The Interaction between Labor and Credit Markets: The Impact of Bankruptcy on Labor Supply Decisions

Daphne Chen*
Florida State University

March 27, 2012

Abstract

One of the purposes of Chapter 7 bankruptcy law is to improve debtors' work incentives by giving them a "fresh start". I ask the question "How much does a fresh start increase labor supply" by constructing a dynamic partial equilibrium job search model with bankruptcy choices which allows direct assessment of counterfactual outcomes. The model predicts that a fresh start on average increases the labor supply of Chapter 7 bankruptcy filers by 3.5%.

*I am deeply indebted to Dean Corbae for his guidance and encouragement. I would like to thank Satyajit Chatterjee, Richard Chiburis, Wenli Li, Burhan Kuruscu, Erwan Quintin, and Don Schlagenhauf, as well as numerous seminar participants for valuable suggestions. All errors are mine. E-mail: dchen@fsu.edu

1 Introduction

There are two bankruptcy choices in the United States, Chapter 7 and Chapter 13. Chapter 7 bankruptcy, which accounts for around 70% of total filings, provides a "fresh start" to debtors by allowing them to keep all of their current and future earnings after bankruptcy. With over 1.5 million bankruptcy filings per year, there has been brewing debate over whether the bankruptcy system should be less favorable to debtors.[1] But what motivated the birth of a fresh start bankruptcy system in the U.S. in the first place? Fresh start was justified by the Supreme Court on the grounds that it would encourage work incentives.[2] As summarized in the 1934 ruling involving Local Loan Company and Hunt,

> *"From the viewpoint of the wage earner, there is little difference between not earning at all and earning wholly for a creditor."*

This paper quantifies the effect by asking the question, "How much does a fresh start increase the labor supply?"

One might not expect a link between bankruptcy law and labor supply decisions. However, wealth and borrowing constraints have been shown in past research to have a significant effect on households' labor supply decisions. For instance, Rendon (2006) finds that reservation wages are affected negatively by wealth and positively by borrowing constraints. On the one hand, once individuals in debt file for bankruptcy, they are relieved from their debt and do not need to work as much to repay. Moreover, because individual wealth increases instantly upon bankruptcy (from negative to zero or above depending on exemptions), people can be more selective and wait for jobs that offer higher wages. These two forces suggest that debtors may reduce work after bankruptcy.

On the other hand, debtors face borrowing constraints both before and after bankruptcy. Beforehand, according to Edelberg (2006), people in poorer financial positions tend to be constrained from borrowing because they are more likely to default and thus face high loan interest rates. In addition, debtors usually have difficulty obtaining new loans after bankruptcy.

[1]As a result, the Bankruptcy Abuse Prevention and Consumer Protection Act of 2005 (BAPCPA) made several significant changes to the U.S. bankruptcy code, attempting to make it more difficult for some consumers to file bankruptcy under Chapter 7.

[2]A fresh start may have other benefits to the society besides improving work incentives, such as encouraging entrepreneurship. Motivate by the following quotes, I focus on the effect of bankruptcy on individual labor supply decisions as opposed to investment decisions.

A Chapter 7 bankruptcy history stays on one's credit record for ten years as prescribed by the Fair Credit Reporting Act (FCRA), and Musto (2004) finds that individuals with bankruptcy records have very limited access to borrowing because of the dramatic drop in their credit scores. To better prepare themselves against unexpected events such as job interruption or unanticipated expenses without access to borrowing, individuals may want to work more and save more. These two competing arguments ("wealth effects" versus "borrowing constraint effects") make the effect of bankruptcy on labor supply ambiguous.

Most papers in the literature, such as Athreya (2002), Livshits et al. (2007), and Chatterjee et al. (2007), assume that consumers draw idiosyncratic productivities from a known distribution and supply labor inelastically, which eliminates any interaction between credit markets and labor markets. There are very few papers that introduce a labor decision into a bankruptcy model. Athreya and Simpson (2006) allow endogenous search effort for unemployed individuals that affects the job arrival rate. Under their model setting, it is assumed that bankruptcy only affects nonworkers through the change in search effort, but does not affect workers. In Li and Sarte (2006), individuals make indivisible labor supply decisions such that they either do not work or work full-time. Bankruptcy only affects the extensive margin in their model but not the intensive margin.

While most papers focus on only Chapter 7 bankruptcy, Li and Sarte (2006) allow individuals to make both bankruptcy-chapter choices. While a fresh start grants debt removal with full exemption of future wages, Chapter 13 bankruptcy filers instead have to give up a fraction of their earnings, typically for the next three to five years, to repay creditors, during which they cannot incur new debt without consulting the trustee because additional debt is believed to compromise the debtor's ability to complete the repayment plan.[3] I follow their modeling strategy, which treats wage garnishment from Chapter 13 bankruptcy as a wage tax. Although Chapter 13 bankruptcy filers can re-access the credit market sooner than Chapter 7 bankruptcy filers, which reduces their work incentives, the wage garnishment makes the change in the labor supply under different bankruptcy-chapter choices unclear. If substitution effects dominate income effects, then wage garnishment reduces work.

One of the key differences between this paper and Li and Sarte (2006) is that they adapt the equilibrium concept from Athreya (2002) where every person in the economy faces the same loan interest rate and the same

[3]See U.S.C. 1305(c), 1322(a)(1), 1327.

borrowing constraint (which is set exogenously to match the average debt-to-income ratio). Because borrowing constraints, as mentioned above, have been shown in empirical work to affect labor supply, I instead solve for a competitive menu of loan prices that break even at equilibrium, as in Chatterjee et al. (2007). By allowing the loan prices to be risk based, consistent with findings of Edelberg (2006), the equilibrium generates endogenous borrowing limits given individuals' characteristics. For each loan contract, I calculate the recovery rate that depends on the expected repayment streams through possible future wage garnishment under Chapter 13. The expected repayment is affected by individuals' labor supply decisions after bankruptcy because the financial intermediaries can recover more when individuals on the repayment plan earn more by working more. This essentially makes the loan interest rates individuals receive before bankruptcy dependent on their labor supply decisions after bankruptcy.

Because bankruptcy choices are endogenous, Chapter 7 bankruptcy filers tend to have less earnings and more debt than average both in the data and in the model.[4] The self-selection for a fresh start must be taken into account when assessing labor supply responses under counterfactual scenarios. I deal with the endogeneity directly by incorporating a sequential job search model with a continuous wage-offer distribution. Consumers can make labor participation decisions according to their reservation wages. Employed individuals can continue or quit jobs if not separated involuntarily. Non-employed individuals can accept or reject job offers if they receive one. For individuals who participate in the labor market, they can also choose how much to work. This allows us to investigate the change in labor supply on both extensive and intensive margins.

If a fresh start is considered as a "treatment", the "average treatment effect on the treated" (ATET) calculates the difference in average labor supply for a Chapter 7 bankruptcy filer under filing and repayment, which measure the impact of bankruptcy on labor supply decisions. For each filer, we know his equilibrium labor supply decision. However, for the exact same person, we also need to know his labor supply decision when he were instead to repay the creditor. This requires the knowledge of what we observe and what we do not observe. Therefore we must run a counterfactual experiment for filers. With a model calibrated to match labor and credit market statistics, the ATET can be calculated directly because we can solve for each filer's

[4]In Table 4 of Han and Li (2007), based on the 1984-1995 PSID, they report an average income of $23,934 for the bankruptcy sample and $36,460 for the entire sample. Net debt that can be discharged through bankruptcy is $7,475 for the bankruptcy sample and $1,256 for the entire sample.

optimal labor supply decisions under all possible bankruptcy choices. Since the counterfactual experiment is done on individual level, it is sufficient to have a partial equilibrium job search model where the wage offer distribution is held fixed. Although it might be of interest to evaluate the effect of bankruptcy policy reforms on aggregate labor supply, this requires a general equilibrium model where the wage offer distribution can endogenously respond to policy changes, and it is behind the scope of this paper.

Why can't we just estimate the effect of bankruptcy on the labor supply from micro-level data? First of all, we lack detailed information on both labor and credit market activities. The National Longitudinal Survey of the Youth 1979 (NLSY79) and the Michigan Panel Survey of Income Dynamics (PSID) are two possible candidate datasets to work with. While the NLSY79 has detailed information on labor market activities, it has minimal information on bankruptcy. The 1996 PSID provides more information on bankruptcy, but it only surveys wealth every five years. Despite the difficulties, Han and Li (2007) make the first (and only) attempt to estimate the effect from a static treatment model using data from the 1984-1995 PSID. They control the selection issue through the use of instrumental variables, which must affect bankruptcy decisions but not directly labor supply decisions, except through bankruptcy filings. The instruments they utilize are social stigma and financial benefits. Because social stigma is unobservable, the lagged state bankruptcy rate is used as a proxy. Financial benefit is defined as the amount of net debt that can be discharged through bankruptcy, which has to be calculated from the wealth information, which they assume to be the same for every five-year interval. They find that a fresh start reduces the labor supply by 9% for Chapter 7 filers, the opposite to the stated goal, although the effect is not statistically significant.

The paper is organized as follows. I start by introducing the ATET methodology in Section 2. I formulate the model environment in Section 3. In Section 4, I describe the equilibrium. The model is parameterized in Section 5. In Section 6, I describe equilibrium behavior. In Section 7, I present the benchmark model results and reconcile my result with reduced-form estimation results by running treatment regressions on my simulated data. Section 8 concludes.

2 ATET Methodology

The labor supply response table as shown in Table 1 can help us understand how to correctly measure the effect. The ultimate goal of this paper is to

Table 1: Labor Supply Response Table

$d^* \setminus d$	0	7	13
0	(0,0)		
7	(7,0)	(7,7)	
13			

first fill the table up through a model and then evaluate the effect from it.

Each individual first has to assess the value of choosing each bankruptcy action $d = \{0, 7, 13\}$ listed as the columns of Table 1 where $d = 0$ means an individual does not file for bankruptcy, $d = 7$ means he files for Chapter 7 bankruptcy, and $d = 13$ means he files for Chapter 13 bankruptcy. Their actual choice d^* is the maximum of those possible values. Each individual belongs to one of the three rows according to his actual bankruptcy decision. For instance, a Chapter 7 bankruptcy filer chooses $d^* = 7$ and thus is assigned to the second row.

The diagonals are observable since the individual has revealed $d = d^*$ is their optimal choice. On the other hand, the off-diagonal elements are not observable - we only know that those values of d are not as high as d^*. Specifically, for a Chapter 7 bankruptcy filer, we observe his labor supply response in cell (7,7) of the table when he is under Chapter 7 bankruptcy, but we do not observe his labor supply response in (7,0) when the filer were instead to choose to repay the creditor.

I calculate the average annual working hours conditional on bankruptcy decisions using a combined cross-sectional dataset from 1984-1995 PSID.[5] There are 28893 nonfilers versus only 58 Chapter 7 filers and 41 Chapter 13 filers in the dataset. As is evident from Table 2, Chapter 7 bankruptcy filers on average work for 1890.60 hours, which is lower than nonfilers who on average work for 2114.20 hours in a year.[6] The standard errors for the mean estimates are shown in parentheses. The small sample size of bankruptcy filers induces imprecise estimates with large standard errors. We are not able to calculate any off-diagonal value directly from data. Given the limited information that we can get, this table is only for illustration purpose on how we can calculate the diagonal values from data.

[5] Please see the appendix for sample selection criteria.

[6] I also calculate the average annual working hours from NLSY79 from the same time period. The average annual working hours is 2039.16 for nonfilers, 2005.94 for Chapter 7 filers, and 2078.60 for Chapter 13 filers.

Table 2: Annual Working Hours from PSID 1984-1995

$d^* \setminus d$	0	7	13
0	2114.20 (3.85)		
7		1890.60 (94.83)	
13			1946.29 (87.58)

Back to Table 1, the effect of a fresh start on labor supply for each Chapter 7 bankruptcy filer is the difference between the values in (7,7) and that in (7,0). Therefore, the impact of a fresh start on labor supply can be measured by taking the average effect among all Chapter 7 bankruptcy filers. Formally,

$$ATET = \bar{h}(7,7) - \bar{h}(7,0) \tag{1}$$

where $\bar{h}(d^*, d)$ is average labor supply response given equilibrium and counterfactual bankruptcy decisions. If the ATET is positive, this implies that a fresh start increases labor supply. To make the comparison, it requires knowledge of what we do not observe, i.e., the value in (7,0), and this is why we must run a counterfactual for bankruptcy filers.

The reason why we cannot simply replace the value in (7,0) with the observable value in (0,0) is because bankruptcy events are endogenous instead of randomly assigned. If we do not consider the possibility that Chapter 7 bankruptcy filers are more likely to suffer from unemployment and have lower wealth than others, that is, if we ignore the endogeneity of bankruptcy decisions, the estimates could be biased.

There are two possible ways to deal with the endogenous bankruptcy treatment if we estimate from micro-level data. The first situation is when the we can include in the regression the factors which determine the bankruptcy decisions. Therefore, given the covariates, the bankruptcy decision is independent of the labor supply responses ("unconfoundedness assumption"). We can then estimate the the effect of endogenous bankruptcy on labor supply via a "kitchen sink" regression. The problem is that the bankruptcy decisions can also be affected by the labor market outcomes. For instance, a person having undergone a period of prolonged unemployment is more likely to default. The reverse causality thus violates the unconfoundedness assumption.

The second possible method is through instrumental variables (IV), which have effects on the bankruptcy decisions but not directly on the labor supply decisions, except through bankruptcy filings. Han and Li (2007) use two instruments, social stigma and potential financial benefits from bankruptcy, in their analyses. Because personal preference is not directly observable, they use lagged state bankruptcy rate as a proxy of social stigma. To control for the possibility that the proxy may be correlated with the labor-market conditions, they also include lagged state unemployment rate and lagged state income-growth rate in the regression. The potential financial benefit from bankruptcy, defined as the amount of unsecured debts net of non-exempted assets, is calculated from the wealth information. Because the PSID surveys wealth every five years, they assume that individuals have the same wealth over every five year interval, introducing measurement errors. In addition, their financial benefit is highly correlated with net wealth for individuals who are in debt, and labor supply is negatively affected by wealth, according to literature findings. This casts doubts on the validity of the instrument.

The endogeneity issue of bankruptcy seemingly cannot be resolved through one of the two above methods due to the interdependence of labor and credit market behaviors. I take an alternative approach to estimate this effect from a model that allows individuals to make endogenous bankruptcy and labor supply decisions. The difference between the equilibrium and counterfactual labor market outcomes can be assessed through the model. In the next section, I begin describing the model environment.

3 The Model

Time is discrete and infinite. There is a unit measure of agents who survive to next period with a constant probability ρ. Newborns replace those who do not survive. Each agent is endowed with one unit of time that they can allocate between work h and leisure $1-h$. Competitive financial intermediaries take deposits from and give loans to agents. There exists a government that collects labor income taxes and runs social welfare programs.

3.1 Preferences

Agents value non-negative consumption $c \geq 0$ and dislike work h. The utility function $u(c,h)$ is strictly increasing and concave in consumption c

and strictly decreasing and convex in hours worked h. Agents discount the future at rate $\beta \in [0, 1]$.

3.2 Bankruptcy

An agent enters a period with assets $a \in I\!R$ and expense shocks $\zeta \in \mathcal{Z}$. The expense ζ occurs with probability $z(\zeta)$ independent of time, interpreted as unanticipated medical bills or lawsuits. The net worth of an agent in the beginning of the period is defined as $a - \zeta$.

Let $b \in \{0, 7, 13\}$ denote the bankruptcy flag status, where $b = 0$ means the agent has no bankruptcy record, $b = 7$ means he has a Chapter 7 bankruptcy record, and $b = 13$ means he has a Chapter 13 bankruptcy record. While agents have a bankruptcy flag on their credit record, they are excluded from the credit market (i.e., $a' \geq 0$).

An agent can have no bankruptcy record even if he has filed for bankruptcy in the past, because bankruptcy filers may remove their bankruptcy records $b \in \{7, 13\}$ with probability γ^b in each period provided that they do not default in that period. The removal of the bankruptcy flags is modeled as a Markov process to avoid keeping track of the number of periods the flags already are on one's credit record. The average duration of carrying a bankruptcy flag b (not counting the period of default) is therefore $1/(1-\gamma^b)-1$. If $\gamma^b = 0$, agents remove flags immediately in the period after default. If $\gamma^b = 1$, agents carry bankruptcy flags forever.

Agents without a bankruptcy flag $b = 0$ can exercise the default option if $a-\zeta < 0$. All debtors are eligible for Chapter 7 bankruptcy, but Chapter 13 bankruptcy is only available for wage earners. If agents file for bankruptcy, their debts are discharged and they continue into the next period with a bankruptcy flag associated with their bankruptcy choices. For instance, if they file under Chapter 7 ($d = 7$), their bankruptcy flag next period will be $b' = 7$. However, agents with a bankruptcy flag $b = \{7, 13\}$ on the credit record can only default if repayment results in negative consumption.

We assume that an agent cannot save or borrow (i.e., $a' = 0$) in the period of default. This is to capture the fact that whatever they save will be confiscated by the court and given back to creditors, so they do not have incentives to save. They are also not able to get loans in the period of default, because they will default all loans altogether, so no financial intermediary will be willing to extend loans.

Denote δ^b as the fraction of earnings garnished for agents with bankruptcy flag status b. Because Chapter 7 bankruptcy filers start afresh, they have all their current and future earnings exempted, so $\delta^7 = 0$. Chapter 13 filers have a fraction $\delta^{13} > 0$ of their earnings garnished as long as they have the bankruptcy flag attached.[7] For agents without a bankruptcy flag, $\delta^0 = 0$.

3.3 Employment

The employment status for an agent is binary $e \in \{0, 1\}$, where $e = 1$ indicates the agent is employed and $e = 0$ indicates the agent is either unemployed or out of the labor force. An employed agent enters a period with wage rate w. He may receive an exogenous separation shock with probability κ and become non-employed involuntarily. Otherwise, given his wage rate w, he can decide whether to continue or quit the job. Denote the job-continuation decision as $l \in \{0, 1\}$. If $l = 1$, agents continue with their current job. If $l = 0$, agents quit and become non-employed. Agents who stay employed decide how much to work h. Their before-tax earnings wh are assumed to be garnished by creditors before being taxed at rate τ by the government. Creditors receive $\delta^b wh$. The government collects $\tau(1 - \delta^b)wh$. For simplicity, this model does not allow on-the-job search.

A non-employed agent may receive a wage rate offer w from a known distribution $G(w)$ with probability ϕ^b. The likelihood of getting an offer depends on an agent's bankruptcy flag status.[8] Non-employed agents make a job-acceptance decision l^w if they receive a wage rate offer w. If $l^w = 1$, agents accept the job offer and make the work-leisure decisions. If $l^w = 0$, agents reject the job offer and stay non-employed.

3.4 Credit Market

Agents can borrow from or lend to competitive financial intermediaries who take the risk-free rate r as given. The asset choice decision made by agents is denoted as a'. Agents save if $a' > 0$ or borrow if $a' < 0$. The price schedule $q(a', \tilde{s})$ depends on the agents' asset choice a', given that they are in state $\tilde{s}$ when they borrow. In the event of Chapter 13 bankruptcy, the creditor's right to repayment is proportional to their share of total defaulted loans.

[7] In practice, Chapter 13 bankruptcy requires that debtors repay creditors using earnings net of necessary expenses. The garnished amount should not exceed 25 percent of employee's disposable earnings. This paper follows Li and Sarte (2006) to assume that the amount of necessary expenses is proportional to earnings.

[8] Based on a Survey by the Society for Human Resource Management (2010), 60% of companies use credit information (especially bankruptcy record) when making employment decisions. Chen and Corbae (2012) explore how credit checks (observable signals correlated to an agent's unobservable type) may affect outcomes in a labor matching model.

For instance, for agents who default on unsecured debt a' and expenses shock ζ, financial intermediaries receive a fraction $-a'/(-a'+\zeta)$ of the total repayment.

3.5 Welfare Benefits

The government runs a balanced budget by taxing earnings at rate τ to finance welfare benefits, which can take on three levels, $y \in \{0, \underline{y}, \overline{y}\}$ where $0 < \underline{y} < \overline{y}$. When agents make a transition from employment to non-employment, they receive unemployment insurance $\overline{y}$. In subsequent periods while they remain non-employed, they lose the benefits with probability ν (calibrated to match the average duration agents are eligible for unemployment insurance). Once they lose unemployment insurance, they do not regain eligibility before they take a new job. Non-employed agents who are ineligible for unemployment insurance receive "floor benefits" $\underline{y}$, providing a lower bound of consumption for agents in the economy. Employed workers do not receive any type of government transfer, i.e., $y = 0$.

3.6 Timing of the Events

There are two subperiods in one period. Agents enter a period in state $s = (e, b, a, w, y, \zeta)$. Newborns are assumed to enter with no job, no bankruptcy flag, and no assets. They receive floor benefits $\underline{y}$ and experience the unanticipated expense shock ζ with probability $p(\zeta)$. In another words, they enter in state $s = (0, 0, 0, 0, \underline{y}, \zeta)$. Agents make employment decisions as in a sequential job search model with exogenous separation in the first subperiod. In the second subperiod, they make bankruptcy and asset choice decisions.

3.6.1 Subperiod 1

- Agents enter subperiod 1 in state $s = (e, b, a, w, y, \zeta)$.
- Employed agents ($e = 1$) receive separation shocks. If not separated from jobs, agents make the job continuation decisions $l \in \{0, 1\}$.
- Non-employed agents ($e = 0$) receive the wage offer w from distribution $G(w)$ with probability ϕ^b and make the job-acceptance decisions $l^w \in \{0, 1\}$.
- Non-employed agents learn their eligibility for unemployment insurance benefits.

- Employment status $\tilde{e}$ with associated wage rate $\tilde{w}$ and eligible welfare benefits $\tilde{y}$ are updated.

3.6.2 Subperiod 2

- Agents enter subperiod 2 with updated state $\tilde{s} = (\tilde{e}, b, a, \tilde{w}, \tilde{y}, \zeta)$ according to labor market activities in subperiod 1.
- Agents make bankruptcy decisions $d \in \{0, 7, 13\}$.
- Employed agents ($\tilde{e} = 1$) make work-leisure decisions $h \in [0, 1]$ and receive earnings. Non-employed agents ($\tilde{e} = 0$) receive social benefits $\tilde{y}$ from the government.
- Agents consume c and make asset choice decisions a'.
- Agents learn their death shocks. If they survive, the bankruptcy flag b' and expense shocks ζ' for next period are updated.

4 Equilibrium

4.1 Agent's problem

Let $V(s)$ be the values of agents who enter subperiod 1 in state $s = (e, b, a, w, y, \zeta)$ and $W(\tilde{s})$ be the values of agents when they enter subperiod 2 with the updated state $\tilde{s} = (\tilde{e}, b, a, \tilde{w}, \tilde{y}, \zeta)$.

4.1.1 Subperiod 1

For employed agents, their values in subperiod 1 are given by

$$\begin{aligned} V(1, b, a, w, 0, \zeta) =& \kappa W(0, b, a, 0, \overline{y}, \zeta) \\ &+ (1 - \kappa) \max \left\{ W(1, b, a, w, 0, \zeta), W(0, b, a, 0, \overline{y}, \zeta) \right\}. \end{aligned} \tag{2}$$

If they are separated exogenously from their jobs with probability κ, they continue to subperiod 2 with values of being non-employed $W(0, b, a, 0, \overline{y}, \zeta)$. They are eligible for unemployment insurance when they just become unemployed. For agents who do not receive the separation shock, if the value of continuing with current jobs $W(1, b, a, w, 0, \zeta)$ is greater than the value of quitting $W(0, b, a, 0, \overline{y}, \zeta)$, agents remain employed.

For non-employed agents, their values in subperiod 1 are given by

$$V(0,b,a,0,y,\zeta) = \phi^b \int_w \max\left\{W(1,b,a,w,0,\zeta), E_{\tilde{y}|y}W(0,b,a,0,\tilde{y},\zeta)\right\}G(dw) \\ +(1-\phi^b)E_{\tilde{y}|y}W(0,b,a,0,\tilde{y},\zeta). \tag{3}$$

They receive a wage-rate offer w from a distribution $G(w)$ with probability ϕ^b and make the job-acceptance decision. They take the new job if the value of accepting $W(1,b,a,w,0,\zeta)$ is greater than the value of rejecting $E_{\tilde{y}|y}W(0,b,a,0,\tilde{y},\zeta)$, taking into account the probability of losing unemployment insurance while staying non-employed. If they do not have a new job offer, with probability $1-\phi^b$, they continue non-employed with subperiod-2 value $E_{\tilde{y}|y}W(0,b,a,0,\tilde{y},\zeta)$.

4.1.2 Subperiod 2

Agents make bankruptcy decisions $d \in \{0,7,13\}$ and asset choice decisions a' in the second subperiod. Agents without a bankruptcy record ($b=0$) can default if they have negative net worth. For agents with a bankruptcy flag ($b \in \{7,13\}$), default is available to them if repayment results in negative consumption, i.e., $(1-\tau)(1-\delta^b)w + y + a - \zeta < 0$. Because Chapter 13 bankruptcy functions as an earner's repayment plan, only agents who are employed at the time of default are eligible.

$$W(1,b,a,w,0,\zeta) = \max\{W^{d=0}(1,b,a,w,0,\zeta), \\ W^{d=7}(1,b,a,w,0,\zeta), W^{d=13}(1,b,a,w,0,\zeta)\} \tag{4}$$

The value functions of employed agents, given their bankruptcy decisions, are given as follows:

1. If agents do not exercise the option of default, they can save or borrow (if $b=0$) from the financial intermediaries. Their earnings may be partially garnished based on their bankruptcy flag status.

   $$W^{d=0}(1,b,a,w,0,\zeta) = \max_{(h,a')}\left\{u(c,h) + \beta\rho E_{(b',\zeta')}V(1,b',a',w,0,\zeta')\right\}$$

   where $c = (1-\tau)(1-\delta^b)wh + a - \zeta - q(a',\tilde{s})a' \geq 0$.

2. If agents file for Chapter 7 bankruptcy when their incomes are less than the prescribed Ω, they consume after-tax earnings and enter the next period with a Chapter 7 bankruptcy flag.

   $$W^{d=7}(1,b,a,w,0,\zeta) = \max_h \left\{u((1-\tau)wh,h) + \beta\rho E_{\zeta'} V(1,7,0,w,0,\zeta')\right\}$$

3. If agents choose to file for Chapter 13 bankruptcy, they consume after-garnishment after-tax earnings and enter the next period with a Chapter 13 bankruptcy flag.

   $$\begin{aligned} W^{d=13}(1,b,a,w,0,\zeta) = \max_h \{ & u((1-\tau)(1-\delta^{13})wh,h) \\ & + \beta\rho E_{\zeta'} V(1,13,0,w,0,\zeta')\} \end{aligned}$$

Agents who do not work ($l=0$) do not receive any earnings. Chapter 13 bankruptcy is not available for nonworkers. They make bankruptcy decisions $d \in \{0,7\}$. Non-employed agents with bankruptcy flags can only file for Chapter 7 if $y + a - \zeta < 0$. Agents who do not default can save or borrow $a' \in I\!R$ if they do not have a bankruptcy flag and can only save $a' \geq 0$ if they already have bankruptcy flags.

$$W(0,b,a,0,y,\zeta) = \max\{W^{d=0}(0,b,a,0,y,\zeta), W^{d=7}(0,b,a,0,y,\zeta)\} \quad (5)$$

The values of non-employed agents, given their bankruptcy decisions, are given as follows:

1. If agents choose not to default,

   $$W^{d=0}(0,b,a,0,y,\zeta) = \max_{a'}\{u(c,0) + \beta\rho E_{(b',\zeta')} V(0,b',a',0,y,\zeta')\}$$

   where $c = y + a - \zeta - q(a',\tilde{s})a'$.

2. If agents file for Chapter 7 bankruptcy,

   $$W^{d=7}(0,b,a,0,y,\zeta) = u(y',0) + \beta\rho E_{\zeta'} V(0,7,0,0,y,\zeta')$$

The solution to the agents' problem gives the employment decision $l(s)$ in the first subperiod and the default $d(\tilde{s})$, hours-worked $h(\tilde{s})$, and asset choice $a'(\tilde{s})$ decisions in the second subperiod.

Denote the reservation wages as $w^r(s)$ for agents in state s. For employed agents, the reservation wage w^r satisfies the following condition,

$$W(1,b,a,w^r,0,\zeta) = W(0,b,a,0,\overline{y},\zeta)$$

such that agents feel indifferent between continuing and quitting their current jobs when their wage rate is w^r. For non-employed agents, the reservation wage w^r satisfies the following condition,

$$W(1, b, a, w^r, 0, \zeta) = E_{y'|y} W(0, b, a, 0, y', \zeta)$$

such that they feel indifferent between accepting and rejecting the new job offer when the wage offer is w^r.

4.2 Financial Intermediary's Problem

Competitive financial intermediaries take the risk-free rate r as given and provide a menu of deposits and loans with interest rates that make zero profit at equilibrium. The prices take into account that some agents may not survive to collect their savings or repay their debt. The deposit prices are $\rho/(1+r)$. The loan prices further depend on the default risk given by

$$q(a', \tilde{s}) = \frac{\rho R(a', \tilde{s})}{1+r} \tag{6}$$

where $R(a', \tilde{s})$ is the expected recovery rate for loan sizes a', given that agents are in state $\tilde{s}$ when they borrow. Specifically,

$$R(a', \tilde{s}) = E_{\tilde{s}'|(a', \tilde{s})} \left[1_{\{d(\tilde{s}')=0\}} \cdot 1 + 1_{\{d(\tilde{s}')=7\}} \cdot 0 + 1_{\{d(\tilde{s}')=13\}} \cdot \Phi(\tilde{s}') \right] \tag{7}$$

The financial intermediaries receive full repayment (i.e., the recovery rate is 1) if agents choose not to default. When agents default, the amount that the financial intermediaries can recover is determined by the bankruptcy choices made by the agents. If agents file for Chapter 7 bankruptcy, the recovery rate is 0 because they are not obliged to repay using current and future earnings. Denote $\Phi(\tilde{s}')$ as the recovery rate for the financial intermediaries when agents file for Chapter 13 in state $\tilde{s}'$. Because the financial intermediaries partially recover from Chapter 13 bankruptcy through wage garnishment, the recovery rate is directly affected by the labor supply decisions of the defaulters.

Let $\Gamma(\tilde{s}')$ be the total expected discounted repayments from a Chapter 13 bankruptcy filer who defaults in state $\tilde{s}'$. It is given by

$$\Gamma(\tilde{s}') = \gamma^{13} w(\tilde{s}') h(\tilde{s}') + E_{\tilde{s}''|\tilde{s}'} \Lambda(\tilde{s}''), \tag{8}$$

which includes the amount garnished in the period of default $\gamma^{13} w(\tilde{s}') h(\tilde{s}')$ where $w(\tilde{s}')$ denotes the element value of wage w in state $\tilde{s}'$ and expected discounted future repayment $E_{\tilde{s}''|\tilde{s}'}\Lambda(\tilde{s}'')$, which can be defined recursively as follows.

$$\Lambda(\tilde{s}) = \gamma^{13} w(\tilde{s}) h(\tilde{s}) + \frac{E_{\tilde{s}'|\tilde{s}}\left[1_{\{b(\tilde{s}')=13, d(\tilde{s}')=0\}}\Lambda(\tilde{s}')\right]}{1+r}. \tag{9}$$

The wage garnishment terminates only when either agents have the Chapter 13 bankruptcy flag removed or file for bankruptcy again. However, although financial intermediaries do not receive repayment while agents are non-employed, as long as they carry a Chapter 13 bankruptcy flag, their earnings are subject to wage garnishment once they enter the labor market, which potentially makes the reservation wages of agents with a Chapter 13 bankruptcy flag different from others.

Assuming that financial intermediaries share repayment with creditors for the expense shocks, they share the fraction of $-a/(-a+\zeta)$ out of the total repayment from debtors who default on unsecured debt $-a$ and expense shocks ζ through Chapter 13 bankruptcy. Therefore, for a loan size a' that is defaulted via Chapter 13 bankruptcy by agents in state $\tilde{s}'$, the financial intermediaries recover $\Lambda(\tilde{s}') \cdot (-a/(-a+\zeta))$. Therefore, the recovery rate for a Chapter 13 bankruptcy when agents default in state $\tilde{s}'$ can be calculated by taking the total partial repayment received by financial intermediaries divided by the loan size.

$$\Phi(\tilde{s}') = \Lambda(\tilde{s}')/(-a' + \zeta(\tilde{s}')). \tag{10}$$

Because the current asset position a and expense shocks ζ do not provide information about future states, the price functions do not depend on (a, ζ).

4.3 Distribution

Denote by $m(s)$ and $\tilde{m}(\tilde{s})$ the invariant cross-sectional distribution measures of agents in state s and $\tilde{s}$ in the first and second subperiods respectively.

I start by formulating the distribution measures in subperiod 2. Workers include those who continue their old jobs and those who accept new jobs.

$$\begin{aligned}\tilde{m}(1, b, a, w, 0, \zeta) =& l(1, b, a, \tilde{w}, 0, \zeta) m(1, b, a, w, 0, \zeta) \\ &+ \sum_{y} \left[l^w(0, b, a, 0, y, \zeta) \phi^b g(w) m(0, b, a, 0, y, \zeta) \right]\end{aligned} \tag{11}$$

Nonworkers include those who are separated voluntarily or involuntarily from their old jobs and those non-employed agents who do not receive or accept new job offers.

$$\tilde{m}(0,b,a,0,\tilde{y},\zeta) = 1_{\{\tilde{y}=\overline{y}\}} \int_w \kappa + (1-\kappa)(1-l(1,b,a,w,0,\zeta))m(1,b,a,dw,0,\zeta)$$

$$+ \sum_y p(\tilde{y}|y) \int_w \Big[(1-l^w(0,b,a,0,y,\zeta))\phi^b m(0,b,a,0,y,\zeta) \Big] G(dw) \tag{12}$$

In the first subperiod, the population includes both agents who survive from the previous period and newborns. Surviving agents enter a period with asset position and bankruptcy flag status that depend on their default and asset choice decisions made in the previous period. Let $B(b', b, d)$ be the probability that agents have updated bankruptcy status b' given previous bankruptcy flag status b and default decision d in the last period. The distribution for agents with a current job is given by

$$m(1,b',A,w,0,\zeta') = \rho z(\zeta') \sum_\zeta 1_{a'(\tilde{s})\in A} B(b',b,d(\tilde{s}))\tilde{m}(e,b,a,w,0,\zeta). \tag{13}$$

The distribution for agents without a current job, which also includes newborns who enter with zero assets and no bankruptcy flag, is given by

$$\begin{aligned} m(0,b',A,\emptyset,y,\zeta') = & \rho z(\zeta') \sum_\zeta 1_{a'(\tilde{s})\in A} B(b',b,d(\tilde{s}))\tilde{m}(0,b,a,0,y,\zeta) \\ & + (1-\rho)z(\zeta')1_{\{b'=0,\{0\}\in A, y'=0\}}. \end{aligned} \tag{14}$$

4.4 Government

The government taxes labor income (after any applicable wage garnishment) at rate τ from employed agents and provides social welfare benefits to non-employed agents in the second subperiod. The government runs a balanced budget such that the total tax revenues equal the total benefits payouts.

$$\begin{aligned} & \sum_{(b,\zeta)} \int_{(a,w)} \tau(1-\delta^b) w h(1,b,a,w,0,\zeta) \cdot \tilde{m}(1,b,da,dw,0,\zeta) \\ = & \sum_{(b,y,\zeta)} \int_a y \cdot \tilde{m}(0,b,da,0,y,\zeta) \end{aligned} \tag{15}$$

4.5 Definition of a stationary equilibrium

The stationary equilibrium consists of a set of value functions $V^*(s)$ and $W^*(\tilde{s})$, agents' decision rules $(l^*(s), h^*(\tilde{s}), d^*(\tilde{s}), a'^*(\tilde{s}))$, a price function $q^*(a', \tilde{s})$, and a distribution $m^*(s)$ $(\tilde{m}^*(\tilde{s}))$ such that

1. Agents make employment decision $l^*(s)$ to maximize $V(s)$ in (2) and (3) in first the subperiod.
2. Agents make hours-worked, bankruptcy, and asset choice decisions $(h^*(\tilde{s}), d^*(\tilde{s}), a'^*(\tilde{s}))$ to maximize $W(\tilde{s})$ in (4) and (5) in the second subperiod.
3. The price function $q^*(a', \tilde{s})$ satisfies the zero-profit condition in (6).
4. The distributions $(m^*(s), \tilde{m}^*(\tilde{s}))$ in (13), (14), (11), and (12) reproduce themselves.
5. The government runs a balanced budget in (15).

5 Parameterization

The model period is one quarter. I calibrate the model to before 2005, that is, before the implementation of the means test. Therefore, there is no income restriction on eligibility for Chapter 7 filing, i.e., $\Omega = \infty$.[9]

I make the following assumptions for the specifications of the model. I use the following utility function form:

$$u(c, h) = \frac{\left(c^{1-\eta}(1-h)^{\eta}\right)^{1-\alpha} - 1}{1-\alpha}$$

I assume the wage-rate offers follow a lognormal distribution $G(w)$, where the logarithm of the wage-rate offers has a mean of μ_w and standard deviation σ_w. The expense shocks are assumed to take place on two levels $\zeta \in \{0, \bar{\zeta}\}$, where $\bar{\zeta} > 0$. I set the job-arrival rates for agents with bankruptcy flags to be the same, i.e., $\phi^7 = \phi^{13}$. Therefore, the benchmark model has a total of 18 parameters, among which 9 are determined independently of all other parameters and 9 are determined jointly at equilibrium to match target statistics. Table 3 summarizes the parameters determined independently, and Table 4 summarizes the parameters determined jointly and lists the target statistics and the model predications.

[9] There was a historic rush to file for Chapter 7 bankruptcy right before the implementation of the means test in 2005. The model is therefore calibrated to before 2005, as it focuses on a stationary equilibrium.

Description	Parameter	Value	Target
Survival rate	ρ	0.99375	40 years (age 25-65)
CRRA coefficient	α	2.5	Hansen et al. (1992)
Mean of log wage-rate offer	μ_w	0	Normalization
Job-separation rate	κ	0.06	JOLTS (2004)
Probability of losing UI eligibility	ν	0.5	6 months
Chapter 7 flag removal rate	γ^7	0.025	10 years (FCRA)
Chapter 13 flag removal rate	γ^{13}	0.05	5 years
Chapter 7 wage-garnishment rate	δ^7	0	Fresh Start
Risk-free interest rate	r	0.01	Annual estimate of 0.04

Table 3: Benchmark Parameters Determined Independently

5.0.1 Parameters Determined Independently

The survival probability ρ is set to be 0.99375 to match an average duration of adult life of 40 years. The constant relative risk aversion coefficient α is set to 2.5, as in Hanson and Imrohoroglu (1992), who use the same form of utility for agents.

The mean of the log wage-rate offer is normalized to 0. The Job Openings and Labor Turnover Survey (JOLTS) conducted monthly by the U.S. Department of Labor reports an average of the monthly layoff and discharge rates of 1.5%. The exogenous job-separation rate κ is set to be $1.5\% \times 4 = 6\%$. The probability of losing unemployment insurance ν is set to 0.5, which implies that individuals are eligible for unemployment insurance for 2 quarters on average.

The FCRA prescribes that Chapter 7 bankruptcy history stay in one's credit report for 10 years. The probability of removing a Chapter 7 bankruptcy flag γ^7 is set to 0.025, such that the average duration is consistent with the FCRA. The length of repayment plans for Chapter 13 bankruptcy typically ranges between 3 and 5 years. The probability of removing a Chapter 13 bankruptcy flag γ^{13} is set to 0.05, which implies that agents on average have their wages garnished for five years. The risk-free rate r is set to be 1%.

5.0.2 Parameters Determined Jointly

According to Bureau of Labor Statistics (BLS), the fraction of civilian employed between ages 25 and 64 in 2004 was 75%. The income gini calculated from the PSID dataset is reported to be 0.44 by Quadrini (2000). The mean to median wage rate ratio is on average 1.30 from the 1968-1996 PSID

Description	Parameter	Value
Discount rate	β	0.96
Utility share of leisure	η	0.6
Job-offer arrival rate with good credit	$\phi^{b=0}$	0.40
Job-offer arrival rate with bad credit	$\phi^{b\neq 0}$	0.25
Standard deviation of log wage-rate offer	σ_w	0.18
Unemployment insurance	$\overline{y}$	0.235
Food stamps	$\underline{y}$	0.0005
Level of expense shock	$\bar{\zeta}$	10
Probability of expense shock	$z(\bar{\zeta})$	0.0004
Chapter 13 wage-garnishment rate	δ^{13}	0.05
Target Statistics	**Data**	**Model**
Employment rate	0.75	0.76
Income gini	0.44	0.30
mean to median wage rate	1.30	1.01
UI replacement ratio	0.50	0.51
Food stamps to average earnings ratio	0.0015	0.0014
Bankruptcy rate	0.0016	0.0015
Bankruptcy due to expense shock	0.0006	0.0006
Debt to income ratio	0.023	0.020
Chapter 7 fraction	0.72	0.70
Chapter 13 recovery rate	0.57	0.53

Table 4: Benchmark Parameters Determined at Equilibrium

dataset according to Heathcote et al. (2010). I choose the utility share of leisure η, the standard deviation of the wage-offer distribution σ_w, and the job-arrival rate for agents with good credit ϕ^0 to match the employment rate, earnings gini, and mean-to-median wage rate ratio.

The unemployment insurance $\overline{y}$ is chosen to match the average replacement ratio of 0.50. The average monthly Supplemental Nutrition Assistance Program (SNAP) food stamp benefit is about \$101 per person, according to U.S. Department of Agriculture, which amounts to \$404 per quarter. I choose $\underline{y}$ such that an allotment is around 0.15% of average earnings.

According to the Administrative Office of the U.S. Courts, there were 1.556 million personal-bankruptcy filings in 2004. The Census Bureau reported that the total population above age 20 in 2004 was 211 million. The percentage of bankruptcy in the population over 20 was 0.74%. The PSID classified the reasons for bankruptcy filings into five categories, and Chatterjee et al. (2007) associate job loss and credit misuse with earnings shocks, marital disruption with preference shocks, and health-care bills and lawsuits/harassment with expense shocks. According to Chakravarty and Rhee (1999), among all the bankruptcy filings, including both Chapter 7 and Chapter 13, 52.11% are related to earnings shocks and 33.80% are related to liability shocks. Following the adjustment method of Chatterjee et al. (2007), the target percentage of quarterly bankruptcy is 0.16% (i.e., 0.74%×85.9%/4=0.16%), as the model only covers 85.9% of the reasons for bankruptcy filings. Similarly, the bankruptcy rate due to expense shocks is targeted at 0.06% (i.e., 0.16%×33.80/(33.80+52.11)=0.06%). The annual estimate of debt-to-income ratio is 0.0067, taken from Chatterjee et al. (2007), which gives the adjusted quarterly target of 0.023. I choose the discount rate β, the expense shock amount $\bar{\zeta}$ and associated probability $z(\bar{\zeta})$ to match the bankruptcy rate, bankruptcy due to expense shocks, and debt-to-income ratio.

Out of the total 1.556 million bankruptcy filings, 1.118 million are filed under Chapter 7. The percentage of Chapter 7 filings is therefore targeted at 72%. An earlier GAO study in 1983 reports that the amount scheduled to be repaid under Chapter 13 bankruptcy filings is about 57% of the unsecured debt owed. The Chapter 13 wage-garnishment rate δ^{13} and probability of receiving a wage offer with bad credit $\phi^{b\neq 0}$ are chosen to match the Chapter 7 bankruptcy fraction and expected recovery rate for Chapter 13 bankruptcy.

6 Results

6.1 Bankruptcy Choices

The default decisions for workers who do not experience expense shocks are plotted in Figure 1. Agents repay in the region of lower debts and higher wages. Given debt level, agents are more likely to default when their wages are low. Given wage rate, agents are more likely to default when they have more debts.

The advantage of Chapter 7 bankruptcy is that agents are not subject to wage garnishment, at the cost of longer exclusion from borrowing. For agents with higher wages, they can better insure themselves against future income disruptions by saving more; therefore, they are willing to avoid wage garnishment even if they will not be able to borrow for longer periods. On the other hand, income-poor agents are more likely to experience consumption fluctuation without access to the credit market. Therefore, they prefer a shorter exclusion from borrowing even if they have to have a fraction of earnings garnished.

As we can see from Figure 1, when an agent files for bankruptcy, if the wage rate is lower than 1.24, the benefit of having a shorter exclusion from borrowing outweighs the cost of wage garnishment and they choose to file for Chapter 13. On the other hand, if the defaulters have wage higher than 1.24, they file for Chapter 7 bankruptcy to avoid wage garnishment because the benefit of keeping all of their earnings outweighs the cost of longer exclusion from the credit market, given their better wage positions. The data in the 1979-1994 NLSY79 dispay a similar patter. The average real wage rate (in 2004$) is $9.63 for Chapter 13 filers and $10.49 for Chapter 7 filers.

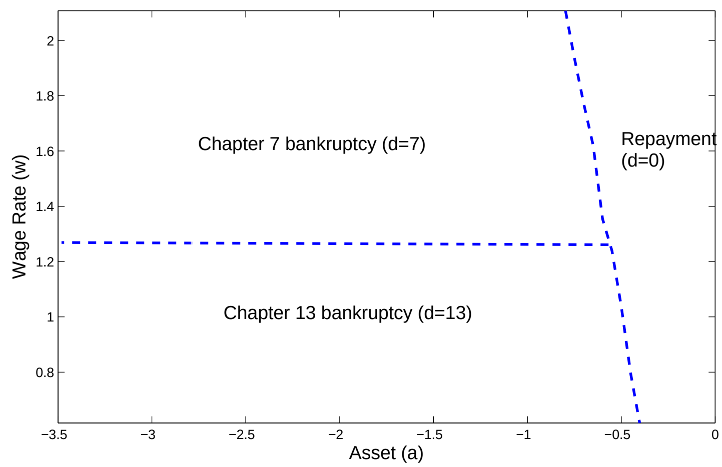

Figure 1: Equilibrium Default Choices for Workers

The default decisions for non-workers depend on their allotment of government transfer. Their bankruptcy decisions are restricted to repayment and Chapter 7 bankruptcy. Agents who receive more government transfer default at a larger debt level. Floor benefit recipients file for Chapter 7 bankruptcy if $a < -0.2$, while unemployment insurance recipients file to default if $a < -0.5$.

6.2 Price Schedules

Given the decision rules of the agents, the financial intermediaries price loans such that the zero-profit conditions are satisfied. Unlike standard bankruptcy models with only Chapter 7 bankruptcy, where financial intermediaries need only bankruptcy decision rules, here they also require knowledge of labor supply decisions to evaluate the recovery rate given the availability of Chapter 13 bankruptcy.

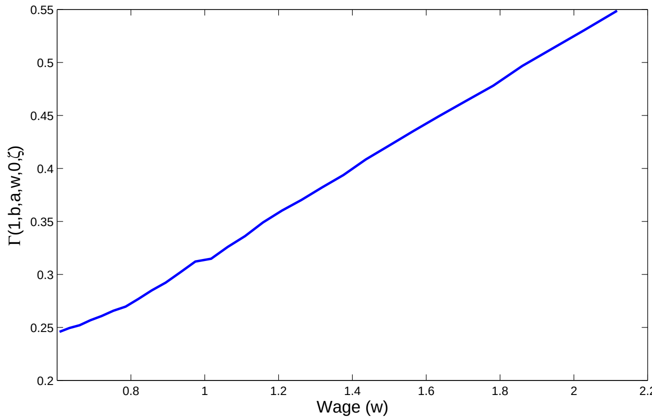

Figure 2: Equilibrium Repayment from Chapter 13 Bankruptcy

When there is no default risk for a given loan, financial intermediaries charge the risk-free rate because the recovery rate is 1 from full repayment. When agents file for Chapter 7 bankruptcy, the recovery rate is 0 because agents have wages fully exempted, and financial intermediaries receive nothing. If agents file for Chapter 13 bankruptcy, the amount of expected discounted total repayment through wage garnishment determines the recovery rate, graphed in Figure 2. We can see that agents with higher wages at the time of default make more repayments. The recovery rate is therefore higher for debtors with higher wages, although what really matters for the recovery rate is earnings, which is the product of wage and hours worked.

Figure 3 graphs the equilibrium price functions for workers. First of all, agents receive higher interest rates (lower prices q) for larger loans because agents are more likely to default when they have more debt. Furthermore, the price functions can be separated into two parts. The first part is for agents who have wage rates higher than 1.24. The price functions for these agents are initially high because they are less likely to default but drop to 0 when their debt levels are large enough to trigger default actions. Because in the event of default high wage earners prefer Chapter 7 bankruptcy to avoid wage garnishment, and the recovery rate of a Chapter 7 bankruptcy is zero, as is evident in Figure 1.

On the other hand, for agents whose wage rates are lower than 1.24, in the event of default, they would like to take advantage of shorter borrowing exclusion periods from Chapter 13 bankruptcy, even if they need to have part of their earnings garnished. Their credit limits are therefore extended

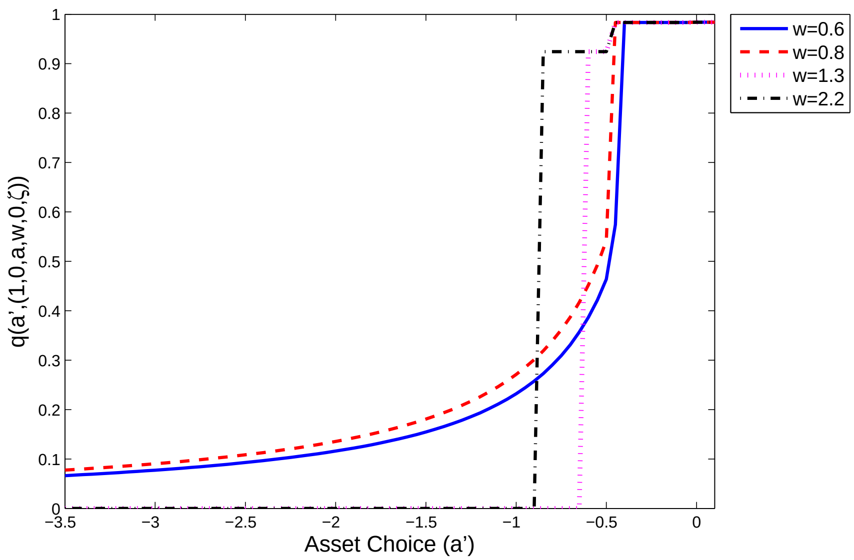

Figure 3: Equilibrium Price Functions for Workers

because the financial intermediaries can partially recover from the wage garnishment associated with a Chapter 13 bankruptcy.

Figure 4 graphs the price function for non-workers. Like the price functions for workers, prices decrease with loan sizes. The loan prices also depend on the social welfare benefits the agents receive. Agents who receive unemployment insurance have lower loan prices than agents who receive floor benefits because they are less likely to default. Although Chapter 13 bankruptcy is not available for agents without a job, the price function also has a long left tail because it is possible that agents will accept a new job offer and file for Chapter 13 bankruptcy in the next period.

6.3 Reservation Wages

Figure 5 graphs the reservation wages for workers. If their current wage rates equal their reservation wages, they feel indifferent between continuing and leaving their jobs. Therefore, they have to receive at least their reservation wages from their jobs in order to remain employed. Without on-the-job search, the only way for workers to receive better wages is through quitting, because only non-employed agents can receive new wage offers. Because the number of periods before accepting a new job is uncertain, agents with

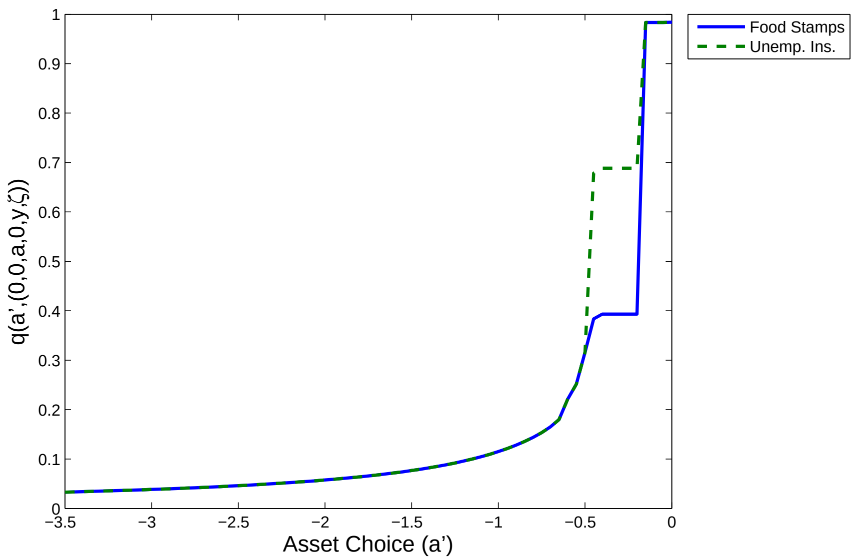

Figure 4: Equilibrium Price Functions for Workers

more assets can better smooth their consumption during non-employment and hence have lower cost of income disruption. Therefore, employed agents have higher reservation wages when they are wealthier.

When workers with bankruptcy flags quit, they can only use their savings to smooth consumption before their receive a better wage-rate offer, because they are constrained from borrowing. Moreover, given their bad credit, they are less likely to receive a job offer than the agents with good credit, i.e., the job arrival rate for the agents with a bankruptcy flag is lower than for the agents without a bankruptcy flag. If they quit, they have longer waiting periods before a new job offer arrives. This lowers their incentives of leaving current jobs. Therefore, the agents with bad credit have reservation wages lower than agents in good credit ratings, given the same asset position.

Among those who are borrowing constrained, the reservation wages further depend on the types of bankruptcy flags they carry. Agents with Chapter 13 bankruptcy flags expect to be excluded for fewer periods than agents with Chapter 7 bankruptcy flags. This can raise their reservation wages, because they are more likely to regain the privilege of borrowing, which helps them smooth consumption while searching for jobs. Furthermore, while they carry a Chapter 13 bankruptcy flag, they lose a constant fraction of their earnings. This may reduce their incentives to take on a job because they receive less earnings due to wage garnishment.

We can see from Figure 5 that given the same asset position an agent with a Chapter 7 bankruptcy flag is more likely to accept a particular offer than an agent with a Chapter 13 bankruptcy flag. This is because agents on a repayment plan take into account that part of their earnings will be garnished. However, the after-garnishment reservation wages for agents with Chapter 13 bankruptcy flags are lower than the reservation wages for agents with Chapter 7 bankruptcy flags.

Notice from the figure that the reservation wages are zero when agents have zero assets if they have a bankruptcy flag. Because in the period after default agents have zero assets and carry a bankruptcy flag, this suggests that there is no difference in the labor supply in extensive margin among bankruptcy filers right after they default.

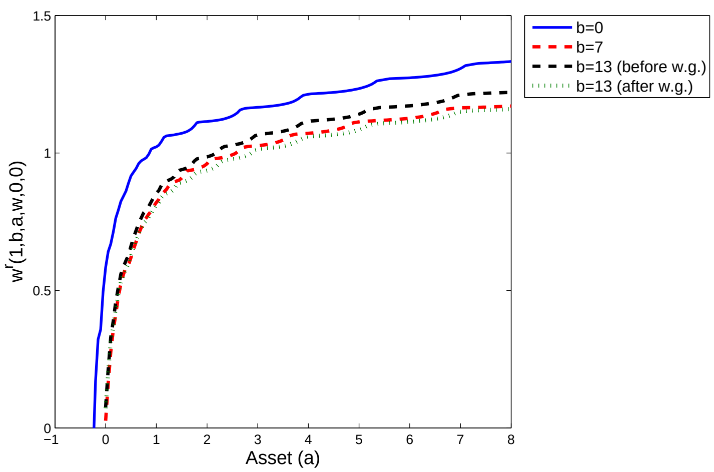

Figure 5: Equilibrium Reservation Wages for Workers

Figure 6 graphs the reservation wages for non-employed agents. When a job offer arrives with their reservation wages, they feel indifferent between accepting or rejecting the new job. Reservation wages for the non-employed increase with their assets and social benefits. Agents without bankruptcy flags have higher reservation wages than agents with Chapter 7 or Chapter 13 bankruptcy flags. The results that reservation wages are negatively affected by wealth and positively affected by borrowing constraints (both for the employed and the non-employed) echoe the empirical findings of Rendon

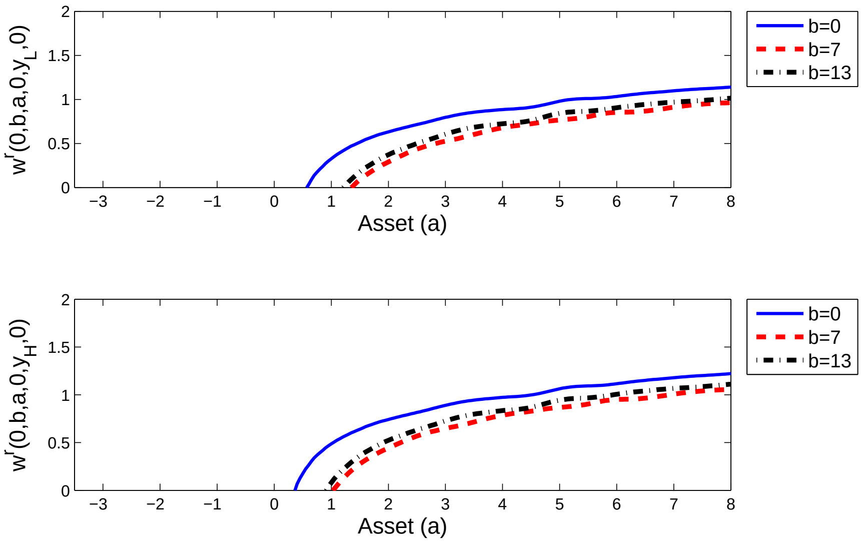

Figure 6: Equilibrium Reservation Wages for Non-Workers

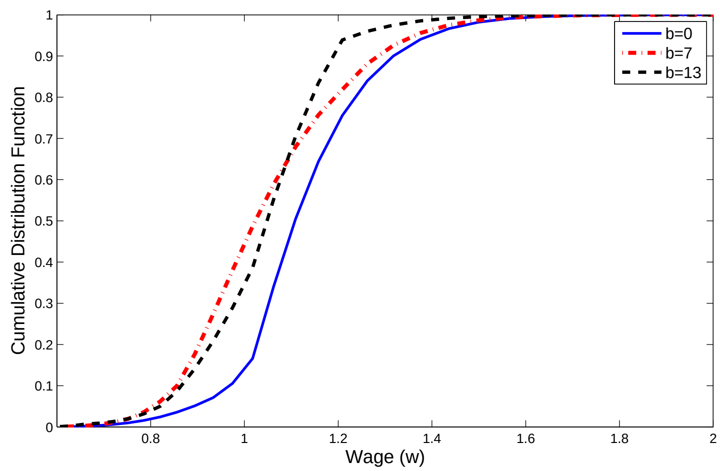

Figure 7: Wage Offer and Equilibrium Wage Distributions

(2006).

The reservation wages generate the difference between the exogenous wage-offer distribution and the endogenous equilibrium wage distribution.

b	Model		Data	
	Mean (Std)	% to Mean for $b=0$	Mean (Std)	% to Mean for $b=0$
0	1.1509 (0.1543)	–	\$11.82 (\$8.64)	–
7	1.0712 (0.1772)	0.9307	\$11.00 (\$8.04)	0.9306
13	1.0633 (0.1389)	0.9239	\$10.71 (\$6.78)	0.9061

Table 5: Mean Wages given Bankruptcy Flag Status

Figure 7 graphs the wage-offer distribution and the equilibrium wage distribution conditional on agents' bankruptcy flag status.

The wage distribution for agents without a bankruptcy flag first-order stochastic dominates the wage distribution for agents with bankruptcy flags. The mean wage for agents with good credit is 1.1509, higher than the mean wages of 1.0712 for agents with Chapter 7 bankruptcy flags and 1.0633 for agents with Chapter 13 bankruptcy flags because agents without bankruptcy flags have higher reservation wages. Compared with statistics from the 1979-1994 NLSY79, the average real wage for individuals who have not filed for Chapter 7 bankruptcy in the past 10 years and have not filed for Chapter 13 bankruptcy in the past five years is \$11.82, which is higher than the average real wage of \$11.00 for individuals with Chapter 7 bankruptcy records or \$10.71 for individuals with Chapter 13 bankruptcy records.

When we compare the two wage distributions with bankruptcy flags, the wage distribution for agents with Chapter 13 bankruptcy flags second order stochastic dominates the one for agents with Chapter 7 bankruptcy flags. Therefore, the standard deviation of the wage distribution for agents with a Chapter 7 bankruptcy record (0.1772) is higher than that for agents with a Chapter 13 bankruptcy record (0.1389). Consistent with the model, the standard deviation of wages is higher for individuals who have filed for Chapter 7 bankruptcy in the past 10 years (\$8.04) than for individuals who have filed for Chapter 13 bankruptcy in the past 5 years (\$6.78), according to the NLSY79.

6.4 Hours Worked

While agents make the labor participation decision in the extensive margin based on their reservation wages, workers make the labor supply decisions in intensive margins. Workers choose the time allocation between work and leisure. Non-employed devote all of their time to leisure.

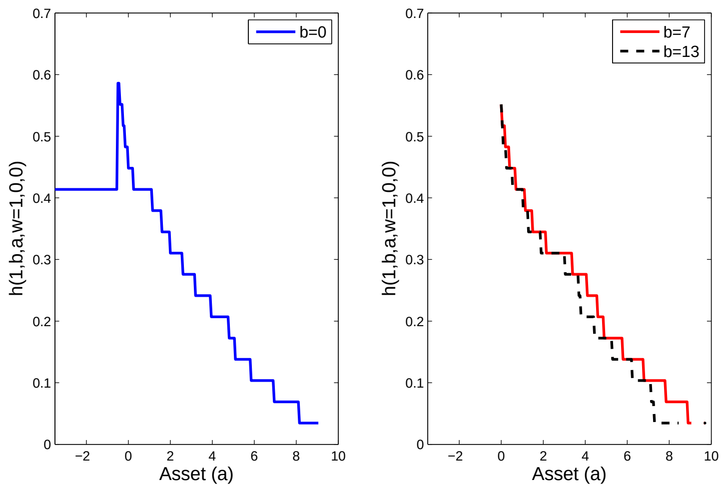

Figure 8: Equilibrium Hours Worked Decisions

Figure 8 graphs the equilibrium hours-worked decisions for workers with wage rate $w = 1$ and no expense shocks. When workers choose to default, their labor supply decisions become a static problem because they wipe out their debt and they can not borrow or save during the period of default. Their equilibrium hours worked lie flat around 0.4. However, when agents repay, their hours-worked decisions can affect their consumption and savings. Therefore, labor supply decisions in intensive margins can depend on agents' characteristics. We can see from the figure that agents work less when they have more assets because leisure is a normal good and they would like to consume more when they are wealthier.

Given the same asset level, agents with Chapter 7 bankruptcy flags work more than agents with Chapter 13 bankruptcy flags. This indicates that the sum of the borrowing constraint effect (from expecting to be excluded longer from the credit market) and the substitution effect (because leisure is more expensive) dominates the wealth effect (from avoiding wage garnishment).

Figure 9 graphs the equilibrium histogram of hours worked. There is a

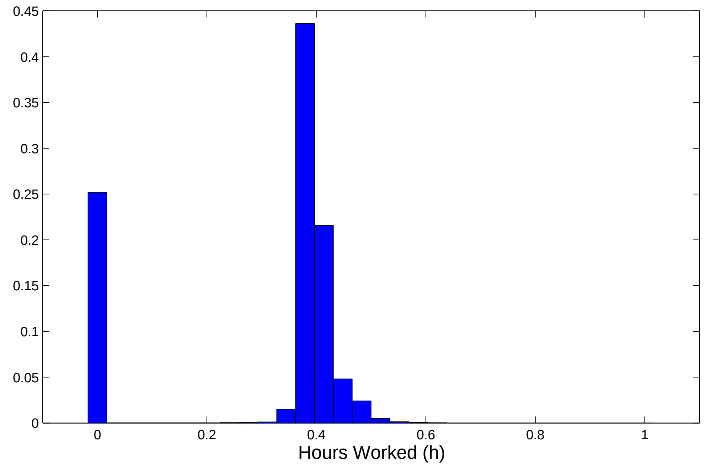

Figure 9: Equilibrium Histogram of Hours Worked

large spike at zero that consists of non-workers who devote all of their time to leisure. Most workers choose hours worked around 0.4 (standard full-time jobs).

7 Measure of the Effects

7.1 On-impact Effects

In this section, I analyze the impact of bankruptcy on the labor supply decisions with a parameterized model. The average labor supply for hypothetical bankruptcy decision d, given that d^* is the optimal bankruptcy decision, can be measured by

$$\mathcal{L}(d^*, d) = E[e' \cdot h' | d^*, d], \tag{16}$$

which depends on the labor supply decisions on both extensive margin and intensive margin.

First, I measure the extensive margin of the labor supply summarized in Table 6 by calculating the average employment rate, defined as

$$\mathcal{E}(d^*, d) = E[e' | d^*, d]. \tag{17}$$

Using agents' equilibrium labor supply decisions, we can calculate the values of $\mathcal{E}(d^*, d^*)$ on the diagonal of Table 6. To fill in off-diagonal values, specifically $\mathcal{E}(d^*, d \neq d^*)$, I solve for the optimal labor supply decisions given counterfactual bankruptcy decisions. Conditional on individuals who file for Chapter 7 bankruptcy, the ATET on the extensive margin is 0.0076. Specifically,

$$\mathcal{E}(7,7) - \mathcal{E}(7,0) = 0.3443 - 0.3367 = 0.0076.$$

Therefore, a fresh start increases the average employment rate by 2.3% (from 0.3367 to 0.3443) for Chapter 7 filers, which suggests that the borrowing constraint effect dominates the wealth effect.

The wealth effect can be isolated by assuming that individuals receive a fresh start with immediate access to the credit market. That is, we assume that the agents do not carry a bankruptcy flag after default. In the next period, employed agents with wage rate w and expense shock ζ do not leave their jobs if

$$W(1,0,0,w,0,\zeta) \geq W(0,0,0,0,\overline{y},\zeta).$$

Non-employed agents with social benefit y and expense shock ζ accept a wage-rate offer w if

$$W(1,0,0,w,0,\zeta) = E_{y'|y} W(0,0,0,0,y',\zeta).$$

Notice that the agents enter the next period with zero assets because they start afresh. Also, they do not carry a bankruptcy flag, because they are not constrained from borrowing.

At equilibrium, the employment rate for Chapter 7 bankruptcy filers is 0.1285 if there is no borrowing constraint effect. Therefore, the wealth effect of a fresh start lowers the employment rate by 61.84% from 0.3367 to 0.1285, and the borrowing constraint effect of a fresh start brings up the employment rate by 64.09% from 0.1285 to 0.3443.

The employment rate for Chapter 7 filers (0.3443) is lower than repaying individuals (0.7533) at equilibrium because they are more likely to suffer from job loss. This reflects the downward bias if we estimate the change in extensive margin without taking into account the endogeneity of bankruptcy decisions.

Moreover, in comparing the labor supply decisions in extensive margins when agents file for bankruptcy under different chapters, it is evident from Table 6 that the employment rates are identical across bankruptcy-chapter choices, i.e., $\mathcal{E}(7,7) = \mathcal{E}(7,13)$. It is clear from Figure 5 and Figure 6 that when bankrupt individuals enter the next period with zero assets, their reservation wages are so low that they choose to stay or take on jobs if possible, regardless of the chapter under which they file for bankruptcy. This is because their work incentives are very high when they have no assets and cannot borrow.

$d^* \setminus d$	0	7	13
0	0.7533	0.7666	0.7666
7	0.3367	0.3443	0.3443
13	0.7894	0.9400	0.9400

Table 6: Employment Rates $\mathcal{E}(d^*, d)$

Second, I measure the intensive margin of the labor supply, shown in Table 7, by calculating the hours worked given employment defined as

$$\mathcal{H}(d^*, d) = E[h'|d^*, d, e' = 1]. \quad (18)$$

The average hours worked given employment for Chapter 7 bankruptcy filers are 0.5596 under repayment and 0.5660 under a fresh start, which suggests that the ATET on the intensive margin is 0.0076. Specifically,

$$\mathcal{H}(7, 7) - \mathcal{H}(7, 0) = 0.5660 - 0.5596 = 0.0064.$$

This implies that a fresh start increases the labor supply in the intensive margin by 1.1% over repayment.

The wealth effect again can be isolated by assuming that individuals are not constrained from borrowing after a Chapter 7 bankruptcy. The average hours worked given employment is reduced by 10.65% from 0.5596 to 0.5 due to wealth effect, because debt removal through bankruptcy reduces work incentives. This implies that the borrowing constraint effect raises the average hours worked up by 11.79% to make net effect becomes positive.

Chapter 7 bankruptcy filers, on average, work more (0.5660) than repaying agents (0.3965) by 29.9% on equilibrium because they have less assets and are borrowing constrained. This again reflects the fact that the estimated change in labor supply in intensive margin can be upward bias if we ignore bankruptcy endogeneity.

Unlike extensive margins, agents provide different intensities of labor supply given employment for different bankruptcy-chapter choices. Chapter 7 bankruptcy filers work more under fresh start than under Chapter 13 bankruptcy.

$d^* \setminus d$	0	7	13
0	0.3965	0.5694	0.5489
7	0.5596	0.5660	0.5475
13	0.4068	0.5682	0.5351

Table 7: Hours Worked Given Employment $\mathcal{H}(d^*, d)$

The average labor supply for hypothetical bankruptcy decision d, given that d^* is the optimal bankruptcy decision, can be measured by

$$\mathcal{L}(d^*, d) = E[e' \cdot h' | d^*, d] \tag{19}$$

taking into account the labor supply in both extensive and intensive margins.

$d^* \setminus d$	0	7	13
0	0.2986	0.4365	0.4208
7	0.1884	0.1949	0.1885
13	0.3211	0.5340	0.5129

Table 8: Average Labor Supply $\mathcal{L}(d^*, d)$

Chapter 7 filers, on average, supply less labor (0.1949) than repaying agents (0.2986) and Chapter 13 filers (0.5129). It is however clear from Table 8 that Chapter 7 bankruptcy filers on average work less than if they were instead to repay (0.1884), which implies the result that a fresh start increases the labor supply by 3.5% over repayment. Specifically,

$$\mathcal{L}(7, 7) - \mathcal{L}(7, 0) = 0.1949 - 0.1884 = 0.0065.$$

Moreover, Chapter 7 bankruptcy filers on average work less than if they were instead to file for Chapter 13 bankruptcy (0.1885). Therefore, a fresh start increases the labor supply by 3.4% over Chapter 13 bankruptcy.

7.2 Reduced-Form Estimation from Simulated Data

In this section, I use simulated data to estimate a treatment effect model as in Han and Li (2007). In particular, we are interested in how a fresh start affects the log working hours. The estimation is done in a two-step procedure in order to control for the endogeneity of bankruptcy. In the first step, I run a probit regression of Chapter 7 bankruptcy filing decisions.

Formally, the Chapter 7 bankruptcy decision is determined by the following equation,

$$\tilde{d}_i = z_i\gamma + \epsilon_i \tag{20}$$

where

$$d_i = \begin{cases} 1 & \text{if } \tilde{d}_i > 0 \\ 0 & \text{otherwise} \end{cases} \tag{21}$$

such that individuals i file for a fresh start when $d_i = 1$ and not file when $d_i = 0$. The covariates must include factors ("instrumental variables") that do not directly affect labor supply except through bankruptcy (the exclusion restriction). From the estimates, we can compute the inverse Mills ratio m_i for each observation i as

$$m_i = d_i \frac{\phi(z_i\hat{\gamma})}{\Phi(z_i\hat{\gamma})} + (1 - d_i)\frac{-\phi(z_i\hat{\gamma})}{1 - \Phi(z_i\hat{\gamma})} \tag{22}$$

where ϕ is the standard normal density function.

The log working hours h_i is determined according to the following equation,

$$h_i = x_i\beta + \alpha d_i + \upsilon_i \tag{23}$$

where υ_i and ϵ_i are (strongly) assumed to be bivariate normal with mean zero and covariance matrix

$$\begin{bmatrix} 1 & \rho\sigma \\ \rho\sigma & \sigma^2 \end{bmatrix}.$$

Therefore, the expectation of log working hours given bankruptcy decisions can be written as

$$E\left[h_i|d_i\right] = x_i\beta + \alpha d_i + \rho\sigma \underbrace{\left(d_i \frac{\phi(z_i\hat{\gamma})}{\Phi(z_i\hat{\gamma})} + (1 - d_i)\frac{-\phi(z_i\hat{\gamma})}{1 - \Phi(z_i\hat{\gamma})}\right)}_{m_i}, \tag{24}$$

This suggests an augmented linear regression in the second step by adding the inverse Mills ratio m_i (calculated from the first step) as part of the covariates. The coefficient of the inverse Mills ratio is the product of the correlation coefficient between error terms ρ and the standard deviation of the error term from bankruptcy decision equation σ. Under this model specification, the difference in expected log working hours between bankruptcy filing and nonfiling for individual i is given by the coefficient of the Chapter 7 bankruptcy filing, α.

I first create a dataset which consists of nearly 50,000 individuals, starting with the invariant cross-sectional distribution for agents without bankruptcy flags.[10] Each individual is tracked for five model periods (quarters).[11] Observations are dropped from the combined cross-sectional dataset after they file for bankruptcy. Furthermore, Chapter 13 bankruptcy filers are excluded from the sample.

I use a similar set of covariates as in Han and Li (2007). In both steps, wage, incomes, change in incomes, and an indicator of whether individual experiences job loss previously and their squared terms are included as part of covariates. The squared terms are introduced in the regression to capture any nonlinear effect of these variables on bankruptcy filing decisions. These variables have effects on both bankruptcy and labor supply decisions.

In the first step, they further include "social stigma" and "financial benefits" as instruments, which (are supposed to) have direct effects on bankruptcy decisions but not only labor supply decisions. Because personal preferences are unobservable, they use lagged state bankruptcy rate as a proxy for social stigma. They further include state unemployment rate to control for any possible correlation between social stigma and work ethics. Individuals do not have a stigma cost associated with bankruptcy from my model, and I thereby use only "financial benefits" and its squared term as instruments. In the second step, the inverse Mills ratio calculated from the first step is added into the regression to control for the selection effect.

The results from the probit regression are presented in the top part of Table 10. Similar with the findings in Han and Li (2007), the potential financial benefits have positive effects on the probability of filings for a fresh start. In another words, the more unsecured debts individuals can discharge through bankruptcy, the more likely they are going to file for a Chapter 7 bankruptcy. Because the two instruments are highly correlated (the financial benefits and the square term), although they are not individually significant, they are jointly significant at 1% level.[12] This implies that the financial benefits has strong explanatory power in predicting the probability of bankruptcy. Therefore, the financial benefits and its square term pass the "test of relevance" as instruments.

[10] When individuals have bankruptcy flags, they must not default unless full repayment results in negative consumption.

[11] It is assumed that there is no individual entry and exit in the dataset. That is, individuals are assumed not to receive death shocks during the five model periods, and no newborn is added into the dataset over the same periods.

[12] The null hypothesis that coefficients of both instruments are zero is rejected with a chi-square statistics of 90.80.

However, it is hard to argue that the instruments can also pass the "test of exogeneity", which requires the financial benefits to be uncorrelated with the log working hours regardless of bankruptcy decisions. However, financial benefit is negatively correlated with asset holdings (with a correlation coefficient of -0.2193), which in turn affect labor supply decisions. In particular, for individuals who are in debt, even if they choose not to default, their labor supply decisions are still directly affected by their potential financial benefits, because it is equivalent to their debt position. Although the test of exogeneity for the instrumental variables is usually not possible because we do not observe both equilibrium and counterfactual outcomes at the same time in reality, it is nonetheless feasible here for the simulated data, since for each individual, the model can predict his labor supply decisions under each bankruptcy scenario. To test this, I run two regressions. The dependent variables for each individual are the log working hours when they file for Chapter 7 bankruptcy and when they choose to pay back the creditors in full. For each regression, every individual is included in the sample regardless of their optimal bankruptcy decision choices. The regression results are shown in Table 9. As we can see from the table, the financial benefit and its square term are statistically significant (individually and jointly) after controlling for covariates in both regressions, which indicates that they fail the test of exogeneity by being correlated with the log working hours.

	No Ch7 Filing		Ch7 Filing	
Log Hours	Coeff.	Sd Err.	Coeff.	Sd Err.
Wage	-0.4631***	0.0157	0.5091***	0.0039
Wage Square	-0.1775***	0.0067	-0.2090***	0.0017
Income	-0.8825***	0.0051	-0.0071***	0.0020
Income Square	2.8495***	0.0073	0.0529***	0.0028
Income Change	0.0314***	0.0014	-0.0023***	0.0005
Experience Job Loss	-0.4774***	0.0094	0.2983***	0.0022
Financial Benefits	0.9530***	0.0300	-0.0615***	0.0300
Financial Benefits Sq.	-2.1694***	0.0094	0.1012***	0.0300

Observations = 146,205; *** significant at 1%

Table 9: Test of Exogeneity for Instruments

Because the model period is a quarter, there is no in-and-out of employment using quarterly data. Therefore, the estimation from a treatment effect model with log working hours as the response variable captures the effect of a fresh start in the intensive margin. The bottom part of Table 10 shows the second-step estimation results (even though we cast some doubts on the validity of the instruments). The positive coefficient of bankruptcy filing implies a positive effect of a fresh start on the log working hours. The coefficient on the Chapter 7 bankruptcy filing indicates that the working hours (given employment) is increased by by 22.73% from having a fresh start, which overestimates the 1.1% increase from intensive margin in Table **??** calculated directly from the model.

Ch7 filing	Coeff.	Sd Err.
Wage	61.9629***	16.3809
Wage Square	-24.1237***	6.4112
Income	-3.1897***	1.0456
Income Square	6.1040***	1.6855
Income Change	-0.3273	0.4127
Experience Job Loss	39.9090***	10.4651
Financial Benefits	4.2009	3.6438
Financial Benefits Sq.	3.3186	8.2045
Log Working Hours	Coeff.	Sd Err.
Ch7 Filing	0.2273***	0.0226
Inverse Mills Ratio	0.0250	0.0072
Wage	-0.5673***	0.0160
Wage Square	-0.1351***	0.0068
Income	-0.9127***	0.0052
Income Square	2.8807***	0.0074
Income Change	0.0440***	0.0014
Experience Job Loss	-0.5425***	0.0096
ρ	0.4484	
σ	0.0558	

Observations = 146,205; *** significant at 1%

Table 10: Estimates of Treatment Effect Model (Quarterly Data)

The reason why most empirical papers interested in labor market activities use quarterly or even monthly data is because the employment decisions happen much more frequently (compared with bankruptcy decisions). If we are restricted in annual datasets, the changes in annual working hours can be a combination from both extensive and intensive margins of labor supply. In particular, Chapter 7 bankruptcy filers can appear to work for less hours because they are more likely to be unemployed during part of the year.

	Part A: No Measurement Err.		Part B: Measurement Err.	
Ch7 filing	Coeff.	Sd Err.	Coeff.	Sd Err.
Wage	0.8276***	0.2830	0.8264***	0.2775
Wage Square	-1.1260***	0.2197	-1.1177***	0.2176
Income	-1.1046***	0.2140	-1.2195***	0.2078
Income Square	0.7136***	0.0710	0.7283***	0.0698
Income Change	-0.0835*	0.0472	-0.0123	0.0448
Experience Job Loss	0.6310***	0.0769	0.6139***	0.0759
Financial Benefits	4.0905	6.9883	0.2098	3.0075
Financial Benefits Sq.	5.0251	15.9417	-4.1553	14.0710
Log Working Hours	Coeff.	Sd Err.	Coeff.	Sd Err.
Ch7 Filing	-0.3225**	0.0095	-0.8978***	0.1854
Inverse Mills Ratio	0.1659	0.0492	0.3325***	0.0584
Wage	-0.1785***	0.0146	-0.1765**	0.0146
Wage Square	0.2544***	0.0099	0.2524	0.0099
Income	-0.1697***	0.0136	-0.1758***	0.0137
Income Square	0.0221***	0.0043	0.0248***	0.0043
Income Change	0.1624***	0.0026	0.1624***	0.0026
Experience Job Loss	-0.2928***	0.1535	-0.2918***	0.0033
ρ	0.3735		0.7469	
σ	0.4442		0.4452	

Observations = 182,799; *** significant at 1%;
** significant at 5%; * significant at 10%

Table 11: Estimates of Treatment Effect Model (Annual Data)

The integrated information might prevent us from disentangling the effects on labor supply in extensive or intensive margins and affect our estimation results. Thus the difficulties associated with empirical estimation of labor market activities in the presence of bankruptcy go beyond the task of finding valid instruments.

To show this, I create another combined cross-sectional annual dataset by keeping track of individuals for 5 years (20 model periods). The asset position and bankruptcy flag status are recorded at the beginning of each year. Annual working hours are the sum of working hours in all four quarters, so are the annual incomes. Bankruptcy can occur at any time of a year. The estimation results are shown in Part A of Table 11. The instruments are jointly significantly from zero in the first stage, but their positive correlation with the second-stage residual indicates that their validity is in doubt. Even after we include the indicator variable of whether an individual experiences job loss to control for the change in extensive margin, the coefficient of Chapter 7 bankruptcy filings estimated from a simulated annual dataset turns from positive to negative as in Han and Li (2007).

To understand how the measurement error in the wealth information can affect our estimation. I take the same dataset but substitute individuals' financial benefits over all five years with the same value as in the first year.[13] The results in Part B of Table 11 show that the introduced measurement errors can have a big impact on the estimation results.

8 Conclusions

According to the PSID, job losses have been cited as one of the most important reasons individuals file for bankruptcy. However, not only do labor market activities affect bankruptcy decisions, but labor-market behavior is also affected by the bankruptcy treatment. While most papers in the literature assume inelastic labor supply regardless of bankruptcy decisions, this paper expands our understanding of how the labor market interacts with the credit market by allowing endogenous decisions in both labor supply and bankruptcy.

In particular, this paper is interested in answering the question How much does a fresh start increase labor supply? because one of the justifications for the fresh-start bankruptcy system in the United States is to improve work incentives. To answer this question quantitatively, I evaluate the labor supply responses after equilibrium and counterfactual bankruptcy decisions by constructing a dynamic sequential partial equilibrium job search model with bankruptcy choices. I find that a fresh start on impact increases the labor supply of Chapter 7 bankruptcy filers by 3.5% over repayment and 3.4% over Chapter 13 bankruptcy. Over the long run, labor supply is increased by 1.7% for the first five years after bankruptcy from a fresh start than from Chapter 13 bankruptcy.

For future research, one question of great interest is how the interaction between the labor market and the credit market might be changed by aggregate policy changes, such as elimination of bankruptcy, reduction of bankruptcy chapter choices, or the recently implemented means test that

[13]Notice that individuals' decisions depend on their actual financial benefits instead of the recorded amount.

prohibits Chapter 7 bankruptcy filings for individuals who earn more than median incomes. To answer these questions, it is necessary that the wage-offer distribution be endogenized, as the equilibrium labor market tightness is affected.

A Data Description

The statistics presented in Section 1 and Section 6 are calculated from the 1979-1994 NLSY1979. The combined cross-sectional dataset has 12,685 individuals and 190,275 observations. I removed observations according to the following sample selection criteria before generating a final dataset with 39,194 observations.

- Individuals who are less than 25 years old (90,087 observations).
- Individuals who do not report whether they have filed for bankruptcy (42,489 observations).
- Individuals who do not report annual working hours, number of weeks worked, and annual labor incomes (11,406 observations).
- Individuals who filed for bankruptcy under neither Chapter 7 nor Chapter 13 (742 observations).
- Individuals who do not report the date of bankruptcy, if applicable (252 observations).
- Individuals whose annual labor incomes are top coded (114 observations).
- Individuals who work for more than 5096 hours a year (3,962 observations).
- Individuals who work for more than 98 hours per work week (0 observations).
- Individuals whose real wages (in 2004$) are more than $100 (192 observations).
- Individuals whose wages are less than half the minimum wage of the same year (1,837 observations).

B Computational Procedure

1. Set asset grids such that the asset decisions do not reach the bounds.
2. Discretize wage-rate offer distribution.
3. Guess a labor tax rate τ^n.

4. Guess a price function $q(a', \tilde{s})$.
5. Given the tax rate τ and price function $q(a', \tilde{s})$, solve for value functions $V(s)$ and $W(\tilde{s})$ via value function iteration, from which the employment, default, hours worked, and asset choice decisions are obtained.
6. Update the price function such that the financial intermediary breaks even given agents' decisions. Iterate until the price function converges.
7. Solve for the invariant distribution.
8. Update the tax rate such that the government runs a balanced budget. Iterate until the tax rate converges.

References

Algan, Y., Cheron, A., Hairault, J.O., Langot, F., 2003. Wealth effect on labor market transitions. Review of Economic Dynamics 6, 156–178.

Athreya, K.B., 2002. Welfare implications of the bankruptcy reform act of 1999. Journal of Monetary Economics 49, 1567–1595.

Athreya, K.B., Janicki, H.P., 2006. Credit exclusion in quantitative models of bankruptcy: does it matter? Economic Quarterly , 17–49.

Athreya, K.B., Simpson, N.B., 2006. Unsecured debt with public insurance: From bad to worse. Journal of Monetary Economics 53, 797–825.

Bloemen, H.G., Stancanelli, E.G.F., 2001. Individual wealth, reservation wages, and transitions into employment. Journal of Labor Economics 19, 400–439.

Bulow, J., Rogoff, K., 1989. Sovereign debt: Is to forgive to forget? American Economic Review 79, 43–50.

Chakravarty, S., Rhee, E.Y., 1999. Factors affecting an individual's bankruptcy filing decision.

Chatterjee, S., Corbae, D., Nakajima, M., Rios-Rull, J.V., 2007. A quantitative theory of unsecured consumer credit with risk of default. Econometrica 75, 1525–1589.

Chatterjee, S., Corbae, D., Rios-Rull, J.V., 2008. A finite-life private-information theory of unsecured consumer debt. Journal of Economic Theory 142, 149–177.

Chatterjee, S., Corbae, D., Rios-Rull, J.V., 2009. Credit scoring and the competitive pricing of default risk.

Chen, D., Corbae, D., 2012. Labor market matching with credit checkes.

Domowitz, I., Sartain, R.L., 1999. Determinants of the consumer bankruptcy decision. Journal of Finance 54, 403–420.

Edelberg, W., 2006. Risk-based pricing of interest rates for consumer loans. Journal of Monetary Economics 53, 2283–2298.

Fay, S., Hurst, E., White, M.J., 2002. The household bankruptcy decision. American Economic Review 92, 706–718.

Han, S., Li, W., 2007. Fresh start or head start? the effects of filing for personal bankruptcy on work effort. Journal of Financial Services Research 31, 123–152.

Hansen, G.D., Imrohoroglu, A., 1992. The role of unemployment insurance in an economy with liquidity constraints and moral hazard. Journal of Political Economy 100, 118–42.

Krueger, D., Perri, F., 2006. Does income inequality lead to consumption inequality? evidence and theory. Review of Economic Studies 73, 163–193.

Lentz, R., Tranas, T., 2005. Job search and savings: Wealth effects and duration dependence. Journal of Labor Economics 23, v–394.

Li, W., Sarte, P.D., 2006. U.s. consumer bankruptcy choice: The importance of general equilibrium effects. Journal of Monetary Economics April, 613–31.

Livshits, I., MacGee, J., Tertilt, M., 2007. Consumer bankruptcy: A fresh start. American Economic Review 97, 402–418.

Maddala, G.S., 1983. Limited Dependent and Qualitative Variables in Econometrics. Cambridge: Cambridge University Press.

Musto, D.K., 2004. What happens when information leaves a market? evidence from postbankruptcy consumers. Journal of Business 77, 725–748.

Rendon, S., 2006. Job search and asset accumulation under borrowing constraints. International Economic Review 47, 233–263.

Rouwenhorst, K.G., 1995. Asset pricing implications of equilibrium business cycle models. Princeton University Press. pp. 294–330.

Tauchen, G., 1986. Finite state markov-chain approximations to univariate and vector autoregressions. Economics Letters 20, 177–181.

White, M., 2005. Personal bankruptcy: Insurance, work effort, opportunism and the efficiency of the "fresh start".

White, M., 2007. Bankruptcy Law. Elsevier. volume 2 of *Handbook of Law and Economics*. chapter 14. pp. 1013–1072.