The Impact of Personal Bankruptcy Law on Entrepreneurship

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Abstract

Limited personal liability has long been thought to promote entrepreneurship by providing partial insurance through debt relief in the event of business failure. However, providing this insurance through debt relief makes borrowing more costly and tightens borrowing constraints. To examine the quantitative effects of these two opposing forces on entrepreneurship, I study a life cycle model where households choose between running a risky business and working. Households in the model differ in entrepreneurial abilities and face both labor income and business productivity risks. I calibrate the model to the U.S. economy, and then consider the effect of alternative personal bankruptcy regimes. For reasonable parameter values, a less lenient (higher post bankruptcy garnishment of income) bankruptcy law deters households with moderate entrepreneurial ability from entering entrepreneurship, while variations in bankruptcy systems have negligible effects on higher ability households' occupational choice decisions. The effect of personal bankruptcy law on the level of entrepreneurship is driven primarily by the insurance effect rather than the borrowing cost effect. Consequently, entrepreneurs prefer more lenient bankruptcy regimes that provide higher insurance values.

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1 Introduction

Personal bankruptcy is often used as an exit strategy for failing small businesses that are solely owned, since business debts of a sole proprietorship are legally personal liabilities.[1] In addition, most owners of small corporations are asked to provide personal guarantees when applying for business loans.[2] Hence, most small business owners file for personal bankruptcy when in financial distress.

There are large differences in personal bankruptcy laws across developed countries. In the U.S., a Chapter 7 filing provides debtors with a "fresh start" by discharging all unsecured debts in exchange for all (non-exempted) assets. A crucial feature of Chapter 7 is that all future income of the filer is protected. In contrast, most other developed countries require filers to repay debts from both assets and post-bankruptcy income. For instance, the length of post-bankruptcy income garnishment currently ranges from 0 year in U.S. to 6 years in Germany to 8-10 years in France. Since personal bankruptcy is important for entrepreneurs, one would expect there is a link between these cross country differences in personal bankruptcy regimes and differences in entrepreneurship.

This paper examines the quantitative effects of different personal bankruptcy regimes on entrepreneurship, output and welfare. Many have argued that an entrepreneur-friendly bankruptcy law has helped to create a more vibrant entrepreneurial sector in the U.S. In fact, Lawless and Warren (2005) reported that up to 20% of personal bankruptcy filings are attributable to small business failures in the U.S. Recently heated debates among policy makers in Europe led to reforms of personal bankruptcy regimes in the region (White (2007), Armour & Cumming (2008)): Germany introduced its first personal bankruptcy law in 1999 and there is also an initiative to reduce the harshness of personal bankruptcy at the EU level.[3] However, the impact of different aspects of personal bankruptcy regime on entrepreneurship deserve a more careful

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[1]In the U.S., more than 78% of businesses are sole proprietorships, the number is even higher in Europe, at around 82%.

[2]Berger and Udell (1998) examine the data from the Survey of Small Business Financing, find that up to 52% of all small business loans from financial institutions have personal guarantees against them, and 93% have either personal guarantees or personal assets against them.

[3]Clearly going toward the other direction, U.S. introduced the *Bankruptcy Abuse Prevention and Consumer Protection Act* in 2005, which made it more difficult for individuals to obtain a discharge from indebtedness, although it is intended to prevent abuse of the bankruptcy system (White 2007). Small business debtors, however, were specifically excluded from these changes (Armour & Cumming (2008)).

investigation.

How does personal bankruptcy law affect entrepreneurship? On the one hand, personal bankruptcy provides small business debtors partial insurance by offering an option to discharge debt in case of business failures. This makes borrowing to start a risky business more attractive since it reduces the cost of failure by limiting the borrower's liability. It increases business owners' abilities to smooth across states in an incomplete market by giving some contingency to the debt contract. However, this insurance comes at a price, as financial intermediaries charge a higher premium on loans to cover for default risks, which makes borrowing more costly and tightens the borrowing constraint. Thus, as personal bankruptcy weakens entrepreneurs' ability to commit to future debt repayment, it decreases their ability to invest at the efficient scale. This trade-off suggests that any evaluation of bankruptcy regimes needs to consider the effect of borrowing costs and constraints versus the value of insurance against "bad luck"[4].

This trade-off is especially relevant for entrepreneurship as there is a large literature on financial constraints for entrepreneurs (Evans and Leighton (1989), Evans and Jovanovic (1989)). On the borrowing cost side, Berkowitz and White (2004) find that it is harder to get financing for entrepreneurs in U.S. states with generous asset exemptions.[5] On the insurance side, there is evidence to suggest that the "insurance effect" of personal bankruptcy actually dominates in determining the level of entrepreneurship. Fan and White (2003) find that the probability of households owning businesses is 35% higher in states with unlimited as opposed to low exemptions. Many empirical studies on cross country differences in bankruptcy laws have also found that people are less likely to become entrepreneurs in countries with less "forgiving" regimes (Lee, Yamakawa and Peng (2007), Armour and Cumming (2008)).

To quantify the impact of personal bankruptcy law on entrepreneurship, I construct an incomplete market life-cycle model with occupational choice. Households differ in entrepreneurial abilities, they make repeated occupational choices between working and running a risky business, and they also make bankruptcy decisions taking a bankruptcy system as given. Workers face uninsurable idiosyncratic labor income risk, and entrepreneurs face uninsurable idiosyncratic productivity risk, where the

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[4]Livshits, MacGee and Tertilt (2007) examine a similar trade-off for consumers .

[5]In the U.S., all states have their own specific asset exemptions for chapter 7 bankruptcy. For instance, homestead exemptions range from $5,000 in Georgia to Unlimited in Florida (as long as the property does not exceed half an acre in a municipality or 160 acres elsewhere).

production risk is higher compare to the labour income risk. Potential entrepreneurs are assumed to have different probability distributions over a finite number of productivity realizations, such that those businesses run by high ability households are less risky and more productive on average.

The bankruptcy regime is exogenously given and specifies the following: 1) the length of post-bankruptcy income garnishment; 2) the income exemption level; 3) the fraction of income garnisheed above exemption level and 4) the asset exemption level, capturing the main ways that personal bankruptcy laws differ across countries. Households can save or borrow via one period non-contingent bonds in a perfect competitive financial market. Intermediaries are able to observe household's current labor income shock, entrepreneurial ability level, current level of borrowing, level of business capital, and age. Hence, intermediaries charge a default premium according to the individual-specific risk on each loan. As an equilibrium result, the price of loans is a function of all these observables.

In this model, an increase in the severity of bankruptcy punishment (ie. lowering exemption levels or increasing the fraction or length of post bankruptcy-income garnishment) decreases the endogenous household default probability and raises the expected repayments from bankruptcy filers, thereby relaxing the borrowing constraints. As a result, households are also less willing to take risks, as the insurance value provided by the bankruptcy system decreases.

I first calibrate the model to match several key moments of the U.S. economy, and then consider the effect of alternative personal bankruptcy regimes. Specifically, I start with the calibrated model and perform the following four sets of counterfactual experiment: in the first two I vary the length and the fraction of post-bankruptcy income garnishment; in the third experiment I very the level of asset exemption level; lastly, I set those regimes in the counterfactual to replicate the personal bankruptcy law of Canada, UK, Germany and France.

The key insight from these counterfactual exercises is that variation in bankruptcy regimes has very different impacts on households with different entrepreneurial abilities. First, variations in bankruptcy regimes have negligible effects on the occupational choices of households with high entrepreneurial ability, because businesses run by these entrepreneurs are less risky (ie. severe failures are less likely to occur for them). Secondly, harsh bankruptcy punishments mainly deter households with moderate entrepreneurial ability from entering entrepreneurship, since failure is more

likely to happen, variations in bankruptcy policy have much bigger impact on their occupational decisions. In other words, this quantitative exercise suggests that the insurance effect of personal bankruptcy law on entrepreneurs completely dominates the borrowing cost effect and mainly through affecting the occupational decisions of households with moderate ability levels. As a result, the extensive margin effect of a more lenient personal bankruptcy regime is to encourage more households to under-take risky entrepreneurship.[6] Although, these additional businesses are less produc-tive because the households on the margin are those with moderate entrepreneurial abilities. On the "intensive margin", a more lenient personal bankruptcy regime low-ers the average firm size, this is because: first, the firms on the margin are run by moderate ability households, lower expected productivity means they want to operate at a smaller scale; second, more lenient regime increases borrowing cost which limits entrepreneurs' ability to invest at efficient scale.

Although the model suggests that a more lenient bankruptcy regime leads to a drop in average firm size and average productivity in the entrepreneurial sector, the total output of the economy actually rises. This is because risk-averse households choose to pursue entrepreneurship only if the expected business return is much higher than the sum of expected wage income and the risk-free return of the investment, such that the difference between the two is large enough to compensate for the risk that the household is undertaking. Consequently, entrepreneur households prefer more lenient regimes because they bear more risks compare to worker households, as the insurance value provided by personal bankruptcy is more important for them. On the other hand, worker households prefer less lenient regimes because labour income risks are more moderate compare to business risks in the model, such that they care more about the ability to smooth consumption across time through borrowing.

Among different dimensions of personal bankruptcy law, change in the length(periods) of post-bankruptcy punishment appears to have the largest impact on entrepreneur-ship; change in fraction of garnishment also have large impact. Increase in length and fraction of post-bankruptcy garnishment monotonically lowers the level of en-trepreneurship and discourage moderate ability household from entering entrepreneur-ship. On the other hand, changes in the asset exemption level only have modest effect. In particular, increasing asset exemption level encourage entrepreneurship first and

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[6]This finding agrees with the empirical results of Armour and Cumming (2008) and Fan and White (2007).

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then discourage it once pass certain level, this inverted U-relationship between the two is consistent with the findings of Akyol & Athreya (2009) and Meh & Terajima (2008).

Given that the bankruptcy code mainly affects the occupational decision of households with moderate ability levels. The model replicates three key facts about cross-country differences in entrepreneurship: a less lenient bankruptcy system lead to 1) a lower level of entrepreneurship, 2) a higher proportion of bigger and older firms in the economy, and 3) a lower business turnover rate. The first result is consistent with the empirical findings of Armour and Cumming (2008), they estimated that a 10 year reduction of garnishment time increases the self-employment rate by 1.5%. The ability of the model to account for these facts is driven by the result of tightened bankruptcy law lead to less moderate ability entrepreneurs in the economy and firms run by higher ability entrepreneurs (whose occupational decisions are rarely affected by change in bankruptcy regimes) tend to grow bigger and survive longer. Such that, an increase in the level of entrepreneurship lowers the average productivity in the entrepreneurial sector, because the households on the margin are those with moderate entrepreneurial ability levels. Note that these results depend on the crucial assumption that the households' entrepreneurial ability determine the riskiness of the businesses they run. One support for this view is the observation that older firms are less likely to fail than younger firms.

The paper is organized as follows. Section 2 reviews the related empirical and theoretical literatures, Section 3 documents different personal bankruptcy regimes and some empirical facts of entrepreneurship across some developed countries. Section 4 describes the model. The benchmark parameterizations are presented in Section 5. Section 6 shows the counterfactual results. Section 7 concludes.

2 Literature Review

In addition to the study of Armour and Cumming (2008) which shows that more lenient bankruptcy regimes are associated with an increase in the self-employment rate in their sample countries of 15 countries over 16 years, this paper is also related to other empirical literatures on the impact of bankruptcy policies on entrepreneurship. Fan and White (2007) show that the probability of becoming self-employed is higher in states with higher homestead exemptions. Berkowitz and White (2004) find that

it is harder for small business owners to get external finance in U.S. states with high asset exemptions. Paik (2010) in a recent paper find that the probability of becoming self-employed within unincorporated firms declined after the bankruptcy reform act of 2005, which made qualify for chapter 7 bankruptcy harder. However, these works are likely to suffer from country or state-specific effects, such as tax rates or banking regulations. In another paper, Georgellis and Wall (2006) investigate the impact of marginal income tax rates and bankruptcy exemptions on entrepreneurship, find an S-shaped relationship between bankruptcy exemptions and entrepreneurship. This means that the relationship between asset exemption and level of entrepreneurship is not monotone.

This paper is closely related to Akyol and Athreya (2009), Meh and Terajima (2008) and Herranz, Krasa and Villamil (2007) who also study macroeconomic models of occupational choice with the presence of a bankruptcy system. Akyol and Athreya (2009) find that a personal bankruptcy system encourages entrepreneurship, and alters the timing, size and financing of projects. In their model, entrepreneurial ability is modeled as a fixed input factor in production, rather than affecting the distribution of productivity shocks. Meh and Terajima (2008) find that eliminating asset exemption increases the level of entrepreneurship and welfare; but on the other hand, eliminating the bankruptcy system leads to a large fall in the level of entrepreneurship and welfare. Herranz, Krasa and Villamil (2007) analyze the impact of owners' personal characteristics such as risk tolerance or optimism and bankruptcy system on firm performances, finding that reducing bankruptcy exclusion periods can lead to large welfare gains. They find that the welfare effects for firm owners are much greater than in those consumer studies and that the insurance effect of corporate bankruptcy is more important than the interest rate effect, which again agrees with the finding of this paper.

This paper differs in two key ways from these papers: first, households have different entrepreneurial abilities and the ability level determines households' average entrepreneurial productivity and riskiness. For instance, higher ability households' are less likely to face severe failure compared to moderate ability households and are more likely to get higher productivity shocks. This is a natural assumption because certain individuals are better fitted to run businesses, as in the Lucas (1978) span-of-control type of frame work. These additions allow me to derive the implied productivity differences in the entrepreneurial sectors under each bankruptcy regime,

which arise from variations in the quantity (extensive margin) and selection (intensive margin) of entrepreneurs. Secondly, liquidation costs are incorporated in this paper. As discussed in many studies, the value of capital lost in the liquidation process can be very large: the average liquidation costs cited range from 36.5% to 45% (Shleifer & Vishny 1992) . This has a big influence on the occupational decisions of entrepreneurs who are not doing well, as it substantially increases the cost of quitting business.

There are also other theoretical studies of default and entrepreneurship: Cagetti and De Nardi (2006) study a model of similar occupation choices and find that tighter borrowing constraints generate less wealth concentration and reduce average firm size, aggregate capital, and the fraction of entrepreneurs. Although in their model limited commitment only limits borrowing, as production is riskless, so default does not occur in equilibrium, such that there is no trade-off between insurance effect and borrowing cost effect. Landier (2005) study a multiple-equilibrium model based on endogenous stigma of failure, where the cost of failure depends on the particular equilibrium outcome. In his model, there is only the continuation decision and no occupational choice, plus the cost of quitting business does not depend on any particular bankruptcy regime.

A number of recent papers have studied the economic effects of personal bankruptcy law on consumers in dynamic equilibrium models. Livshits, MacGee and Tertilt (2007) study a model with income garnishment that allows interest to vary with household characteristics such as age, loan size, and income shock. They showed that the U.S. Chapter 7 system leads to welfare gain in comparison to a system that has no personal bankruptcy as in Germany prior to 1999. They also show that expense shocks and life-cycle effects are important factors to consider when comparing bankruptcy regimes. Chatterjee, Corbae, Nakajima, and Ríos-Rull (2007) examine a similar model though without life cycle and expense shocks showing that mean-testing under Chapter 7 leads to large welfare gains. Athreya (2008) incorporates social insurance policy in a similar setting, and finds that the U.S. bankruptcy system creates severe credit constraints, and eliminating bankruptcy lowers (raises) consumption inequality among the young (old). He also argues that social insurance policy is an important factor to consider when evaluating the effect of bankruptcy policy on consumption smoothing. In an earlier paper, Athreya (2002) builds on Aiyagari (1994) assuming one single interest rate for all and finding that eliminating the bankruptcy system improves welfare. Li and Sarte (2006) in a similar setting to Athreya (2002),

incorporate aggregate production and a partial asset exemption as well as the choice between Chapter 7 and 13 in the model and find that eliminating the bankruptcy system reduces welfare. Clearly, though, these models do not account for risk-taking entrepreneurial activities.

3   Entrepreneurships and Personal Bankruptcy Law Across Countries

This section first presents the differences in personal bankruptcy law for five developed countries: U.S., Canada, UK, Germany and France. Key statistics of entrepreneurship for the five countries are presented next.

Personal bankruptcy regimes vary in five key dimensions across countries, 1) the length of the repayment obligation (periods of post-bankruptcy garnisheeing); 2) the income exemption; 3) the fraction of income above exemption level that is garnisheed; 4) the asset exemption; and 5) other punishments. A bankruptcy policy is more "forgiving" or lenient if exemption levels are higher and the fraction that is garnisheed, length of repayment period and other punishments are lower.

Table 1 summarizes the details of personal bankruptcy regimes in five countries at year 2004:[7] France, Germany, UK, Canada and the United States. The first four countries require borrower to repay from both assets and subsequent income after bankruptcy.[8] French bankruptcy law is the least "forgiving" (or the most pro-creditor) : exemptions are low, most income above exemption level is garnisheed, and the repayment period can last up to 10 years. U.S. Chapter 7, on the other hand, is the most "forgiving" (or most pro-debtor) : the asset exemption level is very high, and there is no garnisheeing of post-bankruptcy income. It should be clear that the countries in Table 1 are organized in order: from left to right is the least to the most lenient system.

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[7] Most statistics about entrepreneurship in this paper are taken from around 2003-2004; the personal bankruptcy laws around this period are the most relevant ones. Germany only introduced its personal bankruptcy law in 1999. A couple of countries changed their laws after 2004: US introduced the *Bankruptcy Abuse Prevention and Consumer Protection Act* of 2005, and UK reduced the repayment period from 3 to 1 year later: for more details see White (2007).

[8]Although the Canadian bankruptcy law states rules for post bankruptcy garnishment, most filers actually do not have pay from their future income, this will be addressed in the counterfactual experiment.

Table 2 gives 7 key entrepreneurship statistics for these five countries: 1) proportion of the population that owns and manages a business; 2) proportion of young firms;[9] ; 3) fraction of survey replies being self-employed (European Union, 2004) 4) fraction of businesses younger than 3 years; 5) proportion of firms with zero employees; 6) fraction of employer firms with fewer than 20 employees and 7) annual entry/exit rate. The first two statistics are taken from the Global Entrepreneurship Monitor 2003 Global report, 3) and 4) are taken from Flash Eurobarometer Survey 160, which was conducted in 2004 for the European Union[10]. Statistics on the proportion of employer firms with fewer than 20 employees and entry/exit rates are from Bartelsman, Haltiwanger and Scarpetta (2007).

There are three observations from these statistics: first, there exists a positive relationship between how lenient a bankruptcy regime is and the country's level of entrepreneurship. In the GEM 2003 data, France has the smallest proportion of population identified as entrepreneurs, 4.22%, versus 7% for Germany, 8.8% for the UK, 9.7% for Canada, and 10.6% for the U.S. The same pattern is observed in the Flash Eurobarometer Survey 160 data.[11] Second, there seems to exist a negative relationship between how pro-creditor a bankruptcy regime is and the share of maturer firms in the economy, thus the business turnover rate is higher for those countries with more "forgiving" regimes; this trend is observed consistently across different measures and data sources as well. Third, there is also some weak evidence suggests that countries with less "forgiving" regimes also have lower shares of smaller firms. To summarize, countries with more pro-creditor personal bankruptcy regimes have fewer entrepreneurs, and they also have higher shares of larger firms, higher shares of older firms, and lower business turnover rates.

These observations suggest that the "quality" of active entrepreneurs is higher in countries with tougher bankruptcy laws. In general, better firms would grow bigger and survive longer, which is the reason behind the selection effect of tough bankruptcy

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[9]In the Survey, a new business owner is defined as owner-manger of a firm that has paid wages or salaries for more than 3, but less than 42 months

[10]These survey data are used here because that government published statistics differ quite a bit in definitions of entrepreneurs (even self-employment for that matter) and methodology used for measurement across countries. These survey data, on the other hand, are collected in a consistent fashion across countries: all the questionnaires and conducting methodology are the same for all participating countries.

[11]The large deviation in scale between these two different measures is because that GEM's number is out of adult population, while Eurobarometer measures out of survey replies.

law on entrepreneurs: moderate ability entrepreneurs do not start business and high ability ones get to grow their businesses bigger and longer partially because of the lowered borrowing cost.

4   Model

I extend the model of Livshits, MacGee and Tertilt (2007) to include occupational choice and small business venture. Each generation live for J periods, is comprised of a continuum of ex-ante identical households of measure 1. Households maximize discounted life-time utility from consumption, face idiosyncratic uncertainty about labour income and business return. There is no aggregate uncertainty and the risk-free interest rate is exogenously given. Markets are incomplete: the only assets in this economy are household-specific one-period, non-contingent bonds. There is no market for insurance.

4.1   Household

Each household maximizes its expected lifetime utility,

$$E_0 \sum_{j=1}^{J} \beta^{j-1} n_j u\big(\frac{c_j}{n_j}\big)$$

where $\beta \in (0,1)$ is the intertemporal discount factor, c_j is the consumption at age j. $u(\cdot)$ is the with-in period utility function, where $u(\cdot)' > 0$, $u''(\cdot) < 0$. n_j is the equivalence scale unit of family size at age j. The introduction of family size is important to explain the hump-shaped consumption profile over the life cycle.[12]

For each period, households can choose either to work for labour income in the corporate sector or enter risky entrepreneurship for the next period, $e' \in \{0,1\}$ (e stands for entrepreneur); unlike Meh and Terajima (2008), households cannot work and run a business at the same time. Following Livshits, MacGee and Tertilt (2007), the labor income of household i at age j depends upon its labour productivity and endowment:

$$y_j^i = \epsilon_j^i \bar{y}_j$$

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[12]For details see Gourinchas & Parker (2002), Davies (1988) and Fernandez-Villaverde & Krueger (2004)

$$\epsilon_j^i = z_j^i \eta_j^i$$

where ϵ_j^i is the household's stochastic labour productivity at age j and $\bar{y}_j$ is the deterministic average life-cycle profile of earnings. The household's productivity is the product of persistent shock z_j^i and a transitory shock η_j^i.

At the beginning of life (period 1), every household draws a permanent entrepreneurial ability level $\rho \in \{\underline{\rho}, ...\bar{\rho}\}$ (which does not change over time). This ability level ρ determines the household's distribution of idiosyncratic business productivity shock $\theta \in \{\underline{\theta}, ...\bar{\theta}\}$. So that while the realization of θ' is unknown, ρ is known by everyone before occupational choices are made. The distribution function of θ conditional on having the ability level ρ is denoted by $\Phi_\rho(\theta)$. I will assume that once conditioned on a particular ability level, θ is independent and identically distributed over time, independent of income shocks and having only finite support. The gross period return from a business is given by:

$$F(\theta, k) = f(\theta, k) + (1 - \delta)k = \theta k^\alpha + (1 - \delta)k$$

$0 < \alpha < 1$ is the return-to-scale parameter, and δ is the deprecation parameter. Note that the actual return does not directly depend on ρ, although the distribution of θ does. In this model, households that decide to run a risky business are called entrepreneurs, the remainder of the population is referred as workers.

4.2 Financial Intermediation

The setup in the financial market follows closely the bankruptcy literature[13] in which the risk-free saving interest rate r^f is exogenously given.[14] Loans take the form of one-period bond contracts, which are unsecured and non-collateralized. The face value of these bonds is denoted by d, which is the amount that is to be received (repaid in the case of borrowing) the next period. the convention is that $d > 0$ denotes borrowing, and $d < 0$ denotes saving. The market for bonds is perfectly competitive.

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[13] Such as the work of Livshits, MacGee, and Tertilt (2007), Akyol and Athreya (2009) and Meh and Terajima, (2008).

[14]This assumption constraint the model in a partial equilibrium setting. One might worry that the level of entrepreneurship might affect the overall capital market, which in turn affect the risk-free interest rate. It is likely that these kind of second order effects are small: first, U.S. has a open capital market, the risk free interest rate in determined internationally. Second, the small business loan market in the U.S. is relatively small, valued at $300 billion, only about 0.3% of the U.S. $101 trillion capital market.

While these loans are non-contingent as the face value does not depend on the realization of any value, the option to declare bankruptcy introduces a partial contingency. To capture the household-specific risk of bankruptcy, intermediaries charge household-specific bonds prices. When making loans, intermediaries are assumed to be able to observe the total level of borrowing, size of the business, ability level, current earning shock, and household age. The price of a bond issued by a household of age j, an ability level ρ, with current labour productivity shock ϵ, and portfolio choice d, k is denoted by $q^d(d, k, \epsilon, \rho, j)$.

When making loans to households, intermediaries maximize the expected profit and incur a transaction cost τ per unit of loan. In equilibrium, perfect competition ensures that intermediaries earn zero expected profits on *each* loan they issue[15]. Note that, the actual realized profits can be positive or negative.

4.3 Bankruptcy Regime

A household can declare bankruptcy, the household bankruptcy state is denoted $b \in \{0, 1\}$, with $b = 1$ indicating filed for bankruptcy. To capture the features of bankruptcy provisions across a number of different countries, this paper incorporates the following. First and most importantly, post bankruptcy income garnishment is incorporated. Secondly, period income and business assets used for repayment are treated differently. In contrast to labour income or income from a business which is almost costless to garnishee, the reported liquidation costs of business capital range from 36.5% to 45%[16]. In particular, the bankruptcy system in this model specifies five different type of costs frequently mentioned in the literature:

1. Income garnishment: income of current and G periods after bankruptcy is garnisheed at rate γ and transferred to creditors subject to an exemption level $\bar{w}$;

2. Liquidation of assets: business assets above the exemption level $\bar{x}$ are seized by creditors for liquidation, where the liquidation cost is ζ;

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[15]This assumption is stronger than the typical zero profit condition, since we usually assume that the firm would have to make zero expected profit as a whole, which means it is possible to cross-subsidize between loans. The zero profit condition in this model does not allow intermediaries to do that.

[16] Liquidation costs are calculated as fraction of book value that is lost during the liquidation process

3. Transaction cost: filers lose fraction λ of their consumption during the bankruptcy and garnisheeing period;

4. Exclusion from entrepreneurship: filers cannot run a business during garnisheeing periods. [17]

5. Exclusion from credit market: filers cannot borrow during the bankruptcy and garnisheeing periods[18].

A household's garnishment status is denoted $g \in \{0, 1...G\}$, which is the number of garnishment periods left (i.e. a household not under garnishment has $g = 0$, a household that just declared bankruptcy has $g = G$).

To illustrate how one's income and assets are treated after filing bankruptcy, it is convenient to define the amount of resources left after the bankruptcy decision making as A. Specifically, if a household does not file for bankruptcy and is not under garnishment, A is simply:

$$A(d, k, \theta, \epsilon, e, g = 0, b = 0) = e \times F(\theta, k) + (1 - e) \times \epsilon \bar{y}_j - d \tag{1}$$

where $F(\theta, k)$ is the gross return from running a business. Note that $e = 0$ and $k = 0$ for a worker household.

The resources an entrepreneur with business capital size k, productivity shock θ, has left after declaring personal bankruptcy is given by:

$$A(d, k, \theta, \epsilon, e = 1, g = 0, b = 1) =$$
$$max\{f(\theta, k) - \gamma \max\{f(\theta, k) - \bar{w}, 0\}, 0\} + (1 - \zeta)\min\{(1 - \delta)k, \bar{x}\} \tag{2}$$

Where $f(\theta, k)$ is the value of production, $\gamma \max\{f(\theta, k) - \bar{w}, 0\}$ is the amount that is garnisheed for repaying creditors, and the third is the post-liquidation value of business capital that is exempted. Similarly, for a worker with labour productivity ϵ

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[17]Although only Canada and the UK specifically state that bankrupts are not allowed to run a business during these periods; given the limited access to financial market and garnisheeing of income, one's ability to start a business is effectively limited.

[18]I do not exclude households from saving, as it is not specified in bankruptcy laws. Furthermore, unlike loans, a financial institution is unlikely to reject deposits(or investments) based on one's credit history,

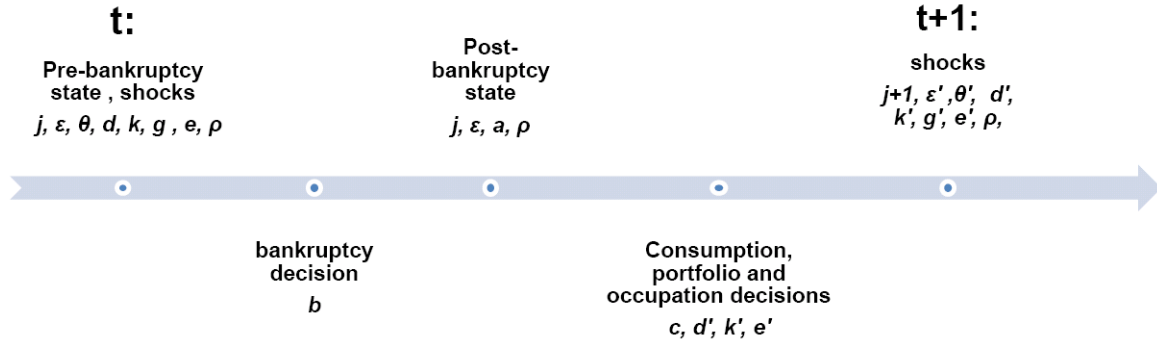and age j, the resources at hand after declaring bankruptcy is,

$$A(d, k, \theta, \epsilon, e = 0, g = 0, b = 1) = \epsilon \bar{y}_j - \gamma \max\{\epsilon \bar{y}_j - \bar{w}, 0\} \tag{3}$$

The resources at hand of a worker under post-bankruptcy income garnishment (when $g > 0$) is:[19]

$$A(d, k, \theta, \epsilon, e = 0, g > 0, b = 0) = \epsilon \bar{y}_j - \gamma \max\{\epsilon \bar{y}_j - \bar{w}, 0\} - d \tag{4}$$

4.4 Timing within the Period

The model timing is as follows. At the beginning of a period, households observe their labour productivity and business productivity shocks (ϵ, θ). Given the realized value of (ϵ^i, θ^i) and their beginning-of-period portfolio (d,k) and occupation e, households decide whether to file for bankruptcy or not. Note that households under garnishment are not allowed to file for bankruptcy. If a household files for bankruptcy, income is then garnisheed and assets above $\bar{x}$ are seized by the creditor; all unsecured debts are discharged, and the household is left with disposable income A as specified in (2) or (3) depending on occupation status. If a household is under garnishment (ie. having filed for bankruptcy in the recent past), income is then garnisheed, and it is left with (4). Given the value of disposable income A, households then choose their current consumption c, occupation for the next period e' and portfolio (d', k'). The above is summarized in the following chart:

4.5 Household's Problem

I define $V_j(\epsilon, A, g, \rho)$ to be the post-bankruptcy decision value function of an age-j household. Similarly define $W_j(d, k, \epsilon, \theta, \rho, g, e)$ as the pre-bankruptcy decision value function of an age-j household whose beginning-of-period shocks, portfolio and status are $(\epsilon, \theta), (d, k)$ and (ρ, g, e) respectively. The value function at age $V_{J+1}(.)$ is set to 0. The pre-bankruptcy decision value function of an age-j household is given by:

$$W_j(d, k, \epsilon, \theta, \rho, g, e) = \max_{b \in \{0,1\}} V_j(\epsilon, A, g, \rho) \tag{5}$$

where different disposable income A are defined as in (1) and (4) for $b = 0$, (2) and (3) for $b = 1$. The post bankruptcy decision value function is defined as follows:

$$V_j(\epsilon, A, g, \rho) = \max_{c, d', k', e'} u(\frac{c}{n_j}) + \beta E[W_{j+1}(d', k', \epsilon', \theta', \rho, g', e')|\epsilon, \rho] \tag{6}$$

subject to

$$\frac{c}{(1-\lambda)^{I(g,b)}} + k' - q^d(d', k', \epsilon, \rho, j)d' = A - L(k, e', d)\zeta k \tag{7}$$

$$g' = G \text{ if } b = 1 \tag{8}$$

$$g' = g - 1 \text{ if } g > 1 \tag{9}$$

$$c > 0, k' \in \{0, ... \bar{k}\} \tag{10}$$

Equation (8) is the budget constraint. The first term on the right hand side is the disposable income at hand, A. On the left hand side, c is the current consumption, d' is the bond position which is multiplied by its associated market price, and k' is the business capital for the next period. $I(g, b)$ is an identification function for transaction cost, which takes a value of 1 if $g > 0$ or $b = 1$, or 0 otherwise. If $e' = 0$, the household chooses to become a worker in the next period. If $e' = 1$ and $k' > 0$, the household becomes an entrepreneur next period. $L(\cdot)$ is an identification function for liquidation cost; it takes the value of 1 if an entrepreneur household decides to liquidate its business without filing for bankruptcy, or 0 in all other cases. Equations (8) and (9) are the law of motion for garnishment status.

4.6 Problem of Intermediaries

A competitive financial market implies that intermediaries make zero profits on unsecured debt made to each type of household. Thus there is no cross-subsidization

across different types of borrowers. Now, denote $\phi(d', k', \epsilon, \rho, j)$ as the probability that a household of age j, the ability level ρ, current labour shock ϵ and portfolio choice (d', k') will declare bankruptcy tomorrow. The zero profit condition on loans to each type of household implies that:

$$q^d(d', k', \epsilon, \rho, j) = \bar{q}^d \{1 - \phi(d', k', \epsilon, \rho, j)[1 - E(\frac{\Gamma}{d'}|b = 1)]\} \tag{11}$$

where $\bar{q}^d = \frac{1}{1+r^f+\tau}$ is the price of unsecured loans $(d' > 0)$ when the probability of default is zero. $E(\frac{\Gamma}{d'}|b = 1)$ is the expected rate of recovery through garnishment of income and liquidation of assets, where Γ is defined as:

$$\Gamma = \begin{cases} \gamma \max\{\epsilon_j \bar{y}_j - \bar{w}, 0\} + GP(j, \epsilon), & \text{if } e = 0; \\ \gamma \max\{f(\theta, k) - \bar{w}, 0\} + (1 - \zeta) \max\{(1 - \delta)k - \bar{x}, 0\} + GP(j, \epsilon), & \text{if } e = 1. \end{cases} \tag{12}$$

where $GP(j, \epsilon)$ is the expected current value of post-bankruptcy income garnishment, which only depends on the household's age, current labour productivity shock and the length of garnishments, that is:

$$GP(j, \epsilon) = E[\sum_{t=1}^{\min\{G, J-j\}} (\bar{q}^d)^t \gamma[\max\{\epsilon_{j+t} \bar{y}_{j+t} - \bar{w}, 0\}]|\epsilon_j] \tag{13}$$

Note that these garnishments are discounted by $\bar{q}^d$, since these repayments resemble default-risk free loans.

4.7   Equilibrium

Equilibrium is defined as follows:

Definition 1 *Given a bankruptcy rule* $(G, \bar{x}, \bar{w}, \gamma, \zeta)$ *and risk free interest rate* r^f *and transaction cost* τ *, an equilibrium is a set of value functions,* V *and* W *, and policy functions* d, k, e *and* b *, a default probability* $\phi(d', k', \epsilon, \rho, j)$ *, and a pricing function* q^d *such that:*

1. *The value functions* V *and* W *solve the household problem, and* d, k, e *and* b *are the associated optimal policy functions;*

2. *The bond prices* q^d *are determined by zero profit condition (11);*

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3. *The default probabilities are correct: $\phi(d', k', \epsilon, \rho, j) = E(b_{j+1}(d', k', \epsilon, \rho))$*

5   Benchmark Parameterizations

The benchmark is calibrated to match several key moments from the U.S. economy. The parameters to be calibrated are related to households preferences and demographic, labour market shocks, entrepreneurial production, intermediation rates, and the bankruptcy system.

5.1   Demographics and Preference

The model period is 1 year. Households live for 57 periods. Agents begin life at age 20 and retire at 65, which counts as the first 45 periods in which agents receive income shocks and entrepreneurial productivity shocks, while the last 12 periods correspond to retirement.[20] I adopt the family size life cycle profile from Livshits, MacGee and Tertilt (2007) , which is based on U.S. census data for 1990.[21] I assume there are five levels of entrepreneurial abilities, from low to high are $\{\rho_1, \rho_2, \rho_3, \rho_4, \rho_5\}$, the fraction of population endowed with each ability level is $\{10\%, 20\%, 40\%, 20\%, 10\%\}$,[22] respectively.

   The period utility function is $u(c) = \frac{c^{1-\sigma}}{1-\sigma}$, where $\frac{1}{\sigma}$ is the intertemporal elasticity of substitution. The annual discount factor is set at 0.96 and $\sigma = 2$.

5.2   labour Productivity

The average age-profile of earning $\bar{y}_j$ is from Livshits, MacGee and Tertilt (2007). The persistent idiosyncratic shock, ϵ, is assumed to follow a four-state Markov process. I set $\rho_\epsilon = 0.99$, and $\sigma_\epsilon^2 = 0.016$, and the transitory shock is set to $\sigma_\eta^2 = 0.068$. When discretizing the transitory shock, I assume that 5% of the population receives a positive(negative) shock each period. The procedure used to approximate this AR(1) process using a Markov process is from Tauchen and Hussey (1991). There is no uncertainty during retirement in which income is composed of 30% of the household's

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[20]I assume that households die at $20+57 = 77$ years old, since the reported average life expectancy is around 76-78 for the US.

[21]They use the average of equivalence scales as reported in Fernandez Villaverda and Krueger (2001)

[22]This is to approximate a normal distribution.

pre-retirement period (45th period) labour income plus 35% of the average labour income of the economy. I assume that households face no uncertainty during retirement because rational agents should have perfectly diversified up to that time.

5.3 Intermediation Sector

The risk-free interest rate is set to 4%, which is the average return on capital reported by McGrattan and Prescott (2001). The transaction cost is set at 4%, which is used by Livshits, MacGee and Tertilt (2007).[23] This implies a risk free return on savings for a one-year period of 4% and a risk -free lending rate of 8%.

5.4 Entrepreneurial Production

I pick the group of $\Phi_\rho(\theta)$ and the set of θs such that the implied mean and standard deviation of return on assets (ROA) from the benchmark model would match the corresponding statistics for sample firms in the 1993 Survey of Small Business Financing from Herranz, Krasa and Villamil (2007). The support of θ has five elements (see Table 3). The lowest state is -3.14. This implies that if $\theta = -3.14$, a small firm loses not only the depreciated capital, but more than its capital stock[24]. Think of a typical bankrupt firm, it is not the case that they are only indebted to their banks[25]. These firms are usually in much severe financial distress, they hold debts to their suppliers, employees, and sometimes to their customers as well[26].

The liquidation cost ζ is set to 35%, which is close to the mean reported for U.S. companies by Shleifer and Vishny (1992). α is used to match the fraction of entrepreneurs in the data. The fraction of population that is owner-manager of a business is 10.6% in the U.S[27]. Unlike Meh and Terajima (2008), I do not assume

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[23]They claim the one they used is slightly less than the average cost of making credit card loans reported by Evans and Schmalnsee (2005).

[24]Note that under this setting, smaller firms are riskier and more profitable at the same time, because the marginal return(loss) to capital is higher for smaller firms (this is due to diminishing return to capital). According to Herranz, Krasa and Villamil's (2007) calculation, more than 2% of firms in their sample have a Return to Assets ratio lower than -100%

[25]Again, these bank loans are usually secured by equipment, land etc.

[26]Trade credit is very important to small business as means of financing, trade credit as share of all small business debts in the U.S. is comparable to debts from financial institutions (Berger & Udell 1998), obviously they take the form of unsecured debts.

[27]From the 2003 survey of Global Entrepreneur Monitor (Reynolds, Bygrave, Autio & Arenius 2004)

that there is a minimal size requirement to start a business, as a household cannot be an entrepreneur and worker at the same time in this model[28]. Finally, the annual deprecation rate is set to 8%.

5.5 Bankruptcy Law

There are five parameters of the bankruptcy system that need to be chosen: periods of post-bankruptcy income garnishment G, income exemption $\bar{w}$, asset exemption $\bar{x}$, the garnishment rate γ and transaction cost λ. Under Chapter 7, G is set to 1 since Chapter 7 indicates that filers would have to act in "good faith," which is usually interpreted as some period of repayment. γ is calibrated to match the fraction of entrepreneur bankruptcies. Asset exemption $\bar{x}$ is set to be 0.9, which is in line with the estimates of \$50,000 by Akyol & Athreya (2009)[29]. The transaction cost is set to 15%, though previous studies have tried to capture income garnishments, stigma cost or even cost of exclusion from the credit market by one garnisheeing parameter. It does not seem to fit this study, because income garnishment rules are specified in all bankruptcy regimes except for the U.S. Income exemption level $\bar{w}$ is set to 0 for the same reason.

Using the same logic as Meh and Terajima (2008), the bankruptcy rate of entrepreneurs 1.66% is obtained by multiplying the fraction of entrepreneur bankruptcies and the overall bankruptcy rate, then dividing by the fraction of the entrepreneurs in the economy.

I do not try to match the total personal bankruptcy filing because I want to concentrate on entrepreneurship, and there is no expense shock in the model. Thus I will only target the fraction of households filing bankruptcy for the two reasons modeled in this paper: business failure and job loss, which counts for about 0.378% of the population [30]. A large fraction of personal bankruptcies are caused by surprise expenses in the U.S., for instance, medical expenses count for roughly one third of total bankruptcy cases (Domowitz and Sartain (1999))[31] In addition, family issues

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[28]Adding minimal size requirements does not seem to affect the result.

[29]The original source is from Rodriguez, Diaz-Gimenez, Quadrini & Rior-Rull (2002)

[30](20% (business failure)+23% (job loss)) $\times$ 0.88% (fraction of bankrupts among population) = 0.378%

[31]Sullivan, Warren, and Westbrook (1999) report that only 19.3% of bankrupts claim medical expense as the cause of bankruptcy, although Jacoby, Sullivan, and Warren (2000) suggest that 34% of bankrupts owed large amount of medical debt.

such as divorces (22.1% from Sullivan, Warren, and Westbrook (1999)) and expenses associated with an unplanned child also play a significant role. In this model, the only reason for a worker to file bankruptcy is job loss (having a very low labour income shock). Sullivan, Warren, and Westbrook (1999) claimed that 67% of bankruptcies were filed because of job loss, but this number has been criticized as exaggerated. The survey of Panel Study of Income Dynamics (PSID) shows that only 23% of filers gave job loss as their primary or secondary reason for filing (White 2007).

The benchmark calibration fits very well with all the preceding targets; these results are presented in Table 6. As shown in Table 7, the benchmark model also predicts the hump shape of age-profile of U.S. entrepreneurs and bankruptcy filers fairly well.

6   Results

This section is organized as follows. The first part describes the counterfactual experiments. The second part present the results in detail, and analyzes the basic forces at work in the model.

The first three set of counterfactual exercises are designed to study the effect on the benchmark model when altering one aspect of personal bankruptcy at a time: in the first set, I change the periods of garnishment G between 1 and 9, results are presented in Table 8; In second set, I study the effect of changes in fraction of garnishment γ, results are presented in Table 9; and the third set deal with changes in asset exemptions, results are presented in Table 10. The following key statistics are reported for each set: 1) the level of entrepreneurship measured as fraction of households being entrepreneurs, 2) the average size of businesses in the entrepreneurial sector, 3) the average productivity of businesses in the entrepreneurial sector relative to the benchmark U.S. case, 4) the fraction of new/exiting businesses, 5) the fraction of entrepreneur within each ability group. All numbers are reported on an annual basis.

The fourth set of counterfactuals are designed to examine the impact of alternative personal bankruptcy rules from Canada, UK, Germany and France on the equilibrium outcome of the calibrated model. Thus, for each counterfactual I only alternate those parameter values associated with the bankruptcy law, namely: the length of garnishment periods G, the garnishment rate γ, the income exemption $\bar{w}$

and the asset exemption $\bar{x}$. The bankruptcy parameters used in these four counter-factuals as well as for the benchmark are reported in Table 11. When available, these numbers are directly calculated as specified in bankruptcy laws. The length of post bankruptcy garnisheeing is: G=3 for the UK, G=6 for Germany and G=9 for France. As for Canada, although the bankruptcy law specifies that garnishment can last up to 3 years, the majority of debts are discharged within 9 months, which makes this bankruptcy procedure quite similar to that of Chapter 7, so I set G equal to 1 in that situation. The income exemption used for UK, Canada and Germany, , $\bar{w} = 0.375$ is obtained from dividing \$21000 by \$56000 (the average income used by Meh and Terajima (2008)). Similarly, that number is 0.35 for the France. Once again, the same set of five key statistics are reported for 12 and 13 for these counterfactuals; in addition, the fraction of entrepreneurs declaring bankruptcy and the total fraction of households declaring bankruptcy are also reported. All numbers are reported on an annual basis. A quick glance will show that the model does a good job of matching the facts described in section 2: less lenient bankruptcy systems lead to 1) lower levels of entrepreneurship, 2) higher fractions of larger, older firms in the economy; and 3) lower business turnover rates. A more detailed breakdown of the results follows.

First, the bankruptcy regime has a significant impact on the "extensive" margin of entrepreneurship. This can be seen in the first row of Table 8, 9, 10 and 12: variations in bankruptcy punishments appear to have a large impact on the aggregate level of entrepreneurship. The fraction of entrepreneurs decreases monotonically as the length and fraction of post-bankruptcy garnishments increases: from 10.71% under the benchmark case to 7.32% when length of garnishment reaches 9, and to 9.47% when fraction of income garnisheed increases to 1. There appears to be an inverted U-relationship between between the asset exemption level and the level of entrepreneurship: fraction of entrepreneurs increases from 10.02% when $\bar{x} = 0.05$ to 10.71% when $\bar{x} = 0.9$, then declines to 10.21% when $\bar{x} = 2$. Similarly, when switching between different country regimes, the level of entrepreneurship decreases from 10.71% under the U.S. regime to 9.75% under the Canadian regime, 9.1% under the UK regime, 7.32% under the Germany regime and 6.43% under the French regime. Notably, most of these changes are coming from the lower ability households. As shown in Table 8, 9, 10 and 12: the fraction of entrepreneurs out of the highest ability households barely changed for every set of benchmark counterfactuals, in fact it is always within the range of 60%-65%. There seems to exist an U-shaped relationship

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between the level of entrepreneurship and the "forgiveness" of bankruptcy law within this high ability group when it comes to the length of garnishment: it declined first from 62.9% when $G = 1$ to 60.3% when $G = 4$, then increased to 63.8% when $G = 9$. This result suggests that, even for the high ability entrepreneurs, the bankruptcy punishments need to be really tough for the lowered borrowing cost to start encourage entrepreneurship. when it comes to changing the level of garnishment and asset exemptions, the level of entrepreneurship within this high ability group tend to increase monotonically with the forgiveness of the bankruptcy regime. On the other hand, the fraction of entrepreneurs for the households in the next ability level dropped drastically and monotonically as the bankruptcy regimes become less lenient for all but the case of asset exemption level. There is an inverted U-relationship between the asset exemption and the fraction of entrepreneurs in this "moderate" ability group.

The intuition behind the vast different effect of bankruptcy regime on different ability households is clear: severe failures are less likely to occur for high ability entrepreneurs. Since bankruptcy only occurs in these bad states, changes in the insurance effect and borrowing cost from varying bankruptcy policies are relatively small for high ability households. As for lower ability households, failure is more likely to occur, so variation in bankruptcy policy has a much bigger impact on their occupational decisions, and it appears that the insurance effect completely dominates the borrowing effect. It is clear that when length of garnishment is high as for the French and Germany bankruptcy regimes, little insurance value is provided against failure as bankruptcy filers would live under poverty line between 6 to 10 years after filing. Consequently, the entrepreneur bankruptcy rate and the overall bankruptcy rate drop close to 4 times from the benchmark U.S. case to the France counterfactual.

As for business dynamics, the fraction of new firms decreases as the regime becomes less lenient. This is due to two reasons: 1) as the fraction of better firms increases, failure in the pool of active businesses is less likely to occur, and 2) filing for bankruptcy and quitting business become more expensive. Similarly, the turnover rate decreased quite a bit, from 10.41% to 6.98% from the benchmark model to the French counterfactual.[32]

Now let us turn to the impact on the "intensive" margin of entrepreneurship, namely the size of firms. For the U.S. benchmark model, average firm capital size is 15.23 which corresponds to $852,000, which went up to just over $1,000,000 when set

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[32]This is a static model, so turnover rate is simply two times the fraction of new firms.

length of garnishment to $G = 9$ under the first set of counterfactual exercises, and went up even higher for the counterfactual with the French regime. This shift is for two reasons. First, the rate of return for capital is higher for high ability entrepreneurs, thus as the fraction of "better" firm increases, the average size increases. Second, though having fairly small effect, the lowered borrowing cost from tougher systems allows entrepreneurs to borrow more and accumulate wealth faster. On the other hand, the capital size appear to have U-shape relationship with asset exemption, this again is due to the change in ability composition of entrepreneurs, as discussed above, there is a inverted U-relationship between asset exemption and the fraction of entrepreneurs among moderate ability households: as the share of moderate ability entrepreneur goes down, the average size of businesses goes up.

The average age of entrepreneurs of all counterfactuals decreased as the bankruptcy law gets tougher. The age distributions of entrepreneurs are presented in Figure 2. Both the benchmark and Canadian counterfactual have higher fraction of older entrepreneurs, as contrary to other countries where the distribution stayed flat. This gives evidence that there is credit constraint for the younger households, at least for the lower ability households. The impact of change in bankruptcy law on low ability households is larger; as the punishments get more severe they stop being entrepreneurs. Since these households are more credit constrained, they have to accumulate enough wealth and then start business later in their life-time in the benchmark U.S. case; which explains why the hump shape at the right end of the age distribution of entrepreneurs starts disappearing as the bankruptcy law becomes less lenient.

When it comes to compare the impact of different aspects of personal bankruptcy regimes, the length of post-bankruptcy punishment clearly has the largest impact: prolong it to 9 periods along can lead to a 31.65% drop in the level of entrepreneurship, 7.4% increase in average productivity and 26.1% increase in average firm capital. It has a very large impact on the occupational choice of the moderate ability households: again changing from the benchmark case to 9 periods of garnishment caused the fraction of entrepreneurs among this ability group from 21.97% to 4.7%, which accounted for the majority of the change in the level of entrepreneurship. The level of income garnisheed also had moderate impact on entrepreneurship: increase the fraction from 25% to 100% lead to a 13.2% drop in the level of entrepreneurship, 5.7% increase in average productivity and 10.3% increase in average firm capital. On the other hand, change in asset exemption have only modest impact on the en-

trepreneurial sector.

The changes in the ability composition of entrepreneur households associated with tougher bankruptcy regime results in an increase in the average productivity in the entrepreneurial sector, which went up 7.4% when increase the length of garnishment to 9 periods, went up 5% when increase the fraction of garnishment to 100% and went up 2.2% when the asset exemption drop to 0.05 (roughly $3000). When we compare regimes across countries, the adoption of French regime lead to a 8.3% increase in average productivity. This suggests that if average productivity in the entrepreneurial sector is the main concern, then those less "forgiving" regimes are more favorable in comparison to the U.S. chapter 7 system. Although one should note that, as the fraction of entrepreneurs increases, the overall output in the economy increases. This is because for any *risk-averse* household to run a business, the expected return from the business has to be greater than the expected wage income plus the risk-free gross return from the invested capital (internally or externally financed). More specifically, the difference would have to be large enough to compensate for the risk these entrepreneur households are bearing. Thus, the aggregate output is the highest in the benchmark U.S. case and the lowest in the French counterfactual, although the firms in the French counterfactual are bigger on average, but it is not enough to offset the drop in the over level of entrepreneurship.

One should be careful when interpreting these partial equilibrium results, because aggregate movements of labour between the entrepreneurial sector and the corporate sector, and changes in the aggregate capital stock (which affect the risk-free rate of return) are not captured here. For instance, an increase in the level of entrepreneurship drives labour out of the corporate sector, thus the wage rate in the corporate sector would rise, which discourages entrepreneurship by increasing the opportunity cost. Many argued that (Cagetti & De Nardi (2006), Evans & Jovanovic (1989), Evans & Leighton (1989)) more potential entrepreneurs in an environment with default lead to higher stock of capital, because entrepreneurs want to save more proportionally to avoid borrowing constraints. This lead to a lower equilibrium risk-free interest rate, which encourages entrepreneurship (this effect amplifies my result, as a higher level of entrepreneurship encourages more households to run businesses). On the other hand, higher level of entrepreneurship increases the demand for capital, which drives the risk-free interest rate higher. A higher risk-free rate discourages entrepreneurship and limits entrepreneurs' ability to invest in efficient size. But, it is unlikely that

these second order effects will revert the main results from this paper.

6.1   Welfare analysis

Ex-ante welfare gains or losses for each of the counterfactuals are presented in table 14, these numbers are calculated as consumption equivalence in gains and losses when compared to the benchmark U.S. case. The first row reports the overall welfare changes,[33] and the following five rows report the decomposition of these gains and losses among different ability groups.

The first row of Table 14 shows that overall welfare increases as the personal bankruptcy laws become less lenient, U.S. benchmark case implies the lowest ex-ante welfare, and the French counterfactual has the highest. However, when separated in to different ability groups, the two groups with the highest entrepreneurial ability actually experience welfare gain when bankruptcy regime gets more lenient, with the gains being higher for the top ability group. The three groups with lowest ability levels (pure worker type) on the other hand, all have welfare losses when the leniency of the bankruptcy regime increases. This result implies that entrepreneurs actually prefer the U.S. regime which give the most insurance value, and workers prefer the French regime which gives the lowest borrowing cost. This is because labour income risk is more moderate when comparing to productivity risks.[34] Because they face lower risks, worker households care more about the ability to smooth consumption over time through borrowing. As a more lenient bankruptcy regime limits their ability to borrow, their welfare drops.[35] On the other hand, entrepreneur households care more about insurance value provided by bankruptcy system. Because productivity risk is larger relative to labour income risks, the effect of insurance value outweighs the effect from increased borrowing cost for entrepreneur households. Thus, their welfare improves as the regime become more lenient. At last, the overall welfare decreases as the personal bankruptcy laws become more lenient is because worker households outweighs entrepreneur households in numbers.

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[33]This is calculated by assuming that before households are born, households don't know their entrepreneurial ability, but know the distribution of abilities among population.

[34]In fact, labour shock never go to the negative region, productivity risk did (the lowest shock being -1.2).

[35]This result may go away if the type of expense shock from Livshits, MacGee and Tertilt (2007) is incorporated here. However, as they mentioned in their paper, the sources and magnitude of expense shock differs across countries. A more detailed discussion is offered in the conclusion part.

6.2 Varying Risk Aversion Parameters

Since this paper evaluates households' willingness to undertake risks under given different bankruptcy policies, it is important to see how sensitive these results are to changes in risk-aversion. I run the same set of 5 programs (for different countries) with two different risk aversion parameters. Table 15 summarizes the results. The first thing one should notice is that with lower risk-aversion parameter the same pattern from the benchmark persists: tougher bankruptcy law is associated with a lower level of entrepreneurship. Meanwhile, we see that the fraction of households being entrepreneurs within the highest ability group barely changed, and the fraction of households being entrepreneurs for the next two ability groups decreased monotonically as I toughen the bankruptcy punishments. As expected, less risk-averse households ($\sigma_1 = 1.5$) are more likely to become entrepreneurs under all bankruptcy codes, as they are more willing to take risks. The average size of businesses also increased slightly for lower risk aversion parameter. On the other hand, with more risk averse households ($\sigma_2 = 3$), the level of entrepreneurship decreases, and average business size decreases. Though only high ability households become entrepreneurs, thus we see the same U-shape pattern for the level of entrepreneurship as when $\sigma = 2$ for high ability households.

7 Conclusion

The main finding of this paper is that variations in bankruptcy regimes have little effect on high ability households' occupational choices, and change in the length(periods) of post-bankruptcy punishment appears to have the largest impact on entrepreneurship, and asset exemption had only modest effect. When it comes to lower ability households' occupational choices, the insurance effect completely dominates the borrowing cost effect. This result suggests that a very lenient bankruptcy regime like the U.S. chapter 7 system does encourage entrepreneurship, though it lowers the average productivity in the entrepreneurial sector, but increases the overall production in the economy. The results also help explain U.S.' higher turnover rate and lower average business size when in comparison to other developed nations.

The model suggests that worker households prefer less lenient regimes due to moderate wage income risks. Although, a large fraction of U.S. personal bankruptcies are

due to medical causes and other surprise expenses rather than income loss or business failures. Livshits, MacGee and Tertilt (2007) in their paper showed that once these expense shocks are incorporated, given reasonable parameter values[36] the Chapter 7 regime leads to a welfare gain on comparison to a no-bankruptcy (no leniency) regime. It is reasonable to say that once expense shock is incorporated in this model, both worker households and entrepreneur households in the U.S. would prefer the U.S. regime. Unlike the U.S., the other four countries all have some form of universal health care systems. Thus, the fraction of bankruptcies due to medical reasons is very small.[37] In addition to low exposure to surprise medical expenses, workers in Europe also enjoy better job security (Lazear 1990) and less earning inequity[38]; which means that they face even less risks compare to their U.S. counterpart. Because they face less risks, they would prefer less lenient system as insurance value provided by bankruptcy does not matter for them.

This model can be extended to several directions. In this paper, I assume that the entrepreneurial ability is immediately observed by households and intermediaries. Suppose that households and banks can only observe the (history of) business outcomes but not the actual ability level. In that situation, households would like to start businesses earlier in life when they are most financial constrained, at the same time mature firms enjoy a lower borrowing cost. Obviously, this would greatly increase the computational intensity as belief updating comes into play.The other interesting direction is taking the effect of "learning by doing" from running a business into the model. In that situation, the potential earnings from being an entrepreneur also increase with experience, rather than remaining constant as in this paper.

Another interesting extension is to look at entrepreneurship in different industries. Since different industries are inherently different in their riskiness, such that bankruptcy policy may have adverse effects. However, one must pay attention to more than just debt contract when considering such industries, as equity type financing with ownership clearly suits those very risky sectors (ie. high-tech).

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[36]Most of variables concerning labour income shocks and financial intermediation used here are taken directly from their paper.

[37]Although most medical practices in France are operated privately, patients are reimbursed by the state for up to 85% of medical costs.

[38]See Livshits, MacGee & Tertilt (2003)

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Table 1: Personal Bankruptcy Law Across Countries Prior 2005

	France	Germany	UK	Canada	U.S. Chapter 7
Asset exemption	modest household goods exemption	modest household goods exemption	household goods and pension exemption, homestead exemption is around $2000	varies across provinces, largest homestead exemption is $40,000	varies across states, some states with unlimited homestead exemption
Income exemption	$6000 for singles, $15000 for family of three	$21000 for couples, up to $38,000 for families per year	"reasonable domestic needs"	$21,000 for singles; $40,000 for families of four	unlimited
Percent of nonexempt income that goes to creditors	increase from 5% to 100% when income exceeds $20,000 for singles or $23,000 for family of four	100% in years 1-3, 90% in year 4 and 85% in year 5	30%-50%	50%	None
length of repayment obligation	8-10 years	6 years	up to 3 years	9 months to 3 years	None
other punishments	discharge contingent on debtors' efforts to find/hold a job	discharge contingent on debtors' efforts to find/hold a job	debtor cannot borrow, manage a business, hold some public offices for 3 years	debtor cannot borrow, manage a business, hold some public offices before discharge	repeat filing not allowed for 6 years

Table 2: Entrepreneurship Across Countries

Source		France	Germany	UK	Canada	U.S.
Global Entrepreneurship Monitor, (2004)	% of population that is owner-manager	4.22%	7%	8.8%	9.7%	10.6%
	Fraction of new firms out of all firms	9.0%	8.4%	11.3%	12.7%	13.9%
Flash Eurobarometer Survey 160, (2004), percentages showed here are out of survey replies	Entrepreneurs	10%	18%	18%	N.A.	22%
	Business younger than 3 years	33%	40%	44%	N.A.	62.5%
(Bartelsman, Haltiwanger & Scarpetta 2007)	Fraction of all employer-firms with less than 20 employees	82%	89.6%*	N.A.	86.7%	88%
	Entry/Exit rate	11%/7.5%	6%/6%*	N.A.	11%/10.5%	12%/10%
Mills and Timmins 2006	Fraction of zero-employee firms	N.A.	N.A.	69.3%	58.2%	77.3%

Note: At the time there is no personal bankruptcy law in Germany. Though other data are taken after 1999, it should be clear that Germany's economy might still be in transition.

Table 3: Business Shocks

state		1	2	3	4	5
productivity	θ	-3.14	-1.47	0.2	1.87	3.52
Ability levels	ρ_1	0.165	0.31	0.33	0.17	0.025
	ρ_2	0.13	0.275	0.33	0.205	0.06
	ρ_3	0.095	0.24	0.33	0.24	0.095
	ρ_4	0.06	0.205	0.33	0.275	0.13
	ρ_5	0.025	0.17	0.33	0.31	0.165

Note that the probabilities of occurrence for ability level ρ_3 is the five state approximation of the normal distribution $N(0.2, 2)$. Other groups' probability distributions are obtained by shifting weights for different states. For instance, $\Phi_{\rho4}$ is obtained by shifting 7% weights from the low productivity states 1 and 2 to high productivity states 4 and 5, $\Phi_{\rho5}$ is obtained by shifting 14% from the low productivity states 1 and 2 to high productivity states 4 and 5. similarly, $\Phi_{\rho2}$ and $\Phi_{\rho1}$ are obtained by shifting weights from high productivity states to low productivity states.

Table 4: Moments Targeted in the Benchmark in Annual Values

Moments	Values	Source
Fraction of Entrepreneurs	10.6%	GEM (2003)
Overall annual bankruptcy rate (job loss+business failure)	0.378%	Own calculation*
Fraction of Entrepreneurs declare bankruptcy	1.66%	Own calculation**

*obtained by adding the fraction of bankrupts are entrepreneurs(20%, from Sullivan, Warren and Westbrook(1999)) and fraction of bankrupts reports job-loss as filing reason(23%, PSID) then multiplied by the over all bankruptcy rate (0.88% from Athreya(2004)).

**obtained by multiplying the fraction of bankrupts are entrepreneurs(20%, from Sullivan, Warren and Westbrook(1999)) and the the over all bankruptcy rate (0.88% from Athreya(2004)) then divide by the fraction of the entrepreneurs in the economy(10.6%, from GEM 2003(2004)).

Table 5: Calibrated Parameters of the Benchmark Economy

Parameters		Values	
Fixed Parameters	σ	Relative risk aversion	2
	β	Discount factor	0.96
	J	Lifetime	57
	ρ_ϵ	coefficient of autocorrelation of labour income	0.99
	$\sigma^2_{\epsilon,3}$	Variance of persistent labour shock	0.016
	σ^2_η	Variance of transitory labour shock	0.068
	δ	Depreciation parameter	8%
	ζ	Liquidation cost	35%
	r^f	Risk free rate	4%
	τ	Annual transaction costs when making loans	4%
	$\bar{x}$	Asset exemption	0.9
Endogenously calibrated parameters	γ	Income garnishment rate	0.433
	α	Degree of return to scale	0.643
	λ	Transaction cost for bankrupts	15%

Table 6: Moments Targeted in the Benchmark in Annual Values

Moments	Data	Benchmark
Fraction of Entrepreneurs	10.6%	10.71%
Overall annual bankruptcy rate (job loss+business failure)	0.378%	0.391%
Fraction of Entrepreneurs declare bankruptcy	1.66%	1.69%
Mean of Return on Assets	1.3	1.313
Standard Deviation of Return on Assets	1.575	1.612

Table 7: Age Profiles of Entrepreneurs and Bankrupts

Fraction of population of being entrepreneur by age group

Age Group	Below 35	35-44	45-54	Above 55
Model	6.8%	14.3%	12.7%	12.6%
Data	5.6%	12.5%	15.4%	11.4%

Fraction of population filed for bankruptcy by age group

Age Group	Below 35	35-44	45-54	Above 55
Model	0.33%	0.44%	0.39%	0.36%
Data	0.84%	0.98%	0.96%	0.70%

Table 8: Variation in length of garnishment

G	1	2	3	4	5	6	7	8	9
% Entre.	10.71	10.12	9.63	9.13	8.75	8.47	8.13	7.83	7.32
Average size	15.23	15.67	16.04	16.39	16.83	17.47	18.09	18.57	19.21
Ave productivity	1	1.01	1.029	1.036	1.043	1.049	1.055	1.062	1.074
Entry/Exit %	5.21	5.055	4.92	4.75	4.43	4.09	3.91	3.79	3.55
% Entre./ρ_1	0	0	0	0	0	0	0	0	0
% Entre./ρ_2	0	0	0	0	0	0	0	0	0
% Entre./ρ_3	0.025%	0.01%	0.004%	0	0	0	0	0	0
% Entre./ρ_4	21.97%	17.45%	16.2%	15.5%	13.3%	11.5%	9.4%	7.6%	4.7%
% Entre./ρ_5	62.9%	62.3%	61.4%	60.3%	60.9%	61.7%	62.5%	63.1%	63.8%

Fraction of Income Garnisheed $\gamma = 0.433$, Asset Exemption $\bar{x} = 0.9$, Income Exemption $\bar{w} = 0$

Table 9: Variation in fraction garnisheed

γ Fraction garnisheed	0.25	0.433	0.65	1
% of Entrepreneur	10.91	10.71	10.27	9.47
Average size	15.01	15.23	15.76	16.55
Average productivity	0.993	1	1.019	1.05
Entry/Exit %	5.24	5.21	5.13	4.97
% of Entre./ρ_1	0	0	0	0
% of Entre./ρ_2	0	0	0	0
% of Entre./ρ_3	0.024%	0.025%	0.019%	0
% of Entre./ρ_4	22.88%	21.97%	19.98%	16.1%
% of Entre./ρ_5	63.24%	62.9%	62.65%	62.51%

length of Garnisheeing $G = 1$, Asset Exemption $\bar{x} = 0.9$, Income Exemption $\bar{w} = 0$

Table 10: Variation in asset exemption garnisheed

$\bar{x}$ asset exemption	0.05	0.45	0.9	1.5	2
% of Entrepreneur	10.02	10.43	10.71	10.52	10.21
Average size	15.87	15.54	15.23	15.59	15.76
Average productivity	1.022	1.01	1	1.017	1.02
Entry/Exit %	5.09	5.15	5.21	5.18	5.12
% of Entre./ρ_1	0	0	0	0	0
% of Entre./ρ_2	0	0	0	0	0
% of Entre./ρ_3	0.014%	0.024%	0.025%	0.027%	0.017%
% of Entre./ρ_4	18.98%	20.08%	21.97%	20.96%	19.22%
% of Entre./ρ_5	62.23%	62.59%	62.9%	63.26%	63.65%

length of Garnisheeing $G = 1$, Fraction of Garnisheed $\gamma = 0.433$, Income Exemption $\bar{w} = 0$

Table 11: Bankruptcy parameters used in counterfactuals

	parameters	France	Germany	England	Canada	U.S.
Periods of post-bankruptcy garnishments	G	9	6	3	1	1
Asset exemptions	$\bar{x}$	0.05	0.05	0.1	0.35	0.9
Income exemptions	$\bar{w}$	0.335	0.375	0.375	0.375	0.0
Fraction of income garnisheed	γ	0.95	0.9	0.5	0.5	0.433

Table 12: Counterfactual Results

	France	Germany	UK	Canada	U.S.
Fraction of Entrepreneurs	6.43%	7.32%	9.1%	9.75%	10.71%
Fraction of Entrepreneur that bankrupts	0.33%	0.39%	1.32%	1.57%	1.69%
Average Size of Businesses	19.78	18.43	17.23	16.07	15.23
Average productivity of Businesses	1.083	1.068	1.044	1.013	1
Fraction New/All Businesses	3.49%	3.77%	4.32%	4.97%	5.21%
Overall fraction of Bankrupts	0.091%	0.098%	0.278%	0.331%	0.391%

Table 13: Fraction of entrepreneurs within different ability level groups

	France	Germany	UK	Canada	U.S.
ρ_1	0	0	0	0	0
ρ_2	0	0	0	0	0
ρ_3	0	0	0	0.002%	0.025%
ρ_4	0.0%	4.85%	14.65%	17.65%	21.97%
ρ_5	64.3%	63.5%	61.7%	62.1%	62.9%

Table 14: Welfare gain/loss relative to benchmakr U.S. case

Countries	Canada	UK	Germany	France
Ex-ante ALL households	+0.0008%	+0.009%	+0.024%	+0.054%
Households with ability ρ_1	+ 0.009%	+0.0021%	+0.083%	+0.161%
Households with ability ρ_2	+0.0009%	+0.0021%	+0.083%	+0.161%
Households with ability ρ_3	+ 0.0009%	+0.0021%	+0.083%	+0.161%
Households with ability ρ_4	-0.0002%	-0.062%	-0.172%	-0.328%
Households with ability ρ_5	-0.03%	-2.14%	-3.653%	-6.259%

Table 15: Changes in Risk-Aversion Parameter

		France	Germany	UK	Canada	U.S.
$\sigma_1 = 1.5$	Fraction of Entrepreneurs	17.04%	17.82%	18.74%	21.78%	22.08%
	Average Size of Businesses	20.43	19.23	18.04	16.78	15.97
$\sigma = 2$	Fraction of Entrepreneurs	6.43%	7.32%	9.1%	9.75%	10.71%
	Average Size of Businesses	19.78	18.43	17.23	16.07	15.23
$\sigma_2 = 3$	Fraction of Entrepreneurs	0.93%	0.95%	0.75%	1.09%	1.13%
	Average Size of Businesses	5.53	5.48	5.64	5.35	5.24