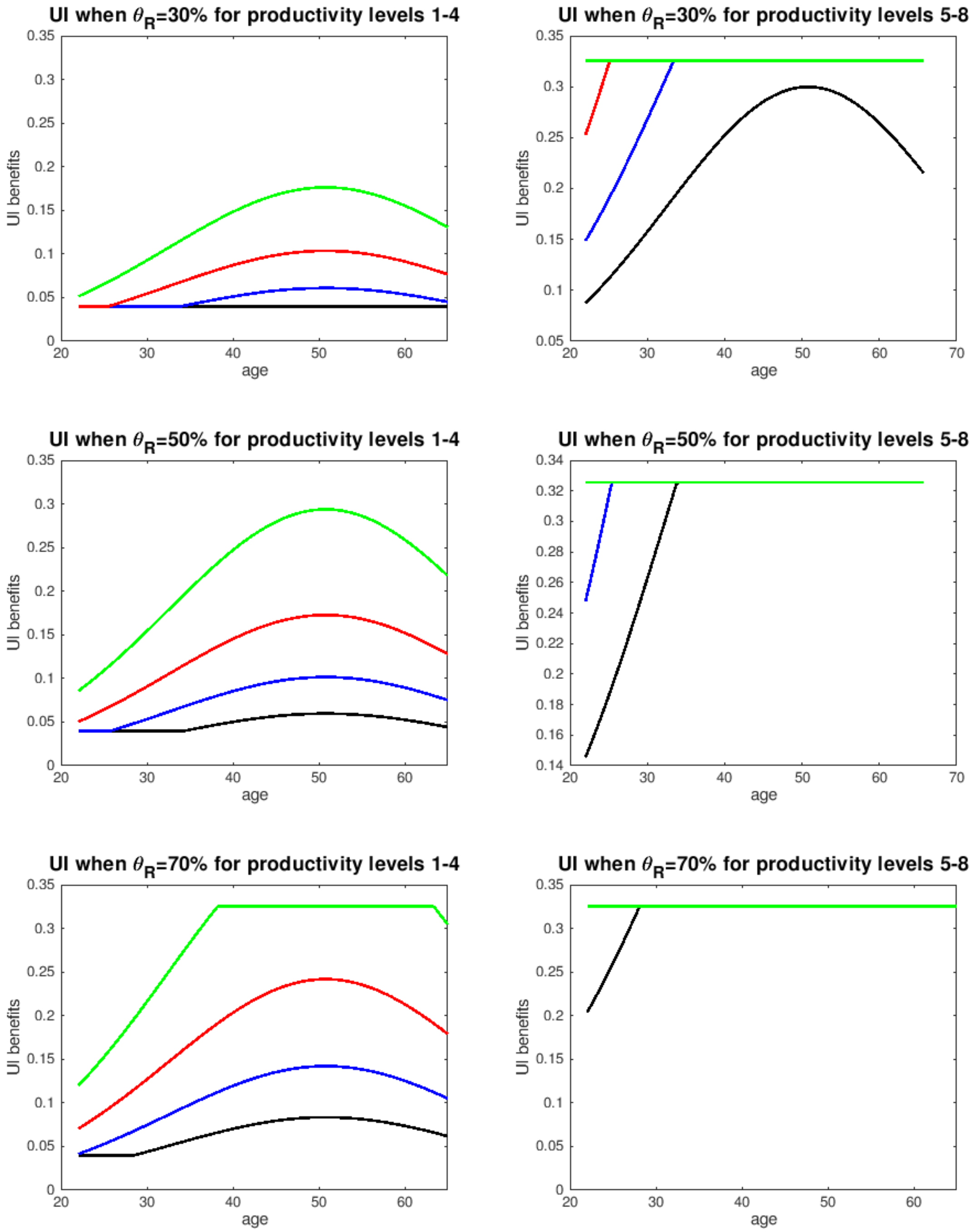


Figure 7: Steady state comparison of UI benefits (normalized units) across age, labor productivity, and for different replacement rates.

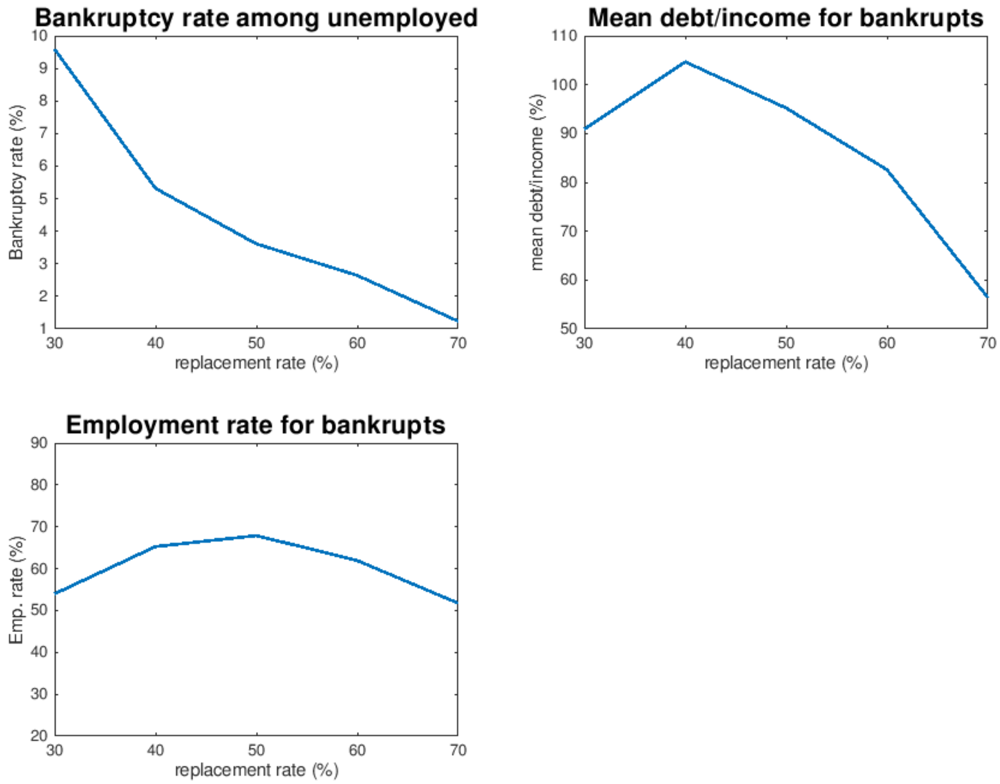


Figure 8: Steady state comparison: bankruptcy rate among unemployed, mean debt-to-income ratio and employment rate for bankruptcy filers across different replacement rates.

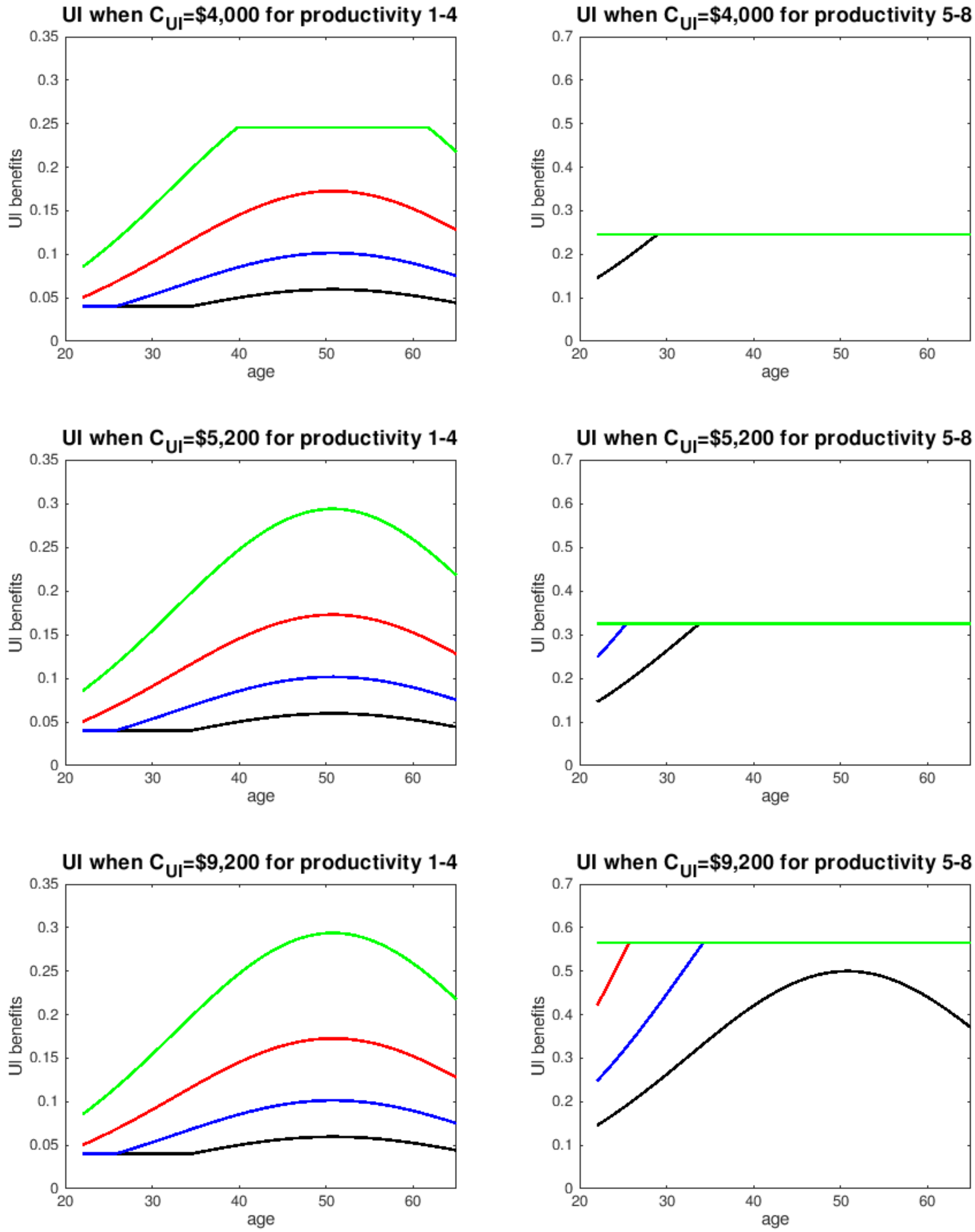


Figure 9: Steady state comparison of UI benefits (normalized units) across age, labor productivity, and for different levels UI cap.

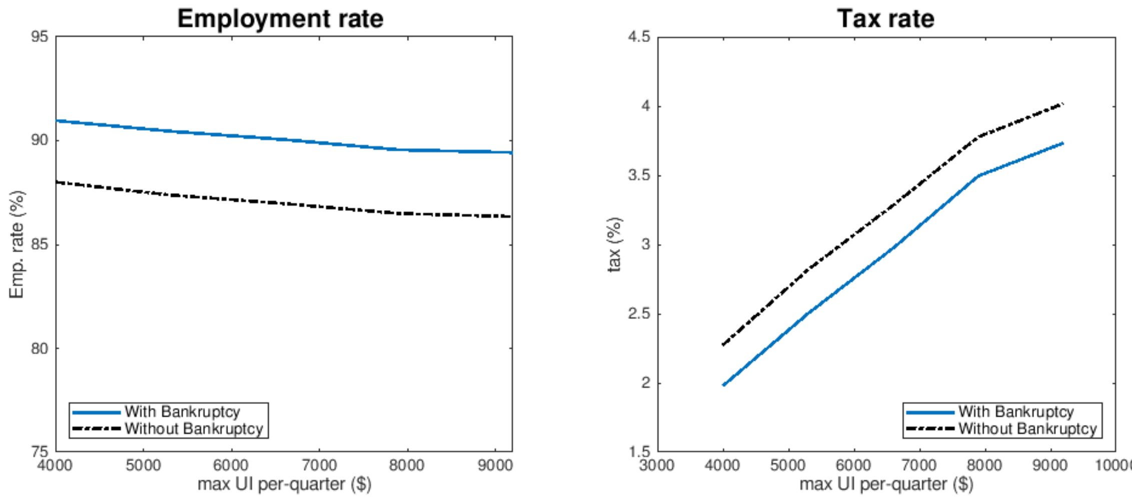


Figure 10: Steady state comparison for employment rate and labor tax across different UI caps for scenarios with and without bankruptcy.

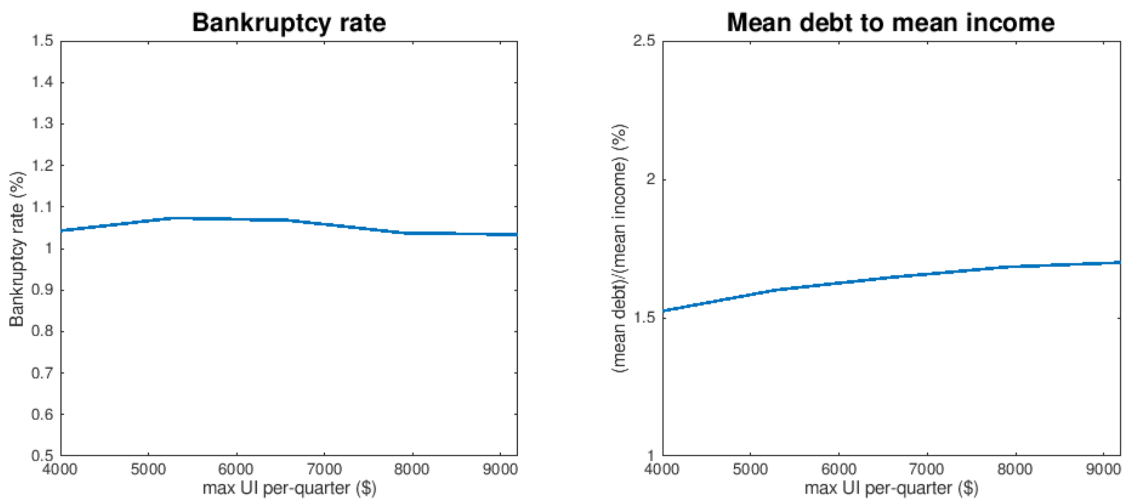


Figure 11: Steady state comparison for bankruptcy rate and mean-debt to mean-income ratio across different UI caps for scenarios with and without bankruptcy.

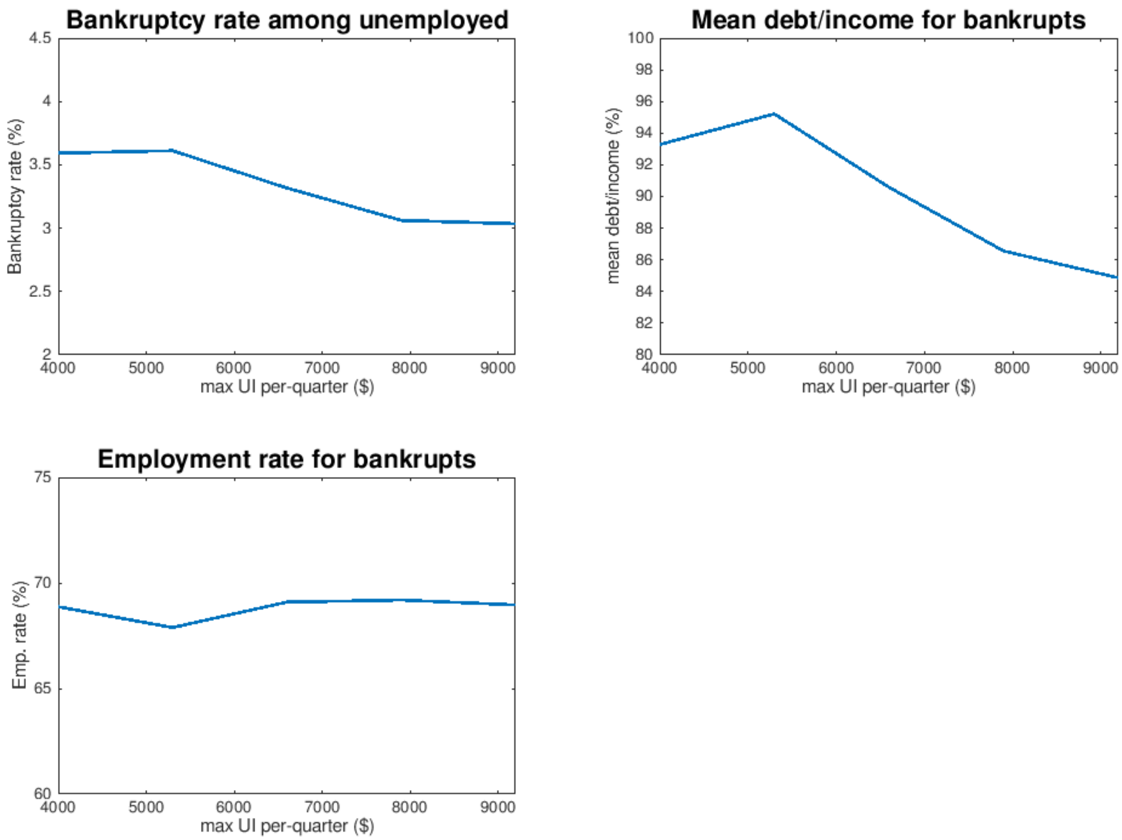


Figure 12: Steady state comparison: bankruptcy rate among unemployed, mean debt-to-income ratio and employment rate for bankruptcy filers for different values of UI caps.

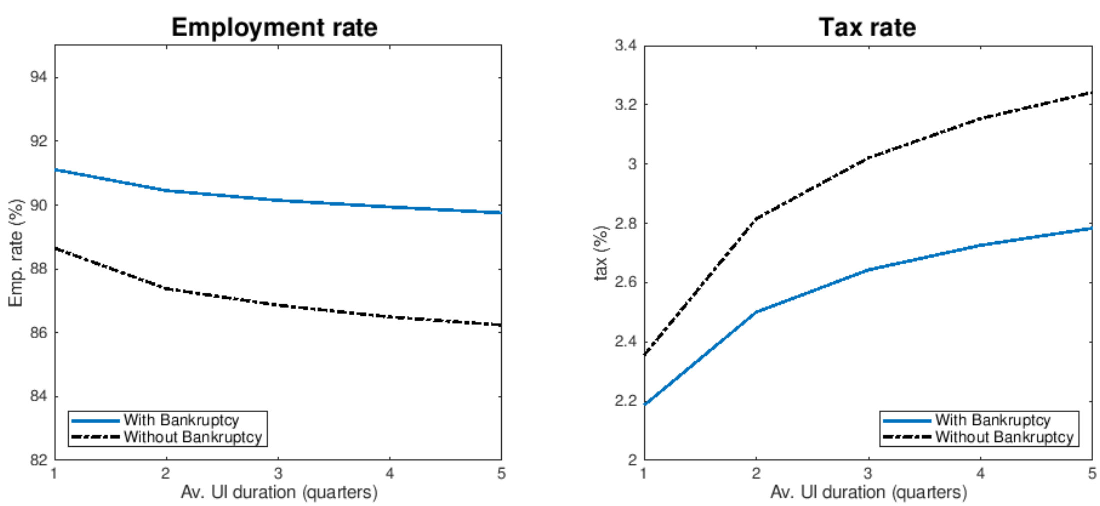


Figure 13: Steady state comparison for employment rate and labor tax across different UI average duration (in quarters) for scenarios with and without bankruptcy.

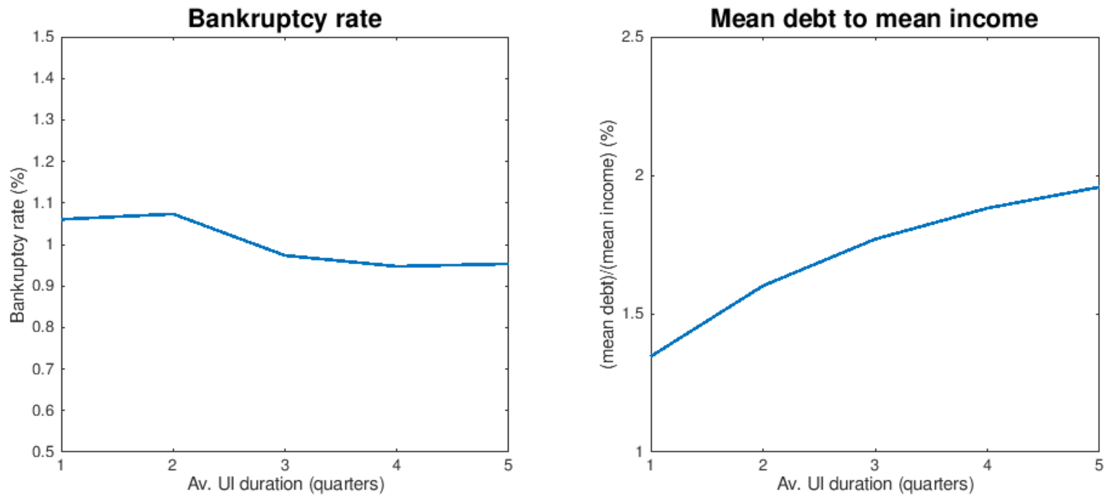


Figure 14: Steady state comparison for bankruptcy rate and mean-debt to mean-income ratio across different UI average duration (in quarters) for scenarios with and without bankruptcy.

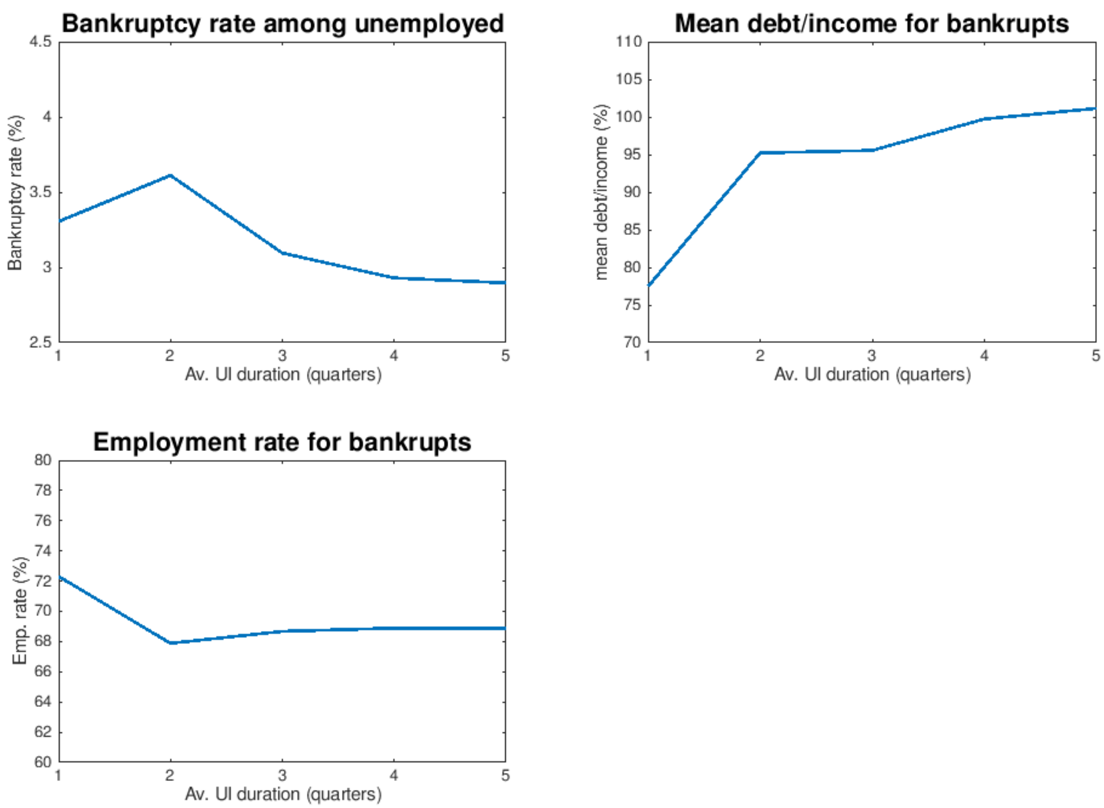


Figure 15: Steady state comparison: bankruptcy rate among unemployed, mean debt-to-income ratio and employment rate for bankruptcy filers for different values of average duration of UI benefits.

## 9.1 Tables

Table 6: Asset Exemptions (2007)

| State | Homestead | Vehicle | Retirement | Other Financial Assets | Wildcard | Federal Available |
|---|---|---|---|---|---|---|
| Alabama | 10,000 | 0 | Unlimited | 0 | 6,000 | No |
| Alaska | 67,500 | 7,500 | Unlimited | 3,500 | 0 | No |
| Arizona | 150,000 | 10,000 | Unlimited | 300 | 0 | No |
| Arkansas | Unlimited | 2,400 | 40,000 | 0 | 500 | Yes |
| California, system 1 | 75,000 | 4,600 | Unlimited | 1,825 | 0 | No |
| California, system 2 | 0 | 2,975 | Unlimited | 0 | 19,675 | No |
| Colorado | 90,000 | 6,000 | Unlimited | 0 | 0 | No |
| Connecticut | 150,000 | 3,000 | Unlimited | 0 | 2,000 | Yes |
| Delaware | 0 | 0 | Unlimited | 0 | 500 | No |
| District of Columbia | Unlimited | 5,150 | Unlimited | 0 | 17,850 | Yes |
| Florida | Unlimited | 2,000 | Unlimited | 0 | 2,000 | No |
| Georgia | 10,000 | 7,000 | Unlimited | 0 | 11,200 | No |
| Hawaii | 40,000 | 5,150 | Unlimited | 0 | 0 | Yes |
| Idaho | 50,000 | 6,000 | Unlimited | 0 | 1,600 | No |
| Illinois | 15,000 | 2,400 | Unlimited | 0 | 4,000 | No |
| Indiana | 0 | 0 | Unlimited | 0 | 20,000 | No |
| Iowa | Unlimited | 1,000 | Unlimited | 0 | 200 | No |
| Kansas | Unlimited | 40,000 | Unlimited | 0 | 0 | No |
| Kentucky | 10,000 | 5,000 | Unlimited | 0 | 2,000 | No |
| Louisiana | 25,000 | 0 | Unlimited | 0 | 0 | No |
| Maine | 70,000 | 10,000 | Unlimited | 0 | 12,800 | No |
| Maryland | 0 | 0 | Unlimited | 0 | 22,000 | No |
| Massachusetts | 1,000,000 | 1,400 | Unlimited | 1,250 | 0 | Yes |
| Michigan | 7,000 | 0 | Unlimited | 0 | 0 | No |
| Minnesota | 200,000 | 7,600 | Unlimited | 0 | 0 | Yes |
| Mississippi | 150,000 | 0 | Unlimited | 0 | 10,000 | No |
| Missouri | 15,000 | 6,000 | Unlimited | 0 | 1,250 | No |
| Montana | 200,000 | 5,000 | Unlimited | 0 | 0 | No |
| Nebraska | 12,500 | 0 | Unlimited | 0 | 0 | No |
| Nevada | 400,000 | 30,000 | 1,000,000 | 0 | 0 | No |
| New Hampshire | 200,000 | 8,000 | Unlimited | 0 | 8,000 | Yes |
| New Jersey | 0 | 0 | Unlimited | 0 | 2,000 | Yes |
| New Mexico | 60,000 | 8,000 | Unlimited | 0 | 1,000 | Yes |
| New York | 20,000 | 0 | Unlimited | 0 | 10,000 | No |
| North Carolina | 13,000 | 3,000 | Unlimited | 0 | 8,000 | No |
| North Dakota | 80,000 | 2,400 | 200,000 | 0 | 0 | No |
| Ohio | 10,000 | 2,000 | Unlimited | 800 | 800 | No |
| Oklahoma | Unlimited | 6,000 | Unlimited | 0 | 0 | No |
| Oregon | 33,000 | 3,400 | 15,000 | 15,000 | 800 | No |
| Pennsylvania | 0 | 0 | Unlimited | 0 | 600 | Yes |
| Rhode Island | 200,000 | 20,000 | Unlimited | 0 | 0 | Yes |
| South Carolina | 10,000 | 2,400 | Unlimited | 0 | 0 | No |
| South Dakota | Unlimited | 0 | 500,000 | 0 | 4,000 | No |
| Tennessee | 7,500 | 0 | Unlimited | 0 | 8,000 | No |
| Texas | Unlimited | 0 | Unlimited | 0 | 60,000 | Yes |
| Utah | 40,000 | 5,000 | Unlimited | 0 | 0 | No |
| Vermont | 150,000 | 5,000 | Unlimited | 1,400 | 8,400 | Yes |
| Virginia | 0 | 4,000 | 35,000 | 0 | 32,000 | No |
| Washington | 40,000 | 5,000 | Unlimited | 0 | 4,000 | Yes |
| West Virginia | 0 | 4,800 | Unlimited | 0 | 51,600 | No |
| Wisconsin | 40,000 | 0 | Unlimited | 2,000 | 10,000 | Yes |
| Wyoming | 20,000 | 4,800 | Unlimited | 0 | 0 | No |
| Federal | 18,500 | 5,900 | Unlimited | 0 | 20,450 | n/a |
| Averages* | 58,821 | 4,884 | 298,333 | 501 | 6,592 | 0 |

*Source:* Mahoney (2015). Note: Contemporaneous exemptions for couples filing jointly from Elias (2007). Under contemporaneous law, California residents can choose between system 1 and 2, and residents can choose federal exemptions in states where federal exemptions are available. States that did not have homestead exemptions are assigned a value of zero.
*Excludes states with unlimited or n/a exemptions.

Table 7: Homestead exemptions 1989 and 2017

| State | 1989 | 2007 | Years of change |
|---|---|---|---|
| Alabama | 5000 | 15000 | 2015 |
| Alaska | 54000 | 72900 | 1992, 1999, 2004, 2008, 2012 |
| Arizona | 100000 | 150000 | 2004 |
| Arkansas | 999999 | 999999 | |
| California | 30000 | 75000 | 1990, 2010 |
| Colorado | 20000 | 60000 | 1991, 2000, 2007 |
| Connecticut | 0 | 75000 | 1993 |
| Delaware | 0 | 125000 | 2006, 2010, 2011, 2012 |
| Florida | 999999 | 999999 | |
| Georgia | 5000 | 21500 | 2001, 2012 |
| Hawaii | 20000 | 20000 | |
| Idaho | 30000 | 100000 | 1992, 2006 |
| Illinois | 7500 | 15000 | 2006 |
| Indiana | 7500 | 17600 | 2005, 2010 |
| Iowa | 999999 | 999999 | |
| Kansas | 999999 | 999999 | |
| Kentucky | 5000 | 5000 | |
| Louisiana | 15000 | 35000 | 2000, 2009 |
| Maine | 7500 | 47500 | 1991, 2001, 2003, 2008 |
| Maryland | 0 | 23675 | 2011, 2013, 2016 |
| Massachusetts | 100000 | 500000 | 2000, 2004 |
| Michigan | 3500 | 38225 | 2005, 2008, 2011, 2017 |
| Minnesota | 999999 | 390000 | 1993, 2007, 2010, 2012 |
| Mississippi | 30000 | 75000 | 1991 |
| Missouri | 8000 | 15000 | 2003 |
| Montana | 40000 | 250000 | 1997, 2001, 2007 |
| Nebraska | 10000 | 60000 | 1997, 2007 |
| Nevada | 95000 | 550000 | 1995, 2003, 2005, 2007 |
| New Hampshire | 5000 | 100000 | 1992, 2002, 2004 |
| New Jersey | 0 | 0 | |
| New Mexico | 20000 | 60000 | 1993, 2007 |
| New York | 10000 | 75000 | 2005, 2011 |
| North Carolina | 7500 | 35000 | 1991, 2006, 2009 |
| North Dakota | 80000 | 100000 | 2009 |
| Ohio | 5000 | 132900 | 2008, 2010, 2013 |
| Oklahoma | 999999 | 999999 | |
| Oregon | 15000 | 40000 | 1993, 2006, 2009 |
| Pennsylvania | 0 | 0 | |
| Rhode Island | 0 | 500000 | 1999, 2001, 2004, 2006, 2012 |
| South Carolina | 5000 | 59100 | 2006, 2010, 2012, 2016 |
| South Dakota | 999999 | 999999 | |
| Tennessee | 5000 | 5000 | |
| Texas | 999999 | 999999 | |
| Utah | 8000 | 30000 | 1997, 1999, 2013 |
| Vermont | 30000 | 125000 | 1997, 2009 |
| Virginia | 5000 | 5000 | |
| Washington | 30000 | 125000 | 1999, 2007 |
| West Virginia | 7500 | 25000 | 1996, 2002 |
| Wisconsin | 40000 | 75000 | 2009 |
| Wyoming | 10000 | 20000 | 2012 |

*Source:* Pattison (2018) constructed from Elias, Renauer and Leonard "How to File for Bankruptcy" (1989-2013) and state statutes.

Table 8: Annual Bankruptcy Rates by States 1991-2017

| | Chapter 7 | | | | Chapter 13 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| state | mean | sd | min | max | mean | sd | min | max | N. Obs. |
| Alabama | 0.274 | 0.107 | 0.141 | 0.614 | 0.398 | 0.055 | 0.280 | 0.481 | 27 |
| Alaska | 0.133 | 0.065 | 0.043 | 0.309 | 0.016 | 0.004 | 0.009 | 0.025 | 27 |
| Arizona | 0.334 | 0.121 | 0.102 | 0.609 | 0.073 | 0.027 | 0.022 | 0.109 | 27 |
| Arkansas | 0.290 | 0.147 | 0.146 | 0.716 | 0.231 | 0.073 | 0.117 | 0.368 | 27 |
| California | 0.324 | 0.122 | 0.076 | 0.515 | 0.084 | 0.033 | 0.027 | 0.161 | 27 |
| Colorado | 0.323 | 0.158 | 0.166 | 0.849 | 0.060 | 0.017 | 0.036 | 0.102 | 27 |
| Connecticut | 0.229 | 0.078 | 0.101 | 0.382 | 0.039 | 0.009 | 0.025 | 0.060 | 27 |
| DC | 0.168 | 0.098 | 0.049 | 0.369 | 0.073 | 0.042 | 0.016 | 0.145 | 27 |
| Delaware | 0.190 | 0.062 | 0.077 | 0.348 | 0.095 | 0.034 | 0.041 | 0.173 | 27 |
| Florida | 0.277 | 0.101 | 0.087 | 0.494 | 0.092 | 0.036 | 0.035 | 0.150 | 27 |
| Georgia | 0.285 | 0.088 | 0.163 | 0.500 | 0.389 | 0.085 | 0.250 | 0.525 | 27 |
| Hawaii | 0.191 | 0.115 | 0.060 | 0.436 | 0.031 | 0.015 | 0.006 | 0.063 | 27 |
| Idaho | 0.353 | 0.153 | 0.157 | 0.738 | 0.070 | 0.030 | 0.024 | 0.117 | 27 |
| Illinois | 0.347 | 0.118 | 0.146 | 0.697 | 0.133 | 0.034 | 0.071 | 0.176 | 27 |
| Indiana | 0.457 | 0.182 | 0.224 | 1.042 | 0.126 | 0.046 | 0.050 | 0.203 | 27 |
| Iowa | 0.243 | 0.109 | 0.117 | 0.585 | 0.020 | 0.004 | 0.014 | 0.030 | 27 |
| Kansas | 0.289 | 0.133 | 0.126 | 0.692 | 0.094 | 0.018 | 0.057 | 0.123 | 27 |
| Kentucky | 0.379 | 0.140 | 0.196 | 0.812 | 0.104 | 0.024 | 0.060 | 0.141 | 27 |
| Louisiana | 0.207 | 0.121 | 0.080 | 0.545 | 0.206 | 0.046 | 0.096 | 0.257 | 27 |
| Maine | 0.204 | 0.099 | 0.074 | 0.461 | 0.026 | 0.008 | 0.016 | 0.042 | 27 |
| Maryland | 0.302 | 0.114 | 0.084 | 0.489 | 0.122 | 0.044 | 0.076 | 0.214 | 27 |
| Massachusetts | 0.198 | 0.073 | 0.076 | 0.366 | 0.045 | 0.013 | 0.029 | 0.083 | 27 |
| Michigan | 0.332 | 0.139 | 0.160 | 0.725 | 0.100 | 0.037 | 0.060 | 0.183 | 27 |
| Minnesota | 0.241 | 0.070 | 0.111 | 0.405 | 0.060 | 0.020 | 0.027 | 0.096 | 27 |
| Mississippi | 0.303 | 0.131 | 0.140 | 0.596 | 0.226 | 0.043 | 0.157 | 0.330 | 27 |
| Missouri | 0.314 | 0.126 | 0.170 | 0.743 | 0.122 | 0.026 | 0.076 | 0.178 | 27 |
| Montana | 0.242 | 0.114 | 0.101 | 0.565 | 0.038 | 0.016 | 0.017 | 0.077 | 27 |
| Nebraska | 0.249 | 0.097 | 0.135 | 0.554 | 0.076 | 0.025 | 0.035 | 0.117 | 27 |
| Nevada | 0.478 | 0.189 | 0.138 | 0.816 | 0.154 | 0.064 | 0.062 | 0.291 | 27 |
| New Hampshire | 0.241 | 0.084 | 0.095 | 0.387 | 0.038 | 0.018 | 0.018 | 0.081 | 27 |
| New Jersey | 0.260 | 0.078 | 0.091 | 0.426 | 0.111 | 0.037 | 0.066 | 0.172 | 27 |
| New Mexico | 0.255 | 0.113 | 0.109 | 0.567 | 0.039 | 0.028 | 0.013 | 0.117 | 27 |
| New York | 0.221 | 0.089 | 0.106 | 0.489 | 0.053 | 0.014 | 0.029 | 0.077 | 27 |
| North Carolina | 0.120 | 0.062 | 0.057 | 0.302 | 0.146 | 0.047 | 0.080 | 0.232 | 27 |
| North Dakota | 0.205 | 0.105 | 0.069 | 0.508 | 0.013 | 0.007 | 0.002 | 0.027 | 27 |
| Ohio | 0.371 | 0.169 | 0.191 | 0.984 | 0.110 | 0.031 | 0.070 | 0.181 | 27 |
| Oklahoma | 0.382 | 0.197 | 0.145 | 0.999 | 0.067 | 0.020 | 0.038 | 0.113 | 27 |
| Oregon | 0.356 | 0.149 | 0.157 | 0.764 | 0.086 | 0.026 | 0.048 | 0.127 | 27 |
| Pennsylvania | 0.194 | 0.095 | 0.095 | 0.485 | 0.085 | 0.029 | 0.048 | 0.147 | 27 |
| Rhode Island | 0.327 | 0.107 | 0.117 | 0.506 | 0.038 | 0.019 | 0.016 | 0.082 | 27 |
| South Carolina | 0.104 | 0.044 | 0.038 | 0.173 | 0.122 | 0.044 | 0.079 | 0.219 | 27 |
| South Dakota | 0.208 | 0.092 | 0.097 | 0.475 | 0.015 | 0.007 | 0.005 | 0.038 | 27 |
| Tennessee | 0.333 | 0.116 | 0.177 | 0.623 | 0.433 | 0.077 | 0.308 | 0.565 | 27 |
| Texas | 0.127 | 0.070 | 0.045 | 0.353 | 0.119 | 0.038 | 0.065 | 0.194 | 27 |
| Utah | 0.347 | 0.148 | 0.132 | 0.667 | 0.186 | 0.068 | 0.075 | 0.314 | 27 |
| Vermont | 0.169 | 0.079 | 0.067 | 0.363 | 0.026 | 0.014 | 0.003 | 0.055 | 27 |
| Virginia | 0.301 | 0.112 | 0.092 | 0.468 | 0.121 | 0.026 | 0.072 | 0.156 | 27 |
| Washington | 0.334 | 0.135 | 0.128 | 0.629 | 0.088 | 0.024 | 0.053 | 0.128 | 27 |
| West Virginia | 0.309 | 0.189 | 0.139 | 0.925 | 0.025 | 0.005 | 0.017 | 0.034 | 27 |
| Wisconsin | 0.288 | 0.102 | 0.148 | 0.595 | 0.067 | 0.026 | 0.023 | 0.104 | 27 |
| Wyoming | 0.268 | 0.132 | 0.104 | 0.590 | 0.026 | 0.009 | 0.013 | 0.042 | 27 |
| Total | 0.272 | 0.142 | 0.038 | 1.042 | 0.104 | 0.099 | 0.002 | 0.565 | 1377 |

Summary statistics for Consumer Bankruptcy by States constructed using bankruptcy filings data from the US Courts and population data from Census.

Table 9: Unemployment Insurance statistics 1991-2017

| | **Regular number of weeks** | | | | **Maximum weekly benefit amount** | | | | |
|---|---|---|---|---|---|---|---|---|---|
| state | mean | sd | min | max | mean | sd | min | max | N. Obs. |
| Alabama | 26 | 0 | 26 | 26 | 217.22 | 39.69 | 150 | 265 | 27 |
| Alaska | 26 | 0 | 26 | 26 | 352.67 | 65.90 | 284 | 442 | 27 |
| Arizona | 26 | 0 | 26 | 26 | 215.83 | 25.69 | 170 | 240 | 27 |
| Arkansas | 25.33 | 1.62 | 20 | 26 | 357.50 | 81.65 | 225 | 454 | 27 |
| California | 26 | 0 | 26 | 26 | 350.74 | 107.06 | 210 | 450 | 27 |
| Colorado | 26 | 0 | 26 | 26 | 400.65 | 107.90 | 234 | 570.5 | 27 |
| Connecticut | 26 | 0 | 26 | 26 | 512.48 | 118.54 | 320 | 691 | 27 |
| DC | 25.93 | 0.38 | 24 | 26 | 341.07 | 28.19 | 293 | 425 | 27 |
| Delaware | 26 | 0 | 26 | 26 | 309.72 | 31.01 | 225 | 330 | 27 |
| Florida | 23.85 | 4.47 | 12 | 26 | 266.67 | 15.50 | 225 | 275 | 27 |
| Georgia | 23.93 | 4.22 | 14 | 26 | 278.43 | 55.93 | 185 | 330 | 27 |
| Hawaii | 25.89 | 0.58 | 23 | 26 | 438.54 | 97.79 | 275 | 592 | 27 |
| Idaho | 25.74 | 1.29 | 21 | 28 | 311.30 | 58.30 | 210.5 | 410 | 27 |
| Illinois | 25.78 | 0.42 | 25 | 26 | 443.39 | 106.81 | 270 | 613 | 27 |
| Indiana | 26 | 0 | 26 | 26 | 314.41 | 85.82 | 166 | 390 | 27 |
| Iowa | 26 | 0 | 26 | 26 | 381.30 | 99.52 | 233 | 553.5 | 27 |
| Kansas | 24.81 | 3.00 | 16 | 26 | 358.41 | 85.77 | 226.5 | 474 | 27 |
| Kentucky | 26 | 0 | 26 | 26 | 338.63 | 80.28 | 204 | 431.5 | 27 |
| Louisiana | 26 | 0 | 26 | 26 | 233.70 | 33.10 | 181 | 284 | 27 |
| Maine | 26 | 0 | 26 | 26 | 439.41 | 112.62 | 288 | 621 | 27 |
| Maryland | 26 | 0 | 26 | 26 | 323.13 | 81.79 | 219 | 430 | 27 |
| Massachusetts | 28.90 | 1.71 | 26 | 30 | 762.70 | 218.40 | 423 | 1103 | 27 |
| Michigan | 24.69 | 2.51 | 20 | 26 | 333.17 | 33.94 | 276 | 362 | 27 |
| Minnesota | 26 | 0 | 26 | 26 | 470.02 | 135.37 | 262.5 | 683 | 27 |
| Mississippi | 26 | 0 | 26 | 26 | 204.81 | 26.93 | 155 | 235 | 27 |
| Missouri | 24.52 | 2.58 | 20 | 26 | 254.56 | 59.96 | 170 | 320 | 27 |
| Montana | 27.09 | 1.00 | 26 | 28 | 334.91 | 103.16 | 197 | 514 | 27 |
| Nebraska | 26 | 0 | 26 | 26 | 267.39 | 81.76 | 144.5 | 400 | 27 |
| Nevada | 26 | 0 | 26 | 26 | 324.17 | 74.52 | 206.5 | 432.5 | 27 |
| New Hampshire | 26 | 0 | 26 | 26 | 336.54 | 94.26 | 173.5 | 427 | 27 |
| New Jersey | 26 | 0 | 26 | 26 | 489.00 | 120.10 | 291 | 677 | 27 |
| New Mexico | 26 | 0 | 26 | 26 | 336.09 | 116.74 | 177 | 503 | 27 |
| New York | 26 | 0 | 26 | 26 | 371.48 | 52.44 | 270 | 427.5 | 27 |
| North Carolina | 24 | 4.62 | 12 | 26 | 379.22 | 83.37 | 245 | 522 | 27 |
| North Dakota | 26 | 0 | 26 | 26 | 365.52 | 136.19 | 202 | 631.5 | 27 |
| Ohio | 26 | 0 | 26 | 26 | 437.96 | 97.53 | 291 | 592.5 | 27 |
| Oklahoma | 26 | 0 | 26 | 26 | 328.50 | 89.76 | 204.5 | 510 | 27 |
| Oregon | 26 | 0 | 26 | 26 | 416.57 | 102.31 | 253 | 597 | 27 |
| Pennsylvania | 26 | 0 | 26 | 26 | 466.74 | 100.69 | 299 | 581 | 27 |
| Rhode Island | 26 | 0 | 26 | 26 | 556.48 | 129.36 | 345 | 707 | 27 |
| South Carolina | 24.56 | 2.55 | 20 | 26 | 274.44 | 51.70 | 180.5 | 326 | 27 |
| South Dakota | 26 | 0 | 26 | 26 | 256.89 | 72.24 | 147 | 385 | 27 |
| Tennessee | 26 | 0 | 26 | 26 | 256.39 | 45.32 | 165 | 325 | 27 |
| Texas | 26 | 0 | 26 | 26 | 342.24 | 82.84 | 224 | 493 | 27 |
| Utah | 26 | 0 | 26 | 26 | 369.35 | 96.52 | 221 | 524 | 27 |
| Vermont | 26 | 0 | 26 | 26 | 337.76 | 95.65 | 187 | 462 | 27 |
| Virginia | 26 | 0 | 26 | 26 | 302.44 | 73.56 | 198 | 378 | 27 |
| Washington | 27.33 | 1.92 | 26 | 30 | 483.48 | 123.68 | 257 | 697 | 27 |
| West Virginia | 26 | 0 | 26 | 26 | 357.87 | 60.87 | 257 | 424 | 27 |
| Wisconsin | 26 | 0 | 26 | 26 | 319.30 | 47.41 | 225 | 370 | 27 |
| Wyoming | 26 | 0 | 26 | 26 | 335.28 | 102.42 | 200 | 490 | 27 |
| Total | 25.85 | 1.58 | 12 | 30 | 357.97 | 131.32 | 144.5 | 1103 | 1377 |

Summary statistics for UI. Data comes from Farber et al. (2015) and US Department of Labor.

## 10 Targets related to earning process

In this section I describe in more detail the how the targets related to the earnings process, $(b_1, b_2, \rho_z, \sigma_\zeta)$ in equation, were calculated.