Unemployment Insurance with Consumer Bankruptcy*

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Abstract

Borrowers are subject to adverse labor income shocks, such as job loss, that are a major reason for consumer bankruptcy. I study how unemployment insurance (UI) interacts with consumer bankruptcy and the welfare implications of this interaction for optimal UI. I start by comparing bankruptcy rates for neighboring counties that belong to different states and exploit policy discontinuities at state borders to identify that more generous UI reduces bankruptcy rates. I construct a general equilibrium model of unsecured consumer credit and unemployment, calibrated to the US Chapter 7 Bankruptcy code and regular UI program. The model explains the cross-state negative relationship between bankruptcy rates and UI generosity. First, higher UI benefits reduce default risk and improve credit access, since they imply higher income during a low-income situation, which increase expected income for borrowers. Second, higher benefits encourage borrowing, increase unemployment, and require more taxes, which increase default risk. For low levels of replacement rate, the model predicts that the first effect dominates, and more UI benefits reduce default risk and interest rates and increase ex ante welfare. As UI increases, default risk increases, and welfare falls. Increasing the replacement rate above the current 50% to 55% would increase welfare by 0.5% if bankruptcy is not considered (welfare increases even beyond 60%), but with a bankruptcy option, it reduces welfare by 1.7%.

Keywords: consumer bankruptcy, unsecured credit, unemployment insurance

JEL Classification Codes: J65, K35, E21, E24, J64

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1 Introduction

Bankruptcy filers tend to be middle- to low-income individuals whose income is mostly labor income. Sullivan et al. (2000) report that 67.5% of bankruptcy filers cite employment-related income reduction as one of the main reasons for filing for bankruptcy.[1] Keys (2018) finds that households are three times more likely to file for bankruptcy in the year immediately following a job loss. Chapter 7 of the US Bankruptcy Law then enables borrowers to enjoy higher consumption in the event of adverse income shocks such as job loss. It is plausible, then, that it interacts with one of the largest social insurance program in the labor market: the unemployment insurance (UI).[2]

The interaction of bankruptcy and UI may not be only in terms of their consumption smoothing benefits, but also their cost: (i) default introduces some contingency into debt contract, but interest rates on loans increase to compensate lenders for the default risk (ii) UI pose moral hazard concerns in terms of work incentives. I consider Chapter 7 bankruptcy and UI jointly.[3] I study how Chapter 7 consumer bankruptcy affects the desirability, in terms of welfare, of different levels of unemployment insurance (UI). In particular, what are the mechanisms through which UI interacts with bankruptcy? What is the effect of UI on default risk, and equilibrium bankruptcy rate, interest rates, debt, etc.? From a welfare perspective, how does consumer bankruptcy affect the welfare implications of unemployment insurance (UI)?

Considering that the employment rate among Chapter 7 bankruptcy filers is around 73% (US Courts, 2007), i.e., most bankruptcy filers are employed, I start by providing empirical evidence that overall bankruptcy rates are lower in states with more generous UI.[4] I then construct a general equilibrium model of unsecured consumer credit with bankruptcy, as in Chapter 7, and a frictional labor market with UI that features the UI regular program in the US. The model is estimated to match key statistics of unsecured credit and labor markets, including subpopulation statistics for employed and bankrupts as well as households earning profiles over the lifecycle. I use the model to understand

[1]The focus of this paper is labor income risk. Other sources of risk, such as unexpected health expenditures, can influence bankruptcy decisions. However, Dobkin et al. (2018) find evidence that hospital admissions are responsible for only 4% to 6% percent of bankruptcies. Also, as discussed by Athreya et al. (2012), it seems unlikely that bankruptcy is the best way to deal with such events; perhaps it should be considered in the context of public health policy, such as Medicaid.

[2]The estimated annual average amount of unsecured debt discharged under Chapter 7 of the US Bankruptcy Code is around 0.92% of GDP (or $135 Bn., US Courts, BAPCPA Reports 2007-2016), which almost double the total expenditure on unemployment insurance benefits of 0.5% of GDP (BEA, 2007-2016).

[3]I build on Athreya and Simpson (2006) who first considered bankruptcy and UI in a unified framework.

[4]I follow Hsu et al. (2018) and define UI generosity as the maximum amount of UI available during a given unemployment spell.

the mechanism behind the negative correlation between bankruptcy rates and UI generosity observed in the data. I then perform policy counterfactuals consisting of steady-state comparisons of different generosity levels of UI with and without the option to file bankruptcy.

In the empirical section, I use county-level data on the total number of Chapter 7 filings and state differences in UI generosity from 1991-2007. I find that overall bankruptcy rates are negatively correlated with UI generosity. Since the same economic shock can affect both state-level UI and bankruptcy decisions, I compare neighboring counties that belong to different states and exploit policy discontinuities at the state borders to identify the effect of UI on bankruptcy. Relative to the sample mean, a 10% increase in the total amount of UI available during a given unemployment spell reduces Chapter 7 bankruptcy rate by 1.87%. This result, at the aggregate level, extend and is quatitatively consistent with the results of Fisher (2005), who, based on the Panel Study of Income Dynamics (PSID), finds that a 10% increase in UI benefits reduce filing rate by 2.2%.

I then construct a lifecycle 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. Labor frictions are modeled using a Diamond-Mortensen-Pissarides (DMP) search and matching framework. Combining an unsecured credit model with a frictional labor market model allows us to study the joint decision of borrowing, default, and labor supply while taking into account the general equilibrium effects of policy changes on these markets.[5] This combination is not trivial, since it implies taking into account the lifecycle properties of borrowing and default with the high frequency of unemployment episodes and duration of UI benefits.[6]

The model is estimated using the simulated method of moments to match key statistics regarding unsecured credit (bankruptcy rate and mean-debt to mean-income) and the labor market (the employment rate), including the subpopulations of bankruptcy filers and non-employed. Also, the labor productivity stochastic process in the model is such that when simulating a sample of households over their lifecycle, the estimated earning process in the simulated data matches the same estimated process obtained using the PSID.

I test the model by performing the policy experiment of altering the UI cap. I simulate the model for a range of values for the maximum amount of UI benefits available during an unemployment spell. For

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

[6] Lifecycle considerations are relevant for welfare purposes given that, for example, bankruptcy is mostly concentrated among young individuals, and they are more interested in borrowing against expected future higher income.

the rage of values similar to the US data across states, the model quantitatively replicates the negative relationship between bankruptcy and UI generosity. In the data, the change in the bankruptcy rate with respect to the maximum amount available is negative and statistically significant but very small. The model explains the small magnitude is because the cap is binding for prime-age middle- to high-earnings workers (relatively less likely to borrow and default). The negative correlation is because a higher cap improves expected income for a fraction of borrowers, which allows them to refinance their loans at lower inters rates (since default risk is lower). However, for levels beyond the current levels, excessive borrowing would translate into higher bankruptcy rates.

The focus of the policy experiments in this paper is the replacement rate component of the UI formula.[7] This focus is because replacement rates are more relevant to the fraction of the population that is more likely to use unsecured credit markets and bankruptcy. With bankruptcy, borrowing is costly and more for low-income young households that are more likely willing to borrow but at the same time pose higher default risk. UI can alleviate the credit distortions of bankruptcy but in a limited way. In particular, when considering replacement rates from 35% to 60%, the steady-state bankruptcy rate monotonically falls (from 1.7% to 1.1%) if the UI cap is kept. However, the overall mean-debt to mean-income ratio first increases when the replacement rate goes from 35% to 50% and then falls. Initially, a more generous UI reduces default risk and allows more debt (UI and credit access complement each other). As the replacement rate increases, more workers hit the cap, and unemployment risk and taxes increase. These effects translate into higher interest rates for loans and lower debt-to-income ratios (so higher UI can crowd out credit access). Thus, the fall in bankruptcy rate beyond 50% is more the result of credit tightening. Increasing the replacement rate for all qualifying unemployed (i.e., with a UI cap), implies higher borrowing and more bankruptcy beyond the benchmark 50% replacement rate.

For low levels of UI, the consumption smoothing benefits of increasing UI dominate, and overall ex ante welfare increases with the replacement rate. For higher levels of UI, the distortions created by extending UI spill over into the unsecured credit markets and reduce welfare. Under the benchmark calibration, increasing the replacement rate above the current 50% (to even beyond 60%) would increase welfare if bankruptcy is not considered, but with a bankruptcy option, it reduces welfare. The ability of UI to increase welfare is even more limited if we consider that all qualifying unemployed will receive the increase in benefits (i.e., not considering a cap on UI benefits).

[7] In simple terms, the replacement rate is the fraction of earning that is given as UI benefit. According to the US Department of Labor most states target a 50% replacement rate.

I also find that bankruptcy has nontrivial labor market consequences. The overall employment rate is 3.1 percentage points lower without bankruptcy. The biggest effect is on young households. Think of this exercise as a scenario in which the government can ideally enforce debt repayments. This result, on its own, is exciting and motivates further study. However, it is out of the scope of this paper, and I leave it to future research. For this paper, what is of interest is that higher interest rates, when default is possible, restrict individuals to use credit markets to smooth consumption and cause primarily young or low-productive workers to reject fewer offers in order to consume more. This result would imply lower moral hazard concerns of UI for this group.

The literature on consumer bankruptcy stresses that default implies a trade-off between the benefits of smoothing consumption across income states versus the cost of smoothing consumption over time.[8] Bankruptcy implies an expensive transfer among borrowers in which ex ante all borrowers pay higher interest rates on their loans to compensate lenders for those few that default ex post. For UI, the trade-off is between the consumption smoothing benefit and the moral hazard. When agents face idiosyncratic uninsurable unemployment shock, there is a role for UI for increasing welfare by transferring resources from the larger and higher-income group of employed workers to the smaller and lower-income group of unemployed. This benefit of the UI can be limited in the presence of a moral hazard.[9]

The main contribution of this paper is to study how the trade-offs of UI interact with bankruptcy over the lifecycle in a general equilibrium model of unsecured credit and frictional labor market. There are two key results, one positive and another normative. First, with bankruptcy, UI has additional benefits and costs in terms of consumption smoothing, which translates into welfare, and it depends on the level of UI which one dominates. Second, from a normative perspective, in an environment where increasing the level of UI beyond the current levels of replacement rates is welfare improving without bankruptcy, adding a bankruptcy option makes the increase of UI welfare reducing. This results contrast with Chetty (2008) that the optimal UI benefit level exceeds 50% replacement rate and that this result is robust since it does not require structural estimation of primitives. Chetty (2008) acknowledge that an important caveat to his policy conclusion is that it does not consider other

[8] I build on the quantitative literature on personal bankruptcy such as Athreya (2002), Chatterjee et al. (2007), and Livshits et al. (2007). See also Livshits (2015) for a recent survey and Gordon (2017) for recent work on optimal bankruptcy policy. This approach shares the same flavor of Eaton and Gersovitz (1981) sovereign default model. For more theoretical treatments of default, see Zame (1993) and Dubey et al. (2005)

[9] The literature on optimal UI is vast. I build on the literature that uses calibrated structural models such as Hansen and Imrohoroglu (1992), Young (2004), Krusell et al. (2010), Mitman and Rabinovich (2015), Koehne and Kuhn (2015), and Michelacci and Ruffo (2015).

types of policy instruments to resolve credit and insurance market failures.[10]

I follow Athreya and Simpson (2006) who first considered bankruptcy and UI jointly. I build on the work of Krusell et al. (2010) and Nakajima (2012) who incorporated a Diamond-Mortensen-Pissarides (DMP) search and matching framework into an incomplete market model with risk adverse heterogeneous agents. I include unsecured credit and bankruptcy with competitive lending similar in spirit to Athreya et al. (2018), but I focus on Chapter 7 bankruptcy. UI is modeled as adapted version of work done by Hansen and Imrohoroglu (1992) and Krusell et al. (2017).

I contribute to the literature on the interaction between consumer bankruptcy policy and explicit forms of insurance, such as the work of Athreya (2003), Athreya and Simpson (2006), Athreya (2008), and Mahoney (2015). Athreya and Simpson (2006) study bankruptcy and UI in a partial equilibrium infinite horizon model. Their model predicts that higher replacement rates necessarily imply more bankruptcy. This prediction is inconsistent with the county-level evidence presented here and also the study by Fisher (2005). In a general equilibrium framework, I consider how labor outcomes (at the individual and aggregate level) resulting from changes in the UI directly affect interest rates on loans, and therefore, credit access for different workers across age, employment status, and labor productivity.[11] The option of bankruptcy is particularly costly for young or low productive workers in the sense that they face higher interest rates.[12] The distortion of bankruptcy also implies that the moral hazard concerns of UI would be lower for credit-constrained workers.[13]

This paper is also related to the literature on the interaction between credit and labor markets, such as the study by Herkenhoff (2014), Athreya et al. (2015), Bethune et al. (2015), Bethune (2017), Kehoe et al. (2019), and Braxton et al. (2019). The closest is Braxton et al. (2019); they focus on the role of aggregate public insurance in sustaining access to credit markets among the unemployed when adverse selection may limit credit access and the implications of credit access for the optimal provision of overall public insurance. Their focus is not on the interaction of bankruptcy and the trade-off implied by the UI, so they do not consider labor supply decisions and the cost of UI in terms

[10] Chetty (2008)'s result, even nowadays, is still commonly found in this literature (See Schmieder and von Wachter (2016) for a recent survey)

[11] Athreya et al. (2018) consider individual labor supply decisions into loan prices, but they do not consider aggregate effects, and they do not study UI.

[12] In this environment, this is because young or low productive are more likely to borrow against higher expected earning but also pose higher default risk.

[13] Michelacci and Ruffo (2015) also argue lower moral hazard concerns about young people. However, their argument is the human capital depreciation (or non-accumulation) during unemployment spells. Chetty (2008) provides empirical evidence that the moral hazard is low for the UI current levels.

of moral hazard.

I also contribute to the literature on the implications of consumer bankruptcy for labor market outcomes, e.g., Han and Li (2007), Herkenhoff et al. (2016), Chen and Zhao (2017), and Corbae and Glover (2019). In particular, Chen and Zhao (2017) study the effect of personal bankruptcy on individual labor supply in an infinite horizon setup. They study both Chapter 7 and Chapter 13 in a partial equilibrium. I focus on Chapter 7 and the labor supply response at the extensive margin. I study the overall effect of removing Chapter 7 bankruptcy on aggregate employment over the lifecycle.

The empirical section of the paper contributes to the literature that empirically studies the relationship of labor market policy to households' financial outcomes, such as Fisher (2005), Angel and Heitzmann (2015), Hsu et al. (2018), Legal-Canisá (2019a), and Arslan et al. (2019). Fisher (2005) finds that higher UI benefits reduce the probability of filing for bankruptcy. Fisher uses individual data from the PSID. The study's limitation is that the total number of bankruptcy filers is low (196 cases). A natural question is whether this result holds at some level of aggregation. I extend this result by finding that Chapter 7 and UI are also negatively correlated when considering the total bankruptcy filings at the county-level.[14]

2 Empirical Evidence of Unemployment Insurance and Bankruptcy

As previously mentioned, Chapter 7 of the US Bankruptcy Law can be seen as a large public program that allows higher consumption at the expense of debt repayment in the event of low labor income, such as periods of unemployment. It is plausible, then, that it overlaps one of the largest social insurance program in the labor market: the unemployment insurance (UI). In this section, I show evidence of this hypothesis and find that this overlap is empirically relevant, at the aggregate level, in the sense that bankruptcy rates are significantly lower in states with more generous UI.

Theoretically, more generous UI can be negatively related to bankruptcy rates. Ceteris paribus, higher UI benefits could reduce the use of bankruptcy, since this implies higher income in a low-income state, which would represent an additional benefit for the UI. However, ex ante, higher UI benefits can encourage risk taking, higher borrowing, and potentially, more default. Also, given the

[14] Also, probably due to sample limitations, Fisher (2005) does not discriminate between Chapter 7 and Chapter 13 bankruptcy. At the county level, the correlation between Chapter 13 rates and UI generosity is positive. The main difference between these types of filers is that Chapter 13 filers are subject to a repayment plan and are more likely to have higher home equity. Legal-Canisá (2019b) studies the role of UI in the composition of personal bankruptcy.

role of unemployment risk for bankruptcy decisions, one may ask if this is the result of insufficient 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 (employed workers) to a relatively smaller and lower-income group (the unemployed).

In this section, I show that the data support this theoretical connection in the sense that bankruptcy rates are negatively correlated with the generosity level of UI. In particular, Chapter 7 bankruptcy rates tend to be lower in counties that belong to states with more generous UI (in terms of the maximum amount available during an unemployment spell). I interpret this result as evidence that Chapter 7 bankruptcy and UI are, at the aggregate level, substitute programs. This evidence motivates and provides empirical support to the study of the interaction between these two programs. This result, at the aggregate level, is consistent with the result of Fisher (2005), who, based on the PSID, finds that higher UI benefits reduce the probability of filing for bankruptcy. A concern about Fisher (2005)'s study is that the total number of bankruptcy filers in the PSID is low (196 cases in this case). The aggregate result presented here complements his result.

I start with a short description of the institutional aspects of bankruptcy and UI.[15] Next, I describe the data sources and provide summary statistics of the main variables that I later use in the empirical analysis.

2.1 Institutional Background

2.1.1 Overview of Consumer Bankruptcy in the US

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. I focus on Chapter 7 since it represents around 70% of all consumer bankruptcies. Under this chapter, debtors obtain the full discharge of their total qualifying unsecured debts, and their current and future earnings are protected from any debt collection action.[16] Chapter 7 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).

[15] See the appendix for more details regarding the institutional aspects concerning to bankruptcy and UI.

[16] Some debts such as alimony, student loans, and most tax debts cannot be discharged.

The Bankruptcy Abuse Prevention and Consumer Protection Act of 2005 (BAPCPA), sometimes referred to as the New Bankruptcy Law, was the last significant change to the US Bankruptcy Code. BAPCPA was the result of the expansion in consumer bankruptcy filings during the '80s and early 2000s. Two main changes introduced by BAPCPA were the introduction of means-tests to Chapter 7 and more complicated paperwork requirements that resulted in higher court and legal fees (50% increase on average, from $921 to $1,377 U.S.GAO (2008))

The introduction of means-tests did not play a major role in explaining the decline in Chapter 7 bankruptcy after BAPCPA and higher fees played a prominent role (Albanesi and Nosal (2018)). This result is consistent with the idea that the stated means-test is not binding. Note that, in order to qualify directly for Chapter 7, filers' income should be below their state median income for a household of their size. If not, the means-testing provision requires the filer's disposable income to be calculated. A filer will not pass the means test if her/his disposable income is beyond a certain threshold. Using administrative data from the US Courts (2007), I find that 99% pass the means test. For these reasons, in the model developed in Section 3, I abstract from means-tests.

2.1.2 Overview of Unemployment Insurance in the US

The federal-state UI programs provide temporary income benefits to workers who lose their job. The number of workers covered by UI represents around 90% of the civilian labor force (employed plus unemployed workers).[17] These programs include Regular Unemployment Compensation (UC), the permanent Extended Benefits (EB), and the temporary Emergency Unemployment Compensation (EUC08). The EB is implemented during periods of high unemployment, and the EUC08 were extensions in benefits implemented during the Great Recession.

This paper focuses on the regular UC for two reasons. First, the theoretical tradeoff explained before is focused in a steady-state environment. Second, the empirical analysis is more challenging when considering EB since this part of the policy change is in response to the unemployment rate, which in turn is the result of changes in economic underlying conditions, posing serious endogeneity concerns.

As shown in Table 9 in the appendix, under the Regular UI program most states have 26 weeks as the maximum number of weeks that UI benefits can be collected, so there is not much variation under

[17] U.S. Department of Labor: https://oui.doleta.gov/unemploy/data_summary/DataSum.asp

this measure. 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 dollar amount of weekly benefits.

2.2 Data Sources

The empirical analysis of the relationship between unemployment insurance and Chapter 7 bankruptcy is done by considering a sample of U.S. counties from 1991-2007. In line with the theoretical framework of Section 3 and the empirical challenges described in sub-section 2.3, I focus on UI under the regular program (UC), not the extended benefits that are triggered during periods of high unemployment.[18] In what follows, I describe the sources of the main variables used in the empirical analysis.

The data on annual county-level Chapter 7 bankruptcy rates comes from US Courts records. I updated the data provided by Keys (2018). The data for state-level UI comes from different issues of the "Significant Provisions of State UI Laws" of the US Department of Labor. These publications contain records on the maximum number of weeks and the maximum weekly benefit amount (WBA) that is available under the regular UI.[19] I follow Hsu et al. (2018) by defining UI generosity in a given state as the maximum amount of benefits available during an unemployment spell (i.e., the maximum number of weeks times maximum weekly benefit amount). These reports are available twice a year, for January and July. Since the data on bankruptcy is available at an annual frequency, I use the average to compute the UI values for a given year.[20]

Data on state-level homestead exemption levels comes from Pattison (2018). The county unemployment rate comes from the Local Area Unemployment Statistics (LAUS) from the Bureau of Labor Statistics. County-level income comes from the Bureau of Economic Analysis (BEA) website.

Comparative sample statistics. For the empirical analysis of the next sub-section, I use only neighboring counties pairs that belong to different states. The total number of counties used 1,136, which represents around 36% of the total number of counties in the mainland US and contains almost one third of the population.

A concern with the bordering-counties specification is that this sample may not contain the same information as the all-counties sample. Table 1 shows some statistics from both samples. Both samples are quite similar in terms of the variables of interest that are later used in the empirical exercise, which

[18]For the same reason, the sample goes up to the year 2007 which excludes the Great Recession and post slow recovery.

[19]Available at `https://oui.doleta.gov/unemploy/statelaws.asp`

[20]This is different from Hsu et al. (2018) that use only the values contained in the July report (though it is unlikely that these small differences would make much difference).

mitigates the potential concern about the information cost of reducing the number of counties. As can be seen in the table, most of the variation in our measure of UI generosity comes from the maximum weekly benefit amount.

Table 1: Comparative sample statistics

	All counties				
	Mean	Std. Dev.	25th perc.	Median	75th perc.
Chap. 7 BK rate (%)	0.267, 0.309*	0.18	0.14	0.23	0.36
Max. num. of weeks	26.05	0.43	26.00	26.00	26.00
Max. WBA	290.71	81.95	230.50	279.50	337.00
Max. Benefits	7,580	2,188	5,993	7,280	8,775
Unemp. Rate (%)	5.74	2.72	3.90	5.20	6.90
Income	2,588,422	9,758,054	216,688	514,524	1,422,771
	Bordering counties				
Chap. 7 BK rate (%)	0.271, 0.313*	0.18	0.14	0.23	0.36
Max. num. of weeks	26.06	0.46	26.00	26.00	26.00
Max. WBA	290.95	86.48	230.00	276.00	339.00
Max. Benefits	7,592	2,326	5,980	7,202	8,827
Unemp. Rate (%)	5.74	2.65	3.90	5.20	7.00
Income	2,503,086	8,862,479	206,564	518,677	1,420,862

*First value of mean is unweighted, the second is the population weighted mean. The data on annual county-level Chapter 7 bankruptcy rates comes from US Courts records. I updated the data provided by Keys (2018). The data for state-level UI comes from different issues of the "Significant Provisions of State UI Laws" of the US Department of Labor. Data on state-level homestead exemption levels comes from Pattison (2018). The county unemployment rate comes from the Local Area Unemployment Statistics (LAUS) from the Bureau of Labor Statistics. County-level income comes from the Bureau of Economic Analysis (BEA) website.

2.3 Empirical Analysis

I proceed to study the empirical relationship between UI and bankruptcy rates. I show that the bankruptcy rate is significantly negatively correlated with UI generosity. I run two regressions of the Chapter 7 county bankruptcy rate on UI benefits from 1991-2007. Using all counties and exploiting the variation in UI policy across states represents a daunting task since states are different in many dimensions and these relative differences evolve differently over time. Using all counties then pose severe challenges to the estimation of the effect of policy difference on the outcomes of interest. As discussed in Dube et al. (2010), using all counties raises an endogeneity concern since UI policy is determined at the state level and may well depend on state economic or political conditions that can also influence bankruptcy.

I addressed this concern by considering a sample of neighboring counties that belong to different states and exploit the discontinuity of UI policy at the border (see for example Dube et al. (2010) and Hagedorn et al. (2019)). Neighboring counties constitute better control groups under the assumption that the state-level shock does not stop at the border and affect county-pairs symmetrically. Also, since the policy is determined at the state level, it is regarded as exogenous from the county-pair perspective.

I follow Hsu et al. (2018) and define UI generosity as the total amount of benefits that is available under the regular UI program during a given unemployment spell (in particular, log(# of weeks $\times$ max WBA)). Consistent with the steady-state equilibrium model developed in the next section, I focus only on the regular UI program since the extended benefits are available only during periods of high unemployment (which in turns worsen the endogeneity concern).

As explained in Dube et al. (2010), considering all counties can be misleading since states are very different in terms of observables and unobservables both in levels and how they evolve over time. Using county fixed effects controls for any heterogeneity as long as it is constant over time. However, changes in underlying state conditions can influence both UI and bankruptcy; a regression using all counties would erroneously attribute changes in bankruptcy to changes in UI because it omits these controlling for such underlying changes.

To control for changes in underlying state-level conditions that may drive both UI and bankruptcy, I examine the difference in UI generosity between bordering counties that belong to different states with different levels of UI (since UI is determined at the state level). I refer to such counties as county-pairs (see for example Dube et al. (2010) and Hagedorn et al. (2019)). The basic idea is that state-level changes in underlying conditions do not stop at the border and affect neighboring counties symmetrically. Also, bordering counties are similar in terms of geography, climate, labor market conditions, routes, etc., so it is more plausible that unobserved heterogeneity between contiguous counties evolves similarly, making them a better control group. Then, the discontinuity of the UI policy at the border can be exploited to identify if differences in UI across county-pairs are associated with differences in bankruptcy rates. The identifying assumption for the border-discontinuity specification is that, conditional on covariates and county fixed effects, within pair differences in the generosity of UI are uncorrelated with the differences in the residual bankruptcy rate in either county, i.e., shocks affect the counties on the two sides of the state border similarly. For this exercise, I estimate the following regression:

$$BK_{cpt} = \alpha + \eta \ln(\max UI_{s(c)t}) + \phi_c + \tau_{pt} + X_{ct} + \varepsilon_{cpt} \tag{1}$$

Here BK_{cpt} represents the Chapter 7 bankruptcy percentage rate in county c belonging to pair p at time t. $\ln(\max UI_{s(c)t})$ represents the measure of UI generosity for county c that belongs to state s. The term ϕ_c represents a county fixed effect that controls for observables/unobservables characteristics that are constant over time. The variables τ_{pt} is a pair-specific time fixed effect that controls for changes in state-level underlying conditions, which is a key element in the identifying assumption of this setup.[21] To control for time-varying differences that are observed, X_{ct} includes county-level unemployment rate and income as well as the state-level home exception.

Standard errors are two-way clustered at the state level and at the border segment.[22] First, UI is constant across counties within a state. Second, each county is repeated as many times as it can be paired with a neighboring county in the other state. As explained in Dube et al. (2010), the presence of a single county in more than one pair induces a mechanical correlation across county-pairs and potentially across the entire border segment. In addition, all standard errors are corrected for heteroskedasticity. Column 2 in Table 2 shows the regression results.

Table 2: The effect of UI on Chapter 7 consumer bankruptcy (1991-2007)

	Chapter 7 bankruptcy rate
	Bordering counties
$\ln(\max UI_{s(c)t})$	-0.0614**
	(0.027)
$Unempl.rate_{c,t}$	Y
$\log(income_{c,t})$	Y
log(state home exemption)	Y
County FE	Y
Pair-specific time FE	Y
N. Obs.	35,226

$\ln(\max UI_{s(c)t}) = \ln(\max \#$ of weeks $\times$ max. WBA). Standard errors are in parentheses and two-way clustered at the state and border segment. All monetary values are in 2017 dollars. Significance levels: *10%, **5%, ***1%.

[21] More specifically, the comparison is between bordering counties at a given point in time in which county-level variables were demeaned by their average.

[22] A border segment is defined as the set of all counties on both sides of a border between two states.

For the bordering counties considered, there is a statistically significant negative correlation between UI benefits on Chapter 7 bankruptcy rates. In particular, a 10% increase in the generosity of UI decreases Chapter 7 bankruptcy rate by 1.87% for an average base rate of 0.31% bankruptcy rate.

A common concern in this methodology is the spillover associated with the fact that workers in the low UI benefit state can commute to the higher UI benefit state (the effect of the policy is not concentrated on one side of the border). However, for the problem addressed in this paper I argue that this is not a concern given the fact that a worker receives the UI benefit from the state where she/he was laid off but has to file for bankruptcy in the state of residence. Assuming it is true that higher UI reduces the probability of filing for bankruptcy; if some workers from the relatively-low UI state are commuting to the high UI state, this may also reduce bankruptcy filings in the lower UI state which would actually attenuate the differences in bankruptcy across county-pairs.

3 Theoretical framework

Theoretically, the negative correlation of bankruptcy and UI may reflect lower default risk because UI is transferring resources from a bigger group with relatively higher income (employed) to a smaller group with relatively lower income and higher default risk (unemployed). However, ex ante, higher UI can promote borrowing and, as it is typically studied in the UI literature, more generous UI may lead to higher unemployment risk and more taxes, which may increase default risk. Nevertheless, if we consider that lenders price loans based on their default risk, higher default risk from a more generous UI may lead to credit rationing reducing the amount of debt. This situation would lead to a lower default rate, but as the result of lower debt, not as the result of the additional income from the UI.

Motivated by the results in Section 2, I develop a model that helps us rationalize the underlying mechanisms connecting UI to bankruptcy rates. The model allows us to evaluate which of the different theoretical mechanisms quantitatively dominates as well as the welfare implications of bankruptcy for UI for the US economy as a whole.

3.1 Model environment

I consider a lifecycle incomplete market model with heterogenous agents à la Aiyagari (1994) extended to include a frictional labor market and default in unsecured consumer credit.[23] Time is discrete; the economy runs forever and is composed of households, firms, financial intermediaries, and the government.

3.2 Labor Market

Labor market frictions are modeled as an extended version of the search and matching framework of Diamond-Mortensen-Pissarides. Risk-averse workers differ on their labor productivity, ε, and whether they are matched with a firm. I denote the match 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, $\eta \in (0, 1)$ is the elasticity of new matches with respect to unemployment and χ 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 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, κ, 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 is left of the firm's current period revenue after capital rental payment. In every period, a worker with a job offer (matched worker) decides if she/he accepts the job offer or not at the negotiated wage (wages are determined in every period as well). At the end of each period, employed workers can exogenously be separated with probability γ^s.

3.3 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

[23] The lifecycle framework is particularly relevant in light of 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 and 34, and around 30% between 35 and 44. These facts highlight the important lifecycle component in the use of credit and bankruptcy to smooth consumption.

the UI qualification status. UI recipients keep their benefits with probability π_k next period such that UI benefits are collected on average for two quarters.[24] Unemployed workers not qualifying for UI receive social benefits, z, to ensure an income floor.

The following formula determines the amount of UI benefits,

$$b(\varepsilon) = \max\left\{\min\left(\theta_R \times w_p(\varepsilon), C_{UI}\right), z\right\} \tag{2}$$

where θ_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 the maximum amount of UI benefits available in a given period.[25]

Retired workers receive social security benefits, z_R, that is equal to 34% of averages earnings in the economy.[26] Labor income taxes, τ, are levied on employed workers. The total amount of taxes collected finances the UI benefits plus the social benefit programs for unemployed and retirees.

Moral hazard. In principle, moral hazard concerns regarding UI can come from workers rejecting job offers or job-searching behavior by unemployed workers without a job offer. As explained in Hansen and Imrohoroglu (1992), it is more likely that it is easier for the government to monitor search efforts while unemployed. In this sense, I abstract from search intensity and consider job rejections only as a source of moral hazard while assuming that the government does not monitor job rejection decisions. Another way to interpret these assumptions is that (in the background) the government can only monitor search behavior and that unemployed search just enough to be eligible to receive UI.

3.4 Credit Market and Financial Intermediaries

The 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.[27] Financial intermediaries trade with households one period non-contingent defaultable discount

[24] This modeling choice is a simplified 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.

[25] States vary in how they calculate the amount of UI benefits. According to the US Department of Labor website, most formulas consider that around 50% of the unemployed worker's earnings over a recent 52-week period to be replaced (up to a maximum weekly benefit amount).

[26] I calculate this replacement rate by dividing the average Social Security Retirement benefits available on the Social Security Administration website.

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

assets with face value $a' \in \mathcal{A}$.[28] 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 intermediary holds a sufficiently large number of loans of any given size, and there is a continuum of agents, so by a law of large number, realized profits are also equal to zero.[29] Financial intermediaries incur a transaction cost ι that is proportional to the loan size.[30]

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 worker and $q_t^U(a', \boldsymbol{e})$ for an unemployed worker. 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

$$\begin{aligned} q_t^W(a', \boldsymbol{\varepsilon}) &= \varphi_t \mathbb{E}_{\varepsilon'|\varepsilon} \left[(1-\gamma^s) p_{t+1}^M(a', \boldsymbol{\varepsilon}') + \gamma^s p_{t+1}^N(a', \boldsymbol{\varepsilon}') \right] / (1+r+\iota) \\ q_t^U(a', \boldsymbol{\varepsilon}) &= \varphi_t \mathbb{E}_{\varepsilon'|\varepsilon} \left[\gamma^m p_{t+1}^M(a', \boldsymbol{\varepsilon}') + (1-\gamma^m)(\pi_k p_{t+1}^N(a', \boldsymbol{\varepsilon}') + (1-\pi_k) p_{t+1}^S(a', \boldsymbol{\varepsilon}')) \right] / (1+r+\iota) \\ q_t^S(a', \boldsymbol{\varepsilon}) &= \varphi_t \mathbb{E}_{\varepsilon'|\varepsilon} \left[\gamma^m p_{t+1}^M(a', \boldsymbol{\varepsilon}') + (1-\gamma^m) p_{t+1}^S(a', \boldsymbol{\varepsilon}') \right] / (1+r+\iota) \end{aligned} \tag{3}$$

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's repayment decisions 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, γ^s. For an unemployed worker, it takes into account the

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

[29] Also, financial intermediaries absorb losses and gains resulting from deaths.

[30] Livshits (2015) argue that this is necessary to match the gap between 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. Also, if the unemployed worker is currently qualifying for UI, the loan price includes the probability of keeping the UI benefits if she reminds without a job.

3.5 Bankruptcy policy

Default is modeled as Chapter 7 of the United States Bankruptcy Code following the institutional background described in Section 2.1.1 and as it is standard in the literature. In the model, the government allows households to default on their debt by filing for bankruptcy in which case their current asset 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, (Δ_W, Δ_U, Δ_S), for employed, unemployed with UI, and unemployed collecting social benefits. These fees are set to zero if they would imply negative consumption. This assumption captures the fact that these fees are waived in some cases for individuals with low income. Bankruptcy cost also includes a direct utility cost, λ, which represents other explicit and implicit costs associated with default not explicitly modeled.

3.6 Households

Households are born into the model at the age of 22, and they work for 44 years, then retire on they turn 66 years old, and live for 21 years as a 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 the 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,

$$\log \varepsilon_t = a_0 t + a_1 t + a_2 t^2 + u_t, \tag{4}$$

$$u_t = \rho_u u_{t-1} + \xi_t, \tag{5}$$

$$\xi_t \sim \mathcal{N}(0, \sigma_\xi^2). \tag{6}$$

So labor efficiency is the sum of a deterministic component and a stochastic one. The deterministic component is a quadratic trend on the worker's age that captures experience gains across the worker's 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 lifetime 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 from 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, λ, which as explained before, includes the social stigma of being a defaulter.[31]

3.7 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 6 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.

[31] 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.

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

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

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 first 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,

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

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

Let w^* be the equilibrium wage. 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

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

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

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

3.8 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 firm's perspective, the value of being matched with a worker is either $\hat{F}_t(\varepsilon|w = w^*)$ or zero if the worker rejects 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, κ. New matches happen at the end of the period, so production will start in the next period if the worker accepts 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 $J^V = 0$.

Wages determination: For the current setup, wages are determined by the an splitting rule between the worker and the firm. In particular, worker's wage will be a fraction of the firm pre-wage-payment current profit, $w = \omega \times \left(k^{\alpha}\varepsilon^{1-\alpha} - rk\right)$, where ω is the worker's share.

3.9 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.

4 Calibration and Estimation

The model period is set to 1 quarter so that the model can capture the high frequency of unemployment events and the period over which regular UI is available (26 weeks, o 2 quarters, in most states).[32]

[32] For example, the postwar average unemployment duration is more than 4 months.

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

4.1 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, ι, is set such that it implies a 3% annual rate (Athreya et al. (2018)).

In the model, average quarterly earning is normalized to 1 and represents \$16,266 in 2007 dollars. This latter value corresponds to the average households' earning in the PSID sample used to construct the targets related to earnings (and explained later).[33]

The UI replacement rate, θ_R, is set to 0.50 replicating what most states target in their benefits formulas (US Department of Labor). In 2007, the population-weighted average of the maximum weekly amount of UI benefits across states was \$407.40. The UI cap, C_{UI}, was then set to \$407.4*13/16,266 ≈ 0.33 per quarter.

Unemployed households not receiving UI receive social benefits—i.e., the income floor—that are set to match the average household monthly transfer from the Supplemental Nutrition Assistance Program (SNAP), which was \$216.10 in 2007, as reported by the US Department of Agriculture. Thus the income floor, z, was set to 0.04. According to the Social Security Administration, the average monthly Social Security Retirement benefit in 2007 was \$1,100 (including spouse and children), so the retirement social security benefit in the model is $z_r = 0.2$.

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

The level of assets in the model represents the household's net worth. As explained by Livshits

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

(2015), negative net worth is the most natural measure of households' indebtedness, which I consider to be more relevant than using revolving credit when focusing on bankruptcy. This is because almost 90% of filers under Chapter 7 have a negative net worth (Administrative Office of US Courts, 2007). 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%. Also, if it were possible to measure the value of exemptions, most likely all bankrupts would have a negative net worth; 99% of filers estimate that no assets would be available for liquidation (Administrative Office of US Courts, 2007).

According to the U.S.GAO (2008), average attorneys' fees for Chapter 7 bankruptcy in 2007 were \$1,078 and the filing fee was \$299, so the total pecuniary cost of filing was \$1,377. I then set $\Delta_W = 0.085$. Considering that these fees can be waived in case of very low income, Δ_U and Δ_S are set to 50% and 25% of Δ_W, respectively. Also, any of these fees are set to zero if that implies a negative level of consumption. Table 3 summarizes the calibrated parameters.

Table 3: Summary of parameters determined independently

Parameter	Description	Value	Source
σ	Coefficient of relative risk aversion	2.0	Standard in the literature
r	Risk-free interest rate (quarterly)	0.373%	Athreya et al. (2018)
ι	Transaction cost for loans (quarterly)	0.742%	Athreya et al. (2018)
θ_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	Social Security retirement benefits	0.20	Social Security Administration
γ^s	Job separation rate (quarterly)	0.06	Shimer (2012)
η	Matching elasticity with respect to unemployment	0.72	Shimer (2005)
Δ_W	Filing fee	0.085	U.S.GAO (2008)
α	Capital share	0.33	Standard in the literature

Set of parameters for which values can either be observed directly in the data or are based on the literature. All monetary values are in 2007 dollars and normalized by average quarterly earning.

4.2 Estimated parameters

In the second stage, the remaining 9 parameters, represented by θ in Equation 7 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

$$\min_{\theta \in \Theta} [M - m(\theta)]' W [M - m(\theta)], \tag{7}$$

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 differ in magnitude), so the estimator minimizes the percentage deviation between data and model moments.

The estimated parameters contained in θ are:

- Utility cost of default: λ
- Disutility from working parameter: ϕ
- Discount factor: β
- Matching efficiency parameter: χ
- 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 labor productivity: ρ_u, σ_ξ

4.2.1 Targeted moments

The first set of targeted moments contains some key statistics of the unsecured credit and labor markets, and the second set contains moments that capture the evolution of households' earnings over the lifecycle. The first set of moments are as follows:

- 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 in which a household is categorized as employed if either the head of the household or the spouse or both are employed. Only households in which the head is between 22 and 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 subpopulation of bankrupts is 110% (US Courts, 2007).

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

- Annual employment rate among Chapter 7 bankruptcy filers of 73% (US Courts, 2007).[34]

The set of moments related to the earning process are calculated using data from the PSID from Heathcote et al. (2010) and ranges from 1967 to 2002. This data set has been cleaned and processed such that missing or miscoded observations are dropped, top-coded values are extrapolated using a Pareto distribution, observations with implausible consumption levels or earnings are dropped (e.g., positive labor earnings with zero hours worked), and wage rates below half of the prevailing federal minimum wage.

In this sample, I calculate total household annual earnings as the sum of earnings of the head of the household and his wife.[35] All monetary values are expressed in 2007 dollars. I restrict the sample to households in which the head is between 22 and 65 years old and in which the combined number of hours worked is above 260. In the data, I assume that the household earning process is the sum of a deterministic component that depends on age and a stochastic component of the following form:

$$\begin{aligned} \log w_{i,t} &= b_0 + b_1 t + b_2 t^2 + z_{i,t} \\ z_{i,t} &= \rho_z z_{i,t-1} + \zeta_{i,t} \\ \zeta_{i,t} &\sim \mathcal{N}(0, \sigma_\zeta^2). \end{aligned} \tag{8}$$

The age coefficients (b_0, b_1, b_2) are obtained using ordinary least squares. The shock process parameters (ρ_z, σ_ζ) 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 by Heathcote et al. (2010), the second-order autocovariance is used, because 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 the log of annual household earnings in the PSID sample: $(b_1, b_2) = (0.14, -0.0016)$.

[34] Note that there are no demographic characteristics in this sample, so I cannot constrain the sample for ages 22 to 65 years old. To get a proxy of the working-age population to calculate employment rate. I only consider those filers who (i) are not receiving a pension or, (ii) if receiving a pension, also have positive labor income.

[35] When a woman is the head of the household (i.e., there is no husband), I consider her earnings.

- The persistence parameter of the residual of log earning, $\rho_z = 0.83$.

- The standard deviation of the i.i.d. shock to the residual log earnings, $\sigma_\zeta = 0.41$.

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

Importantly, since wages are endogenous in the model, the coefficients of the quadratic age trend in the labor efficiency are estimated such that the model delivers a hump-shaped earning profile over the lifecycle by matching (b_1, b_2). In particular, for each set of parameters, I simulate a sample of 10,000 households over their entire lifecycle, store the simulated annual earnings, and repeat the same estimation procedure used with the PSID data to estimate $(b_0, b_1, b_2, \rho_z, \sigma_\zeta)$.

The estimated parameters are obtained by minimizing Equation 7. The discrete nature to default and job acceptance decision as well as the discretization of labor efficiency, translate into nonmonotonicities of the targeted moments that create local minima and require the use of a global optimizer. The estimated parameter values are listed in Table 4.

Table 4: Jointly estimated parameters

Parameter		Value
Utility cost of default	λ	2.71
Discount factor	β	0.95
Disutility from working	ϕ	-0.45
Matching efficiency	χ	0.89
Intercept in ϵ age trend	a_0	-2.67
Linear coef. in ϵ age trend	a_1	0.0741
Quadratic coef. in ϵ age trend	a_2	-0.00144
Autocorrelation of u_t	ρ_u	0.961
Std. Dev. of ξ_t	σ_ξ	0.227

Table 4: Estimated parameters by SMM.

As standard in the bankruptcy literature, λ and β are more related to the moments related to the unsecured credit, i.e., debt-to-income and bankruptcy rates. Employment rates moments will be more informative for ϕ and χ. The probability of receiving a job offer is determined by χ which is in this model is not the same as the job-finding probability, the latter also depends on ϕ, i.e., in this model the job-finding probability is the probability of being match with a firm where the worker will accept to work.

The subpopulation statistics as targeted moments are a novel component in disciplining the parameters. Of particular interest is the employment rate among bankruptcy filers. Matching the employment composition of bankruptcy filers is related to a lower value of *phi*, a parameter that also determines the degree of moral hazard. Since bankruptcy filers tend to be young people, this is informative that the moral hazard concern of UI for young people is lower than for old. This result is consistent with the point made by Michelacci and Ruffo (2015) about optimal UI over the lifecycle with the argument of human capital depreciation (or non-accumulation) during unemployment spells. Here, I provide an additional channel for lower moral hazard for young workers, which is that bankruptcy implies tighter credit conditions for them.

5 Results

In this section, I evaluate whether the model can account for the main statistics regarding the unsecured credit and labor markets targeted. I present some policy counterfactuals regarding steady-state comparison between different levels of UI with and without bankruptcy.

5.1 Model fit

Table 5 shows that the model fits the targets relatively well. This result means that a workhorse unsecured credit model, combined with a workhorse DMP search and matching model, can account for the main statistics regarding unsecured credit and labor markets, including the subpopulations of bankruptcy filers and nonemployed.

Table 5: Estimation: Data vs. Model Moments

Name	Data	Model
Annual bankruptcy rate (2007 SCF)	1.2%	1.3%
Employment rate (2007 SCF)	80%	85.6%
Annual debt-to-income ratio (2007 SCF)**	1.64%	1.54%
Annual debt-to-income ratio for bankruptcy filers (US Courts, 2007)	110%	93.2%
Bankruptcy rate for nonemployed	4%	3.22%
Employment rate for bankruptcy filers (US Courts, 2007)	73%	65.3%
Mean earnings	1.0	0.96
b_1	0.14	0.139
b_2	-0.0016	-0.00146
ρ_z	0.83	0.836
σ_ζ	0.41	0.476

**Debt=max(0,-Networth)

As may be expected, the greater challenge is to match the subpopulation statistics. In particular, for the subpopulation of bankruptcy filers, the mean debt-to-income ratio and employment rate are slightly smaller than the targets. However, this result is not surprising, given the relatively parsimonious process assumed for labor productivity.

I test the model by performing the policy experiment of altering the UI cap. I simulate the model for a range of values for the maximum amount of UI benefits available during an unemployment spell. For the rage of values similar to the US data across states, the model quantitative replicates the negative relationship between bankruptcy and UI generosity of similar order of magnitude. The change in the bankruptcy rate with respect to the maximum amount available is negative and statistically significant but very small. In the model, this result is because the cap is most likely binding for prime-age middle- to high-earnings workers who are less likely to default, but it is also because borrowing increases, which implies more bankruptcy if it is extended beyond current average levels.[36] Figure 1 below show that the model results are consistent with the cross states evidence.

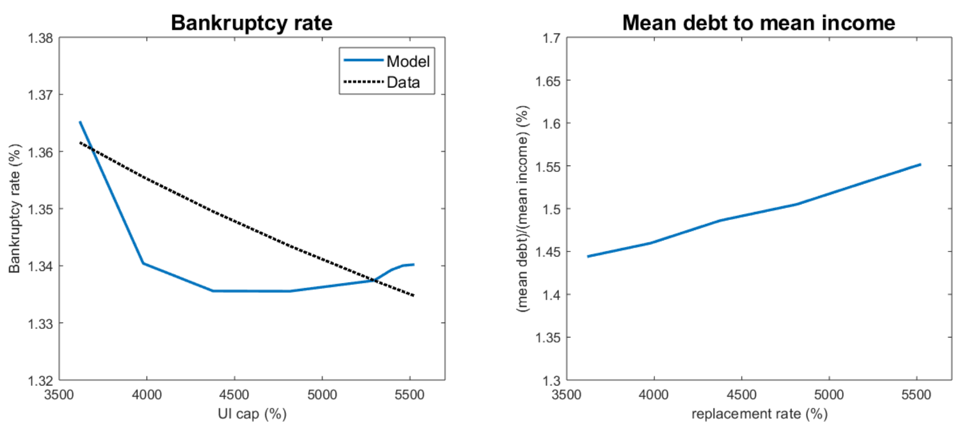

Figure 1: Simulated bankruptcy rates for different levels of UI cap.

5.2 The employment effect of bankruptcy

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

The overall employment rate is 3.1 percentage points lower without bankruptcy (or the nonem-

[36]This prediction from the model is also consistent with the data if instead of regressing bankruptcy rates on log of UI, I use UI in levels and include a quadratic term for UI; the quadratic coefficient is also significant. See Appendix.

ployment rate is 21% higher without bankruptcy). Since I am abstracting from informal default, we can interpret the result of this exercise as an upper bound on the effect of default on employment.[37] This result, on its own, is exciting and motivates further study. However, it is out of the scope of this paper, and I leave it to future research. For this paper, what is of interest is that higher interest rates, when default is possible, restrict individuals to use credit markets to smooth consumption and cause primarily young or low-productive workers to reject fewer offers in order to consume more. This result would imply lower moral hazard concerns of UI for this group and would help in understanding the results of the following sections.

Since young households are more likely to borrow against higher future income, most of the effect is on this age group. Figure 2 shows the employment rate over the lifecycle. For households in their 20s, the employment rate is on average 13 percentage points higher with bankruptcy.[38]

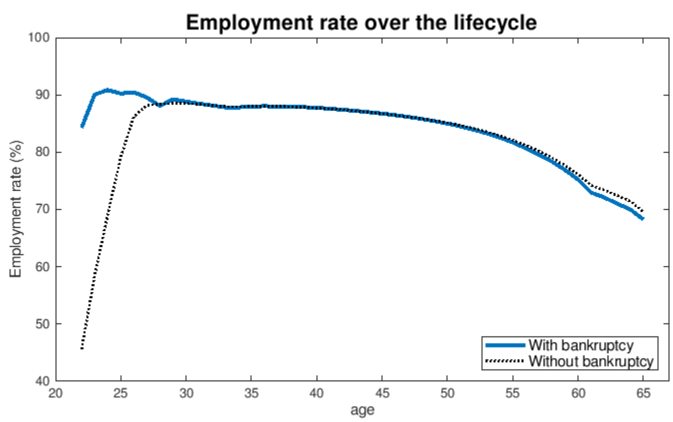

Figure 2: Employment rate across ages for the case in which $\theta_R = 50\%$ with and without bankruptcy.

5.3 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 of unemployment. This measure is plausible under the assumption that it is positively correlated with the amount of benefits that a qualifying unemployed can receive—i.e., states that offer more benefits overall will tend to have a high UI cap, which seems reasonable.

In terms of the model, it is more relevant to define UI generosity in terms of higher replacement rates (or the combination of higher replacement rates and higher UI cap). Note that in the data, it is not clear that replacement rates would be the most convincing notion of generosity, since earning

[37]Think of this exercise as a scenario in which the government can ideally enforce debt repayments.

[38]Note that I am not targeting the employment rate across age groups, but the model yields a patter that is qualitatively similar to what is observed in the data.

distribution can vary across states. Thus states with higher earning distribution may choose lower replacement rates, which would make them seen less generous in terms of UI, even though they still provide more benefits in terms of the dollar amount. Since we do not have such problems in the model, I start the analysis by considering different levels of replacement rates.

5.4 Changes in the Replacement Rate

In this section, I consider different levels of the replacement rate, θ_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 θ_R increase the level of UI benefits for only a fraction of the population (those below the UI cap, such as young or low productive). Figure 8 shows the UI benefit schedule for the first 8 productivity levels across age and different values of θ_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 affects the trade-off implied by the bankruptcy system between smoothing consumption across states of the world versus smoothing consumption over time. In particular, when considering replacement rates, θ_R, from 35% to 60%, the overall bankruptcy rate falls. However, the mean amount of debt to mean income only increases when going from $\theta_R = 35\%$ to $\theta_R = 50\%$ and then falls. Therefore, a more generous UI initially improves consumption smoothing by allowing more borrowing without adding a higher default risk.

Regarding the first result, increases in the replacement rate reduce employment by more when bankruptcy is not allowed (see Figure 3). For example, increasing the replacement rate from $\theta_R = 50\%$ to $\theta_R = 55\%$ implies an increase in nonemployment rate of 3.9 percentage points with bankruptcy and 5.5 percentage points without bankruptcy. As explained previously, 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 or low-productive workers would reject fewer job offers. In this sense, the credit distortions created by the bankruptcy option, reduce the moral hazard problem of rejecting job offers and instead collecting UI.

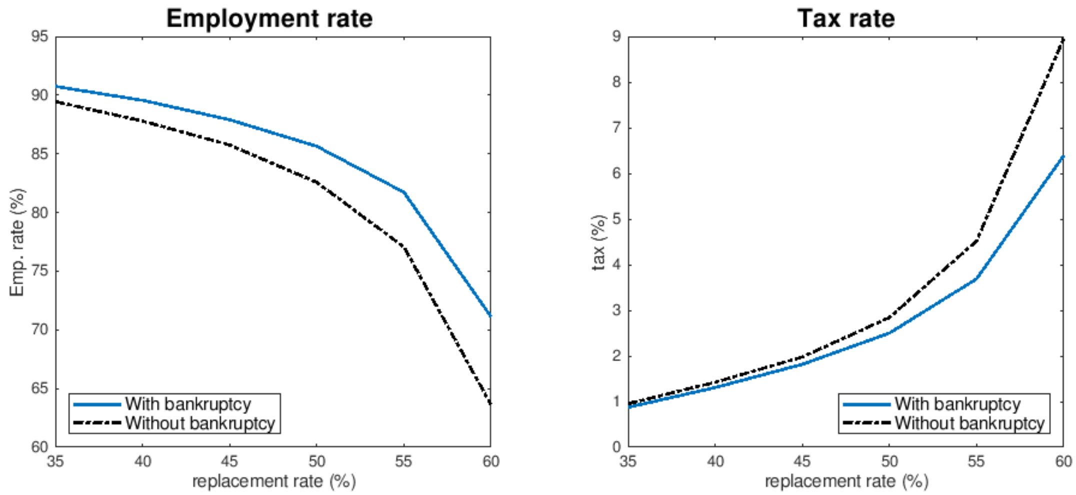

Figure 3: Steady-state comparison of employment rate and labor tax across different replacement rates for scenarios with and without bankruptcy. Benchmark case is for $\theta_R = 50\%$.

Also, changes in the replacement rate have nontrivial credit market effects, given the bankruptcy system. Figure 4 shows that if $\theta_R = 35\%$, the bankruptcy rate would be 1.7%; if $\theta_R = 60\%$, the bankruptcy rate would be 1.1%. Moving from the benchmark of $\theta_R = 50\%$ to $\theta_R = 55\%$ (i.e., a 10% increase) implies a 6.7% reduction in the bankruptcy rate (from a steady-state rate of 1.34% to 1.24%).

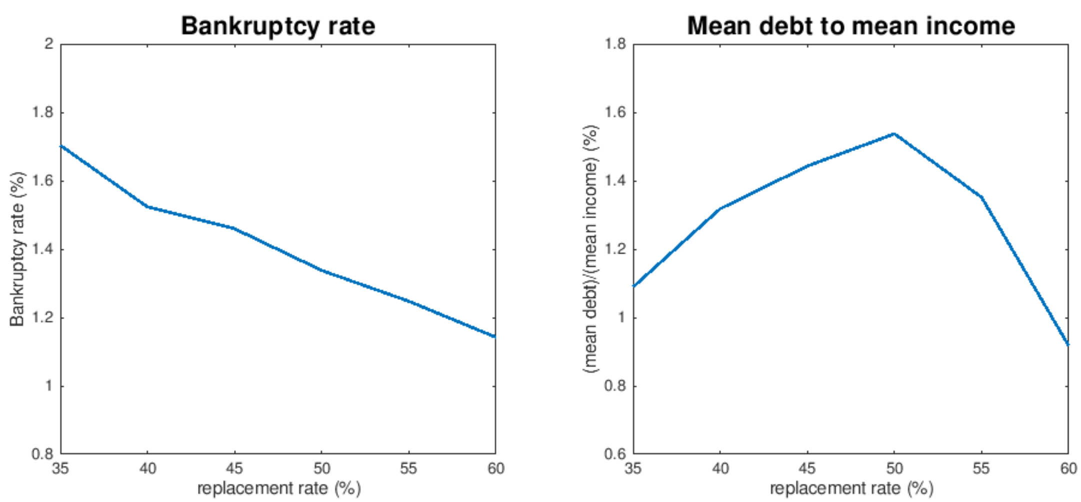

Figure 4: Steady-state comparison of bankruptcy rate and mean-debt to mean-income ratio across different replacement rates keeping the cap on UI benefits. Benchmark case is for $\theta_R = 50\%$.

The bankruptcy rate monotonically decreases with θ_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 $\theta_R = 35\%$ to $\theta_R = 50\%$ and then falls when further increasing to $\theta_R = 60\%$. 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 relatively big and richer group of employed to a relatively small poorer group of unemployed, so initially does not necessarily translate into higher default risk and credit rationing (which alleviates the credit distortion created by the bankruptcy system).

When going beyond $\theta_R = 50\%$, the point is more subtle since the average debt relative to average income also falls (Figure 4). This result coincides with the more rapid increase in unemployment, higher taxes, and the fact that fewer people are receiving higher benefits since most people hit the UI cap. These effects imply that expected income falls on average, increasing default risk. Lenders anticipate these effects and charge higher interest rates, so the fall in debt relative to income could, at least in part, be the result of credit rationing due to higher default risk.

Figures 11, 12, 13, and 14 in the appendix show the average loan price schedule for employed and unemployed across different ages and replacement rate. For the benchmark case, $\theta_R = 50\%$, Young households have minimal credit access when unemployed. For households older than 40 years old, loan price functions are very similar across employment status, so the model predicts that unemployed workers can have substantial access to credit for prime-age workers when unemployed. Increasing the replacement rate from $\theta_R = 35\%$ to $\theta_R = 50\%$ implies substantial credit access for young households. When comparing $\theta_R = 50\%$ with $\theta_R = 60\%$, loan price functions shift to the right, limiting overall credit access and fall for unemployed at most ages. This result partly explains the reduction in overall debt mentioned before.

For the subpopulation of unemployed, the bankruptcy rate falls when going from $\theta_R = 35\%$ to $\theta_R = 60\%$. This result implies that for the range of values considered, increasing the generosity of the UI in this manner increases the pool of unemployed but reduces its relative default risk (Figure 9). As a fraction of the overall population, the fraction of workers that both unemployed and bankrupt falls from $\theta_R = 35\%$ to $\theta_R = 50\%$, but then increases.

The amount of debt relative to income (debt-to-income ratio) that is discharged, on average, initially increases (from $\theta_R = 30\%$ to $\theta_R = 50\%$), which is consistent with the initial increase in overall debt. But then starts falling, which is consistent with the overall decrease in borrowing. When considering the benchmark case with $\theta_R = 50\%$, an increase in the replacement rate to $\theta_R = 55\%$ would reduce the average amount of debt discharged with respect to income by 13.7% in the steady state.

A natural question is how the previous analysis change if there were no cap on the benefits.

The figure in the appendix shows that the bankruptcy rate is U-shaped, and the amount of debt monotonically increases. Without the cap, all qualifying unemployed are receiving the UI benefits, so a higher replacement rate keeps increasing borrowing even beyond the 50% replacement rate. More borrowing can be supported since households that are borrowing are middle- to low-income (relatively young), and their expected income improves. However, more borrowing will also translate into more bankruptcy ex-post, which explains the U-shape on the bankruptcy rate.

Finally, Table **??** 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 surpass any of its benefits.

A key result is in terms of the desirability of increasing the replacement rate from the benchmark of 50% to 55%. In the current environment, there are still welfare gains from increasing the replacement rate beyond current levels (even further from 60%) if bankruptcy is not allowed. Introducing bankruptcy changes this result, and increasing replacement rate beyond current levels is welfare reducing. This result is due to the additional distortions created by extending UI. The optimal replacement rate is below the current levels to 47% if we keep the UI cap and 40% without the cap (see Figure 5). Thus the consideration of bankruptcy does have important implications when thinking about the optimal design of UI. Also, the different components of the UI play a key role in determining the welfare implication of increasing the generosity of UI since they imply different distributional effects across income and age groups.

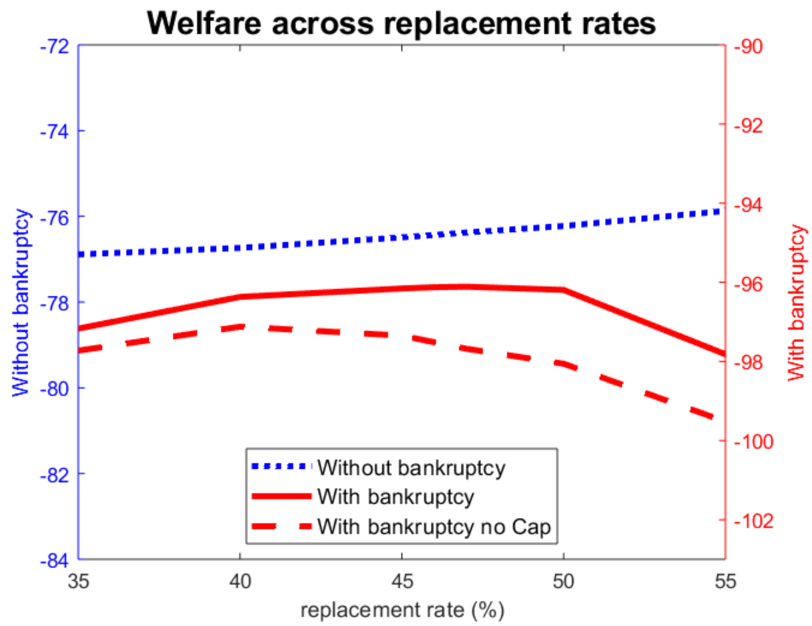

Figure 5: Ex ante welfare across replacement rate for the case with and without bankruptcy.

6 Conclusion

The main contribution of this paper is to study how the trade-offs of UI interact with bankruptcy over the lifecycle in a general equilibrium model of unsecured credit and frictional labor market. There are two key results, one positive and another normative. First, with bankruptcy, UI has additional benefits and costs in terms of its effect on unsecured credit and consumption smoothing, and it depends on the level of UI which one dominates. Second, from a normative perspective, in an environment where increasing the level of UI beyond the current levels of replacement rates is welfare improving without bankruptcy, adding a bankruptcy option makes the increase of UI welfare reducing. The ability of UI to increase welfare is even more limited if we consider that all qualifying unemployed will receive the increase in benefits (i.e., not considering a cap on UI benefits).

To put this result into context, in an environment in which the optimal level of UI at the current levels is optimal but does not include bankruptcy, the introduction of bankruptcy will imply substantially lower optimal UI. An important point to make is that this result can be interpreted as a lower bound since the wage function in the model does not depend on UI. This assumption shuts down a potentially important channel from the firms' perspective. This possibility will be included in future versions of the paper. However, here, reservation wages and equilibrium wages still change with the

UI since it affecting workers' outside option.

A common result in the optimal UI literature, especially within the sufficient statistics literature, is that the current levels of UI is close to the optimal. However, there are still welfare gains from increasing the level of benefits. In an influential paper, Chetty (2008) found that the optimal UI benefit level exceeds 50% replacement rate and that this result is robust since it does not require a structural estimation of primitives. Chetty (2008)'s result, even nowadays, is still commonly found in this literature (See Schmieder and von Wachter (2016) for a recent survey). However, Chetty (2008) himself acknowledged that an important caveat to his policy conclusion is that it does not consider other types of policy instruments to resolve credit and insurance market failures. This result does not hold here even thou, without bankruptcy, there are still welfare gains beyond a 60% replacement rate. The reason is the distortions created by extending UI spill over into the unsecured credit markets.

The policy results of this paper shed light on the policy debate regarding the optimal design of public insurance, such as the UI. Taking the US system to levels of generosity similar to some European countries can have unintentional welfare costs. A key component to make more generous UI welfare improving is to target it to the fraction of the population, such as young and low earnings, that are more affected by the credit constraints imposed by bankruptcy and ensure the proper measures to minimize the distortions in terms of work incentives.

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Appendix

7 More details on Consumer Bankruptcy and UI in the US

7.1 Consumer Bankruptcy in the US

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. I focus on Chapter 7 since it represents around 70% of all consumer bankruptcies. Under this chapter, debtors obtain the full discharge of their total qualifying unsecured debts and their current and future earnings are protected from any debt collection action.[39] Chapter 7 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 the debtor's income, expenses, and type of debt.

The Bankruptcy Abuse Prevention and Consumer Protection Act of 2005 (BAPCPA), sometimes referred to 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 means-tests to Chapter 7, *(ii)* adding more complicated paperwork requirements that resulted in higher court and legal fees (50% increase on average, from \$921 to \$1,377 U.S.GAO (2008)), *(iii)* requiring mandatory credit counseling, *(iv)* adding 2-year residency requirements, *(v)* increasing the waiting period to file again for Chapter 7 from 6 to 8 years (if discharge received the first time) *(vi)* adding a cap to the state homestead exemption by requiring that, in order to fully take advantage of the exemption, the filer should have bought her/his home within 1,215 days (around 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 not, the means-testing provision requires the filer's disposable income to be calculated. A filer will not pass the means test if her/his disposable income is beyond a certain threshold. Using administrative data from the US Courts (2007), I find that 99% pass the means test.

[39] Some debts such as alimony, student loans, and most tax debts cannot be discharged.

Bankruptcy Exemptions: Exemptions are the 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 may be allowed to keep. In Chapter 13 bankruptcy, debtors keep all their property but must pay unsecured creditors an amount that is at most equal to the value of nonexempt assets, so exemptions help keep debtors' plan payments low.

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

States often update their exemptions levels. Table 7 in the Appendix shows homestead exemptions levels for 1989 and 2017 and the years when they were updated.

8 Figures

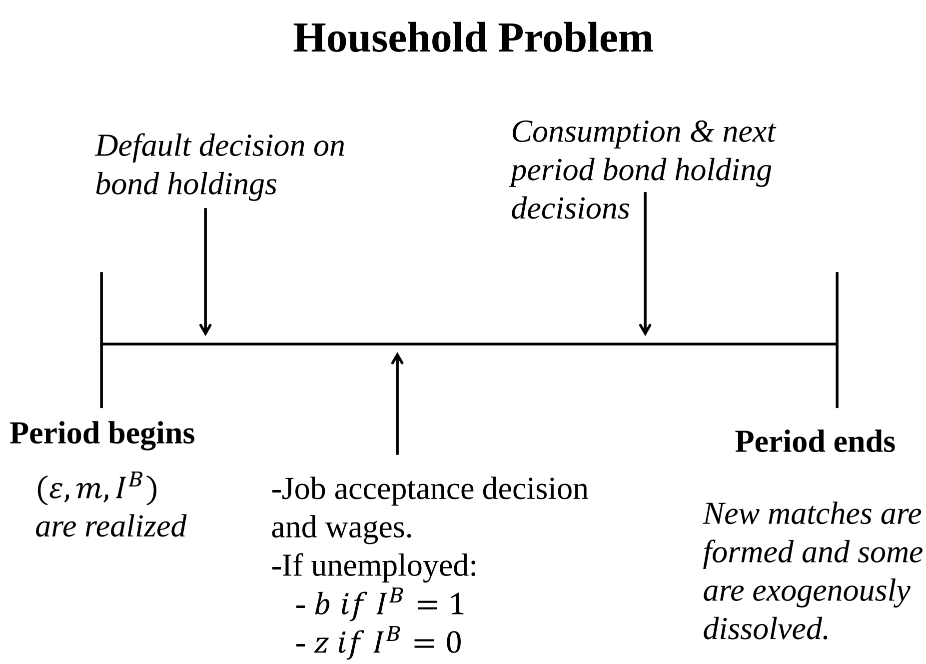

Figure 6: Timing within a period. Note that since all the uncertainty is resolved at the beginning of the period this timing is actually irrelevant and is just an artifact to present the model in an organized way.

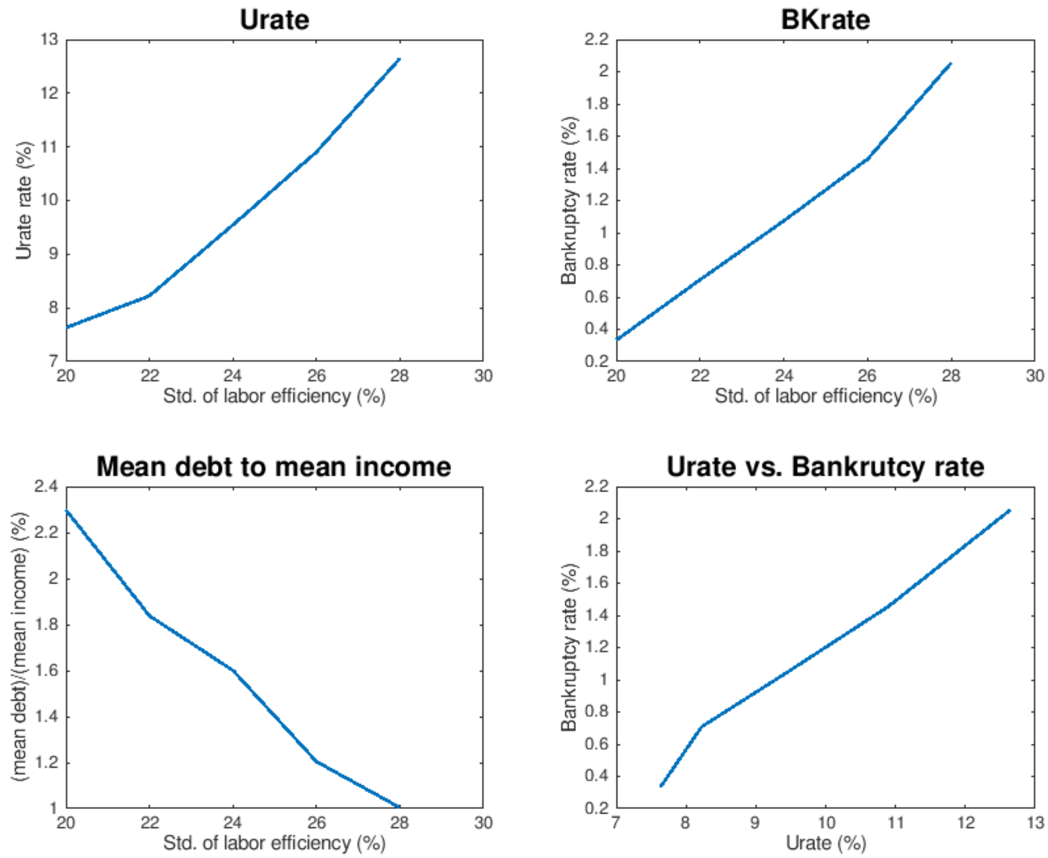

Figure 7: Steady state comparison for different levels of standard deviation of labor productivity (The implied log wage standard deviation are 0.40, 0.43, 0.47, 0.51, and 0.55).

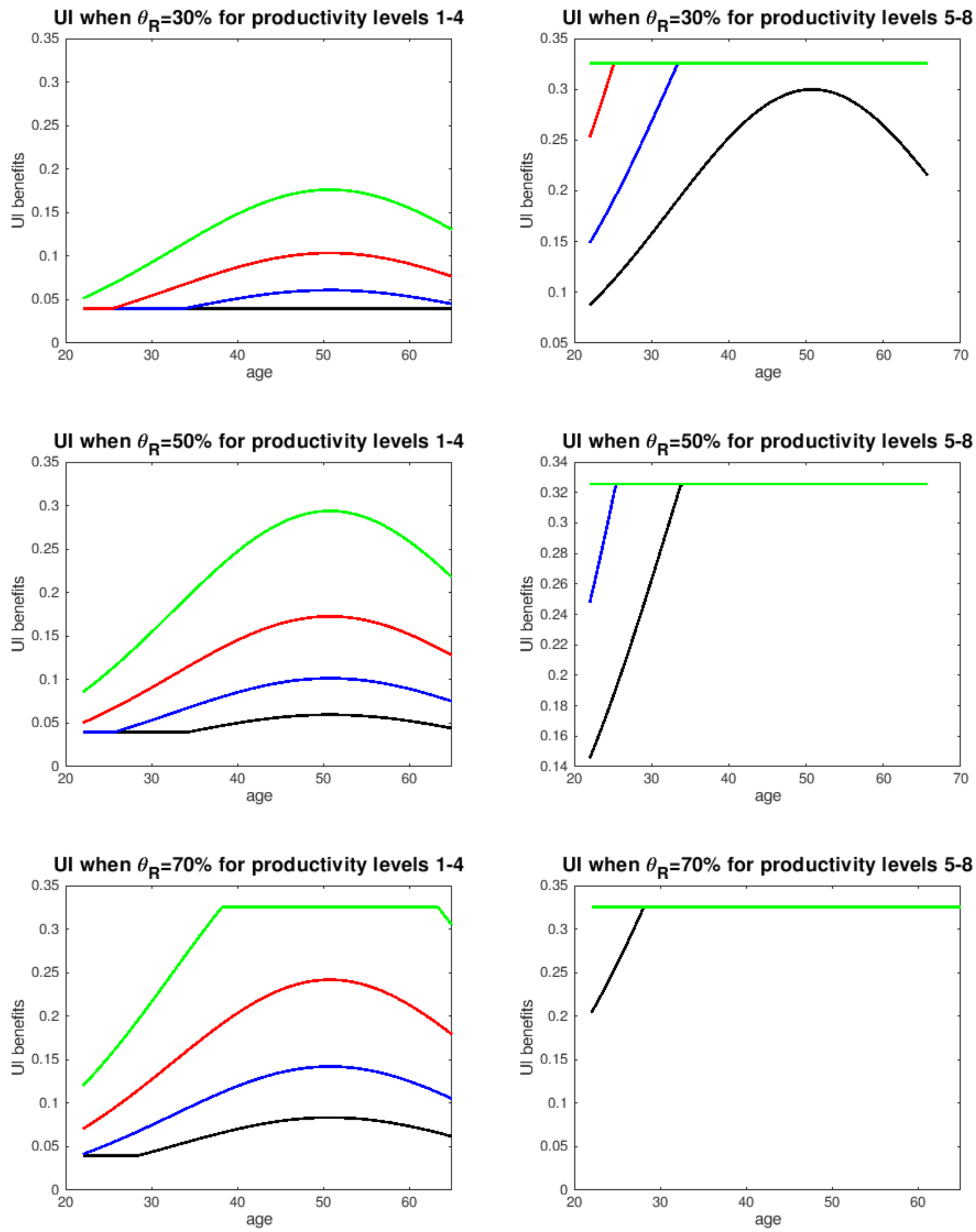

Figure 8: Steady state comparison of UI benefits (normalized units) across age, labor productivity, and for different replacement rates.

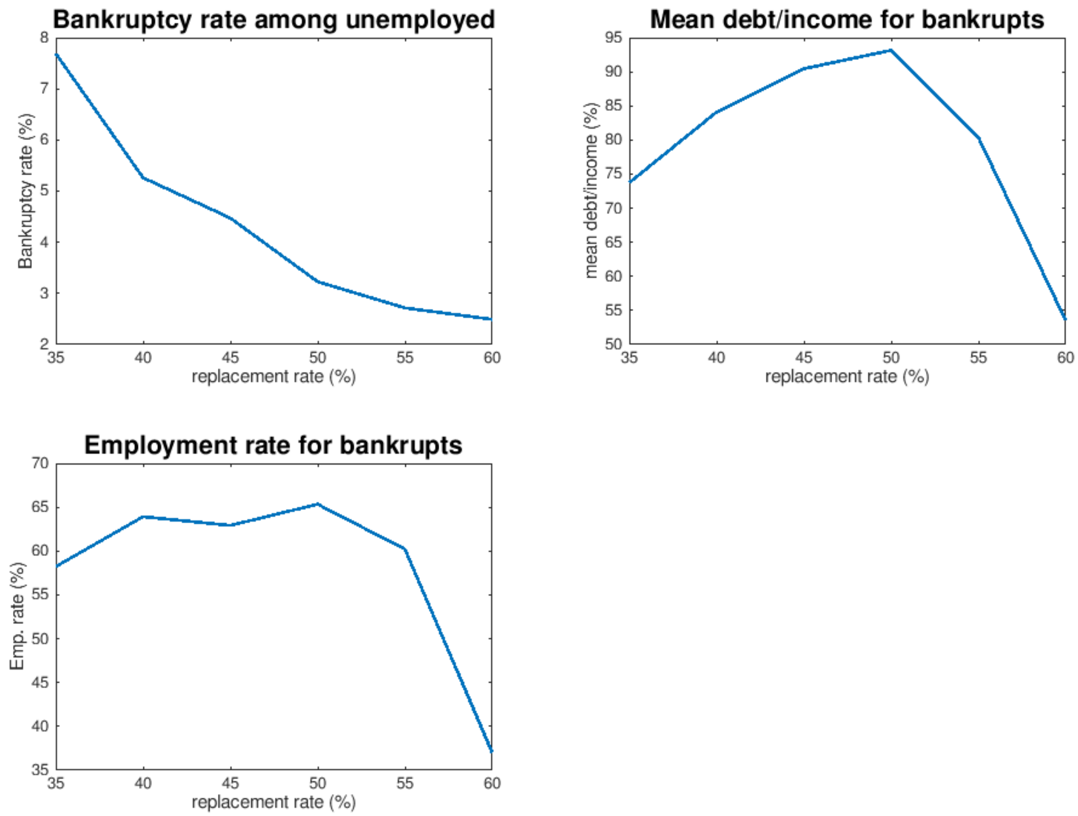

Figure 9: Steady state comparison: bankruptcy rate among unemployed, mean debt-to-income ratio and employment rate for bankruptcy filers across different replacement rates.

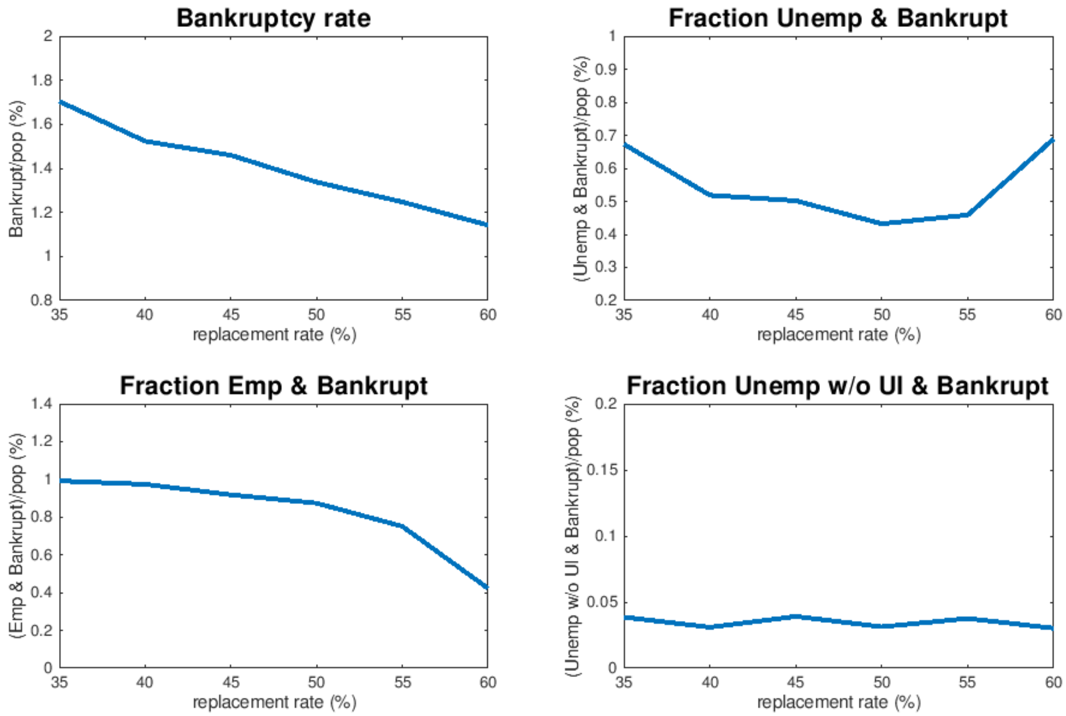

Figure 10: Steady state comparison: bankruptcy rate, fraction of the population unemployed and bankrupt, fraction of the population employed and bankrupt, and fraction of the population unemployed without UI and bankrupt.

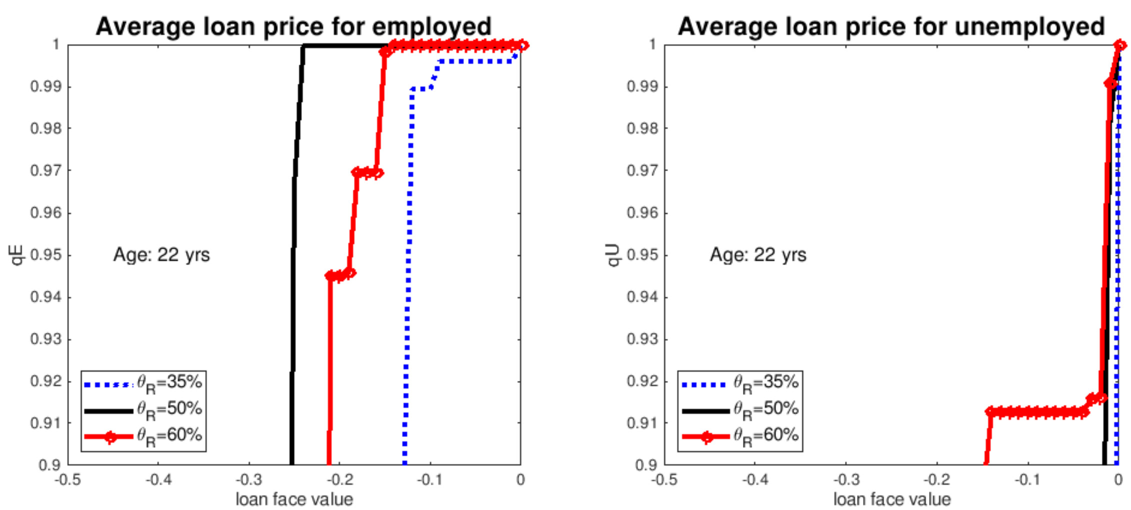

Figure 11: Steady state comparison: Loan price for employed and unemployed across different replacement rates.

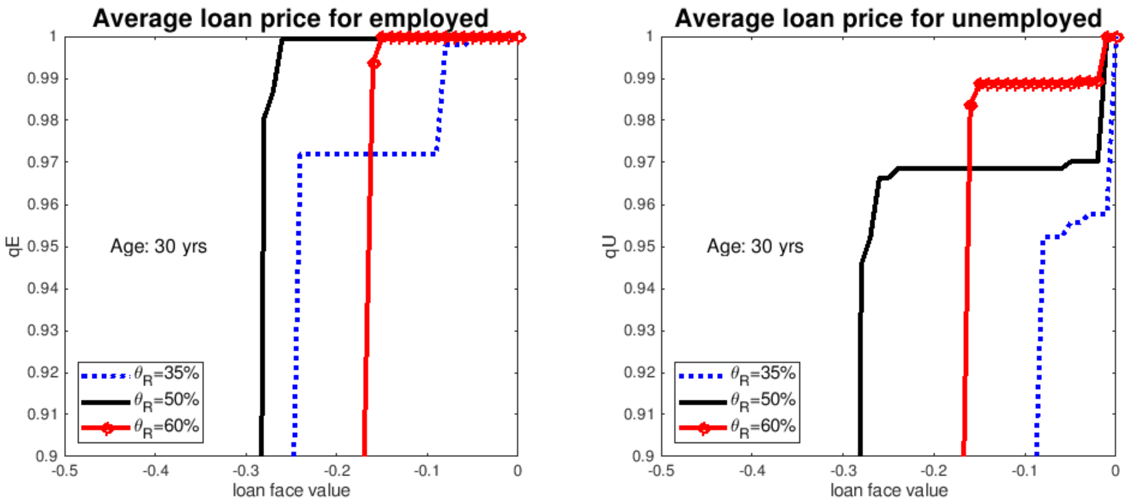

Figure 12: Steady state comparison: Loan price for employed and unemployed across different replacement rates.

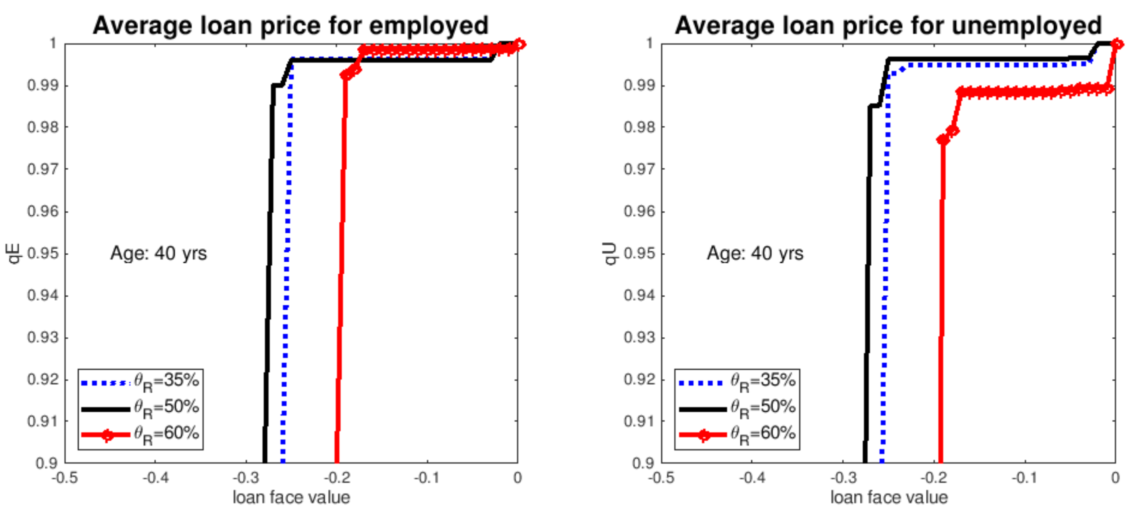

Figure 13: Steady state comparison: Loan price for employed and unemployed across different replacement rates.

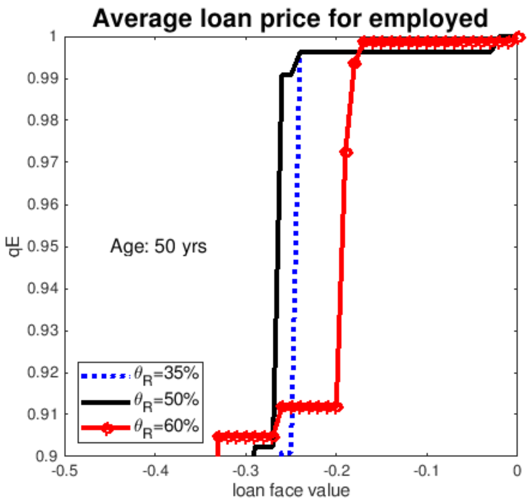

Figure 14: Steady state comparison: Loan price for employed and unemployed across different replacement rates.

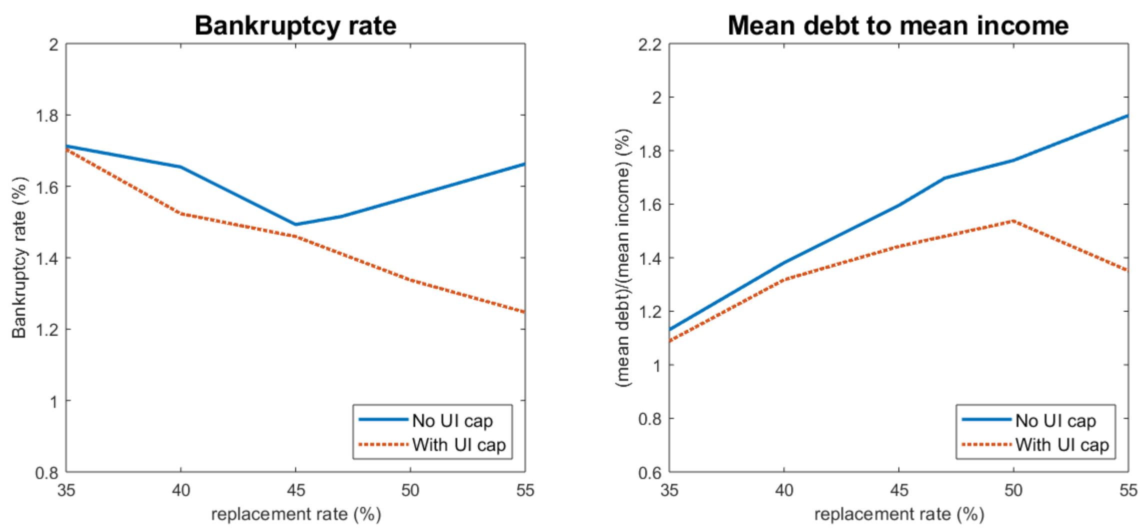

Figure 15: Steady-state comparison of bankruptcy rate and mean-debt to mean-income ratio across different replacement rates with and without the UI cap. Benchmark case is for $\theta_R = 50\%$ with UI cap.

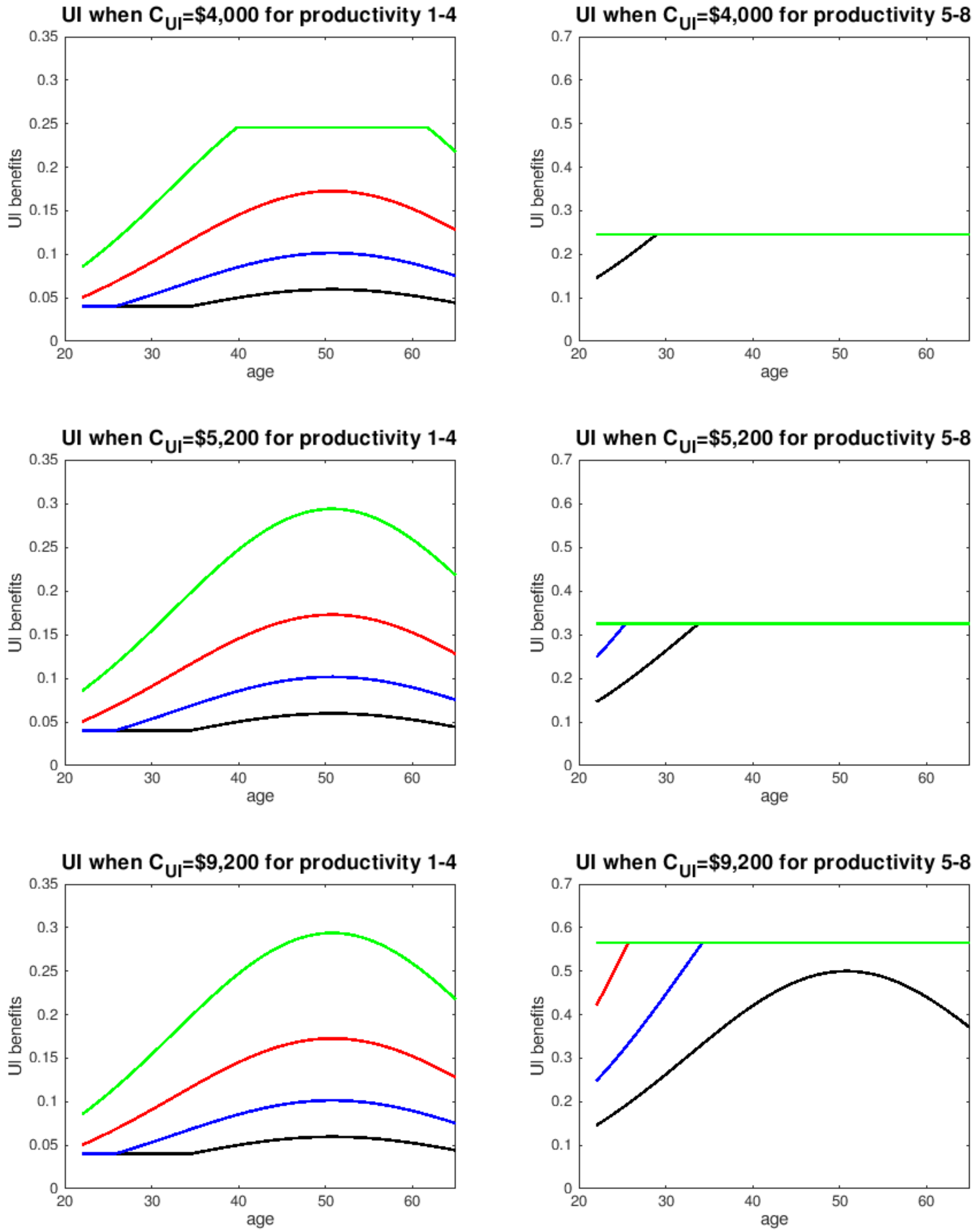

Figure 16: Steady state comparison of UI benefits (normalized units) across age, labor productivity, and for different levels UI cap.

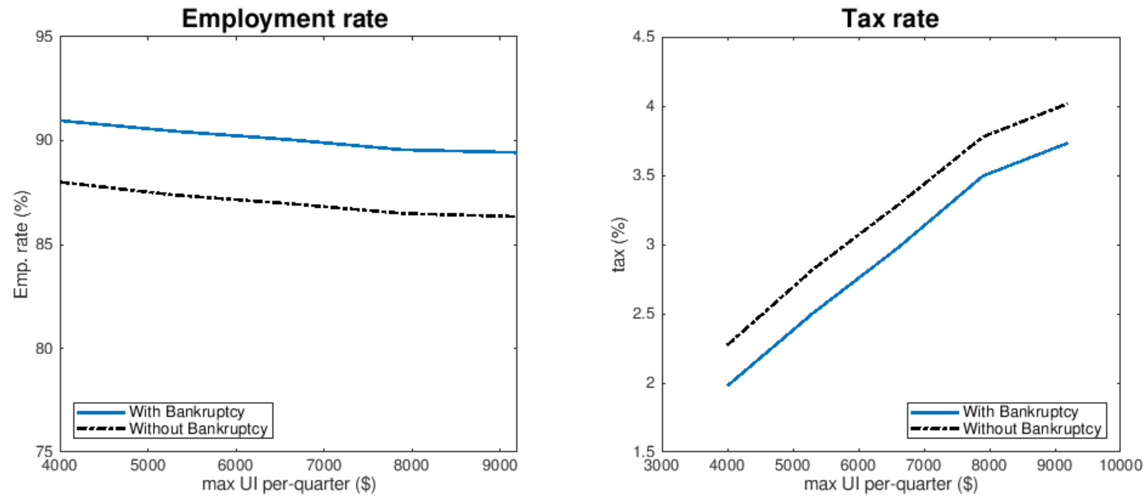

Figure 17: Steady state comparison for employment rate and labor tax across different UI caps for scenarios with and without bankruptcy.

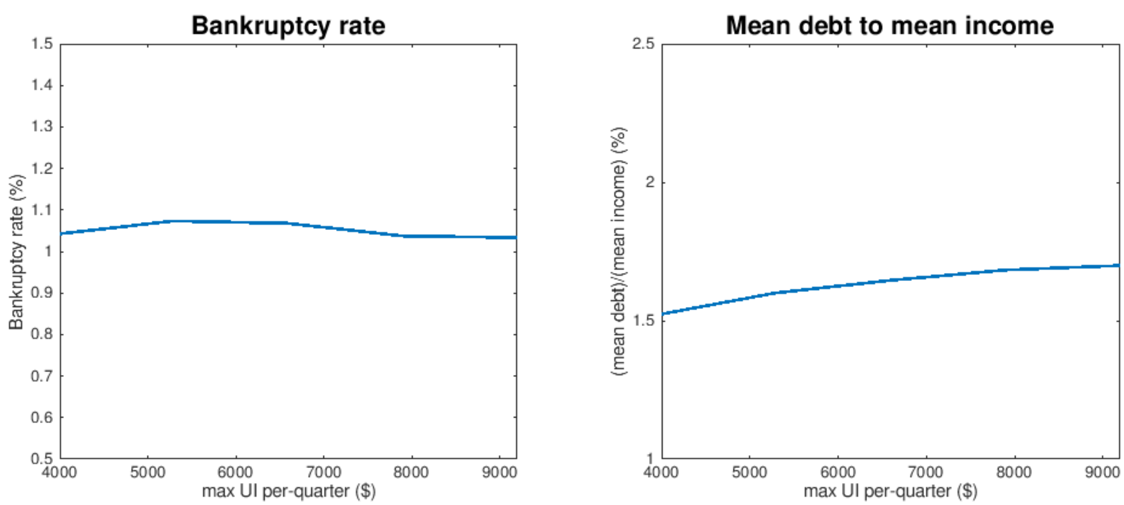

Figure 18: Steady state comparison for bankruptcy rate and mean-debt to mean-income ratio across different UI caps for scenarios with and without bankruptcy.

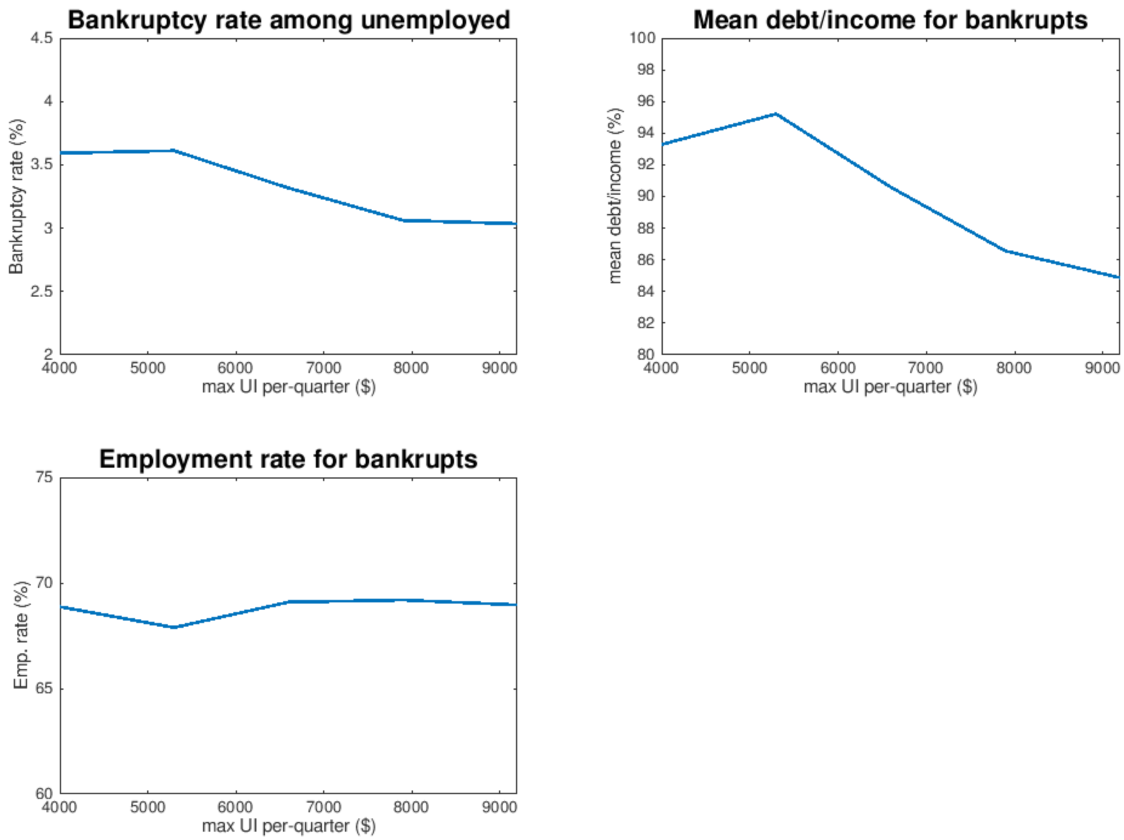

Figure 19: Steady state comparison: bankruptcy rate among unemployed, mean debt-to-income ratio and employment rate for bankruptcy filers for different values of UI caps.

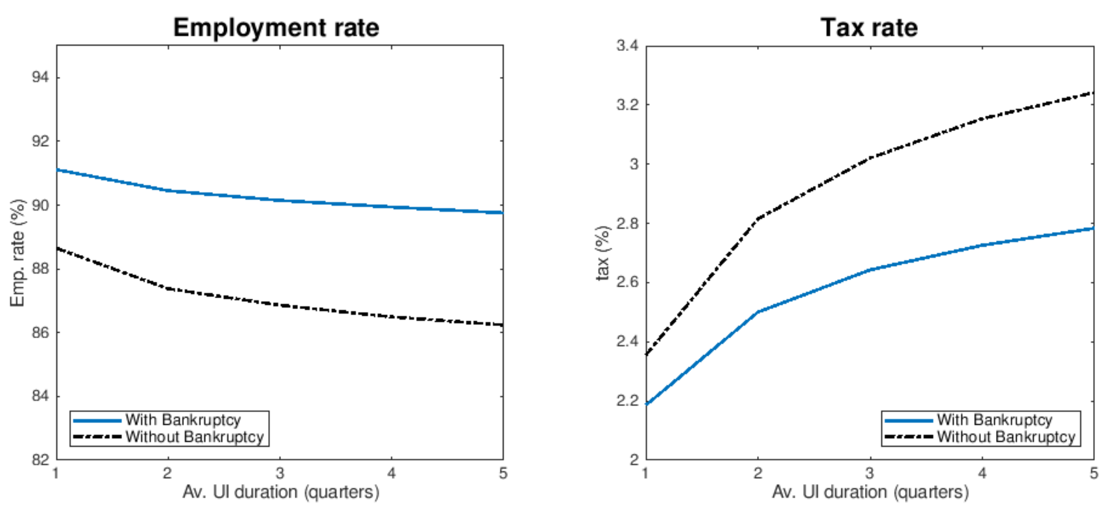

Figure 20: Steady state comparison for employment rate and labor tax across different UI average duration (in quarters) for scenarios with and without bankruptcy.

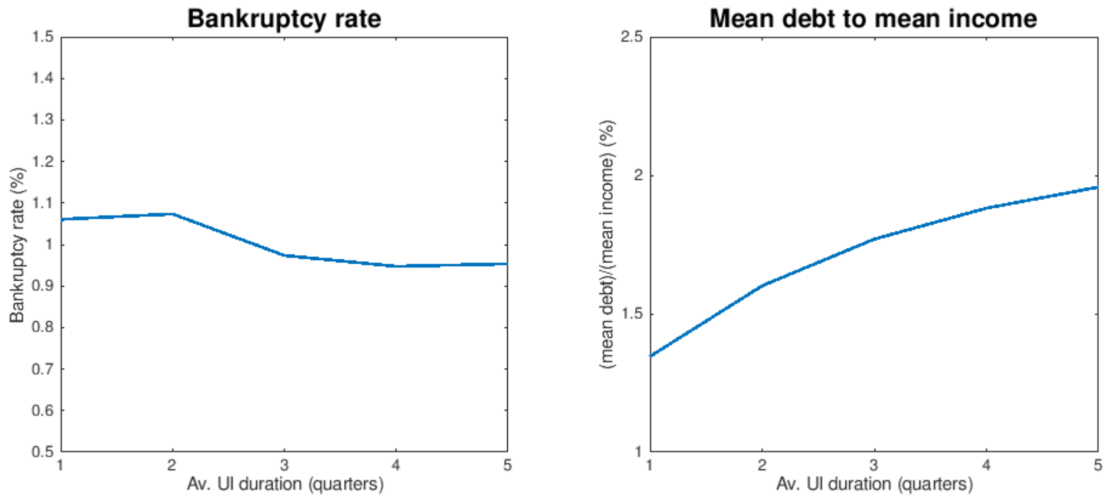

Figure 21: Steady state comparison for bankruptcy rate and mean-debt to mean-income ratio across different UI average duration (in quarters) for scenarios with and without bankruptcy.

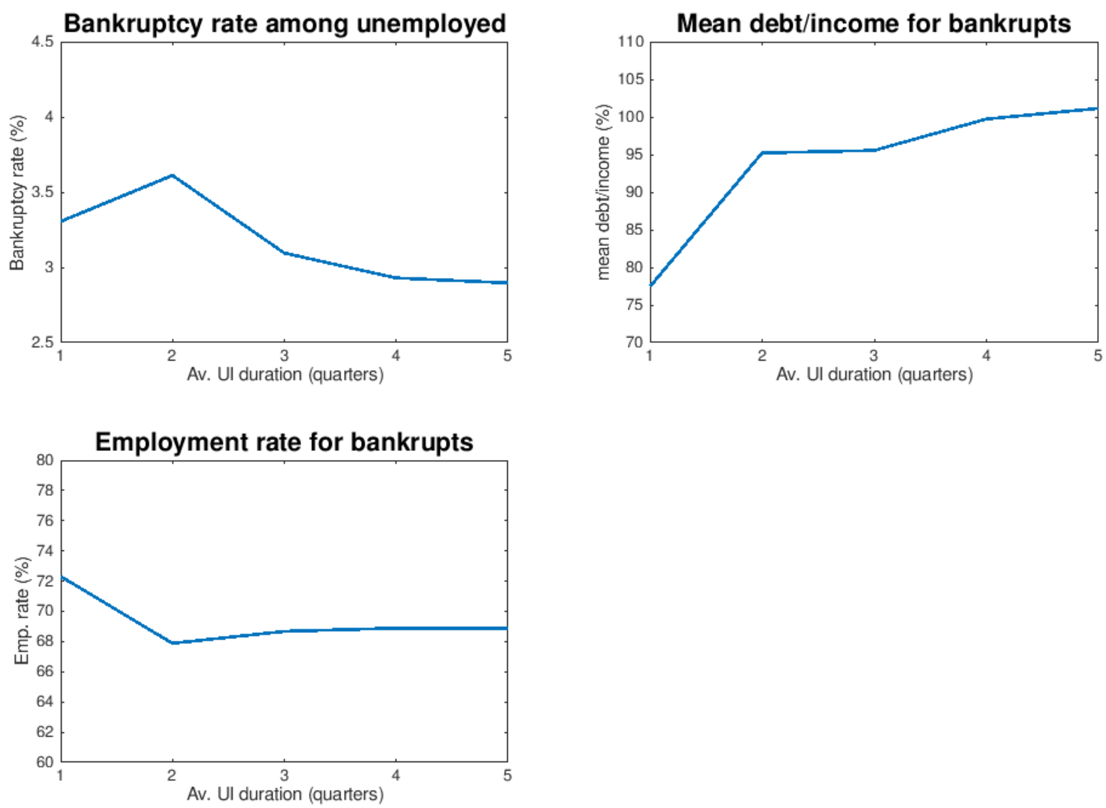

Figure 22: Steady state comparison: bankruptcy rate among unemployed, mean debt-to-income ratio and employment rate for bankruptcy filers for different values of average duration of UI benefits.

9 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.