Bankruptcy, Incorporation, and the Nature of Entrepreneurial Risk[*]

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Abstract

Entrepreneurship is risky; entrepreneurs forgo wages and invest their time and resources into a business with large potential gains, but uninsurable risks. It is vital to know the extent of these risks, and the insurance available against them, in order to assess corporate tax and personal bankruptcy reforms. We document that incorporated entrepreneurs operate larger businesses, accumulate more wealth, and are on average more productive than unincorporated entrepreneurs. We embed the U.S. bankruptcy and incorporation legal systems in a quantitative macroeconomic theory of occupation, incorporation, and default choices that accounts for the cross-sectional facts. In the model, as in the U.S., incorporation provides insurance via limited liability beyond personal bankruptcy exemptions, at the expense of administrative burdens and an endogenous interest rate premium. Our model suggests that capital embodied shocks are important entrepreneurial risks. A calibrated economy in which each unit of installed capital entails a small probability (1.0%) of a catastrophic shock (full destruction of capital) is able to account for the data along multiple untargeted dimensions. We find the welfare gains for entrepreneurs from eliminating investment risk are huge (5.9% increase in annual consumption). And, the welfare loss from removing limited liability to be large.

1 Introduction

Entrepreneurship is inherently risky; the macroeconomic literature on entrepreneurship (Evans and Jovanovic [1989],Quadrini [2000],Cagetti and De Nardi [2006],etc) focuses on how individuals make decision in the face of uninsurable risks, and how these risk influence the savings behavior of entrepreneurs. These risks, along with interest rate premia on external financing, encourage savings by entrepreneurs and allow these models to generate the high level of wealth inequality in the United States.

While acknowledging the successes of these theories, it is important to recognize that there is substantial heterogeneity amongst entrepreneurs. Furthermore, entrepreneurs' choices differ systematically by the amount of insurance against business risks available to them. In particular, the U.S. legal system provides two tiers of insurance for entrepreneurs. The first is that, according to bankruptcy law, the entrepreneur may unilaterally default on liabilities while keeping personal assets up to an exemption level. Second, an entrepreneur may attain limited liability by incorporating her business, and thereby eliminate personal exposure to business risk. This allows the incorporated entrepreneur to effectively choose the level of insurance she desires.

We include bankruptcy and incorporation margins for two reasons. First, the data suggest that incorporated entrepreneurs are *better* entrepreneurs: on average, they enjoy higher incomes, accumulate more wealth, and pay lower interest rates on debt than their unincorporated peers. On the other hand, the insurance provided by limited liability induces incorporated entrepreneurs to default more frequently, thereby increasing their interest rates, both in the data (table 4) and in our theory. Modeling entrepreneurial bankruptcy therefore generates financing frictions emphasized in the literature, but via an endogenous mechanism that relies on realistic contracts. Modeling incorporation gives cross-sectional restrictions on the model, as well as increasing the model's ability to generate wealth inequality.

Second, since incorporated entrepreneurs operate at sizes in between unincorporated and large corporate firms, they are a natural springboard for studying the transition between the entrepreneurial and corporate sectors. Models of entrepreneurship are unable to study corporate tax reform, because they are silent on this transition. This model opens the door to studying such a reform; as an initial application, we use it to predict the effects of making incorporation cheaper on aggregate output, entrepreneurship rates, income and wealth inequality, and welfare.

1.1 Data and Legal Structure

In the United States, an individual entrepreneur can operate her business under one of three legal regimes. The first is a sole-proprietorship, in which all profits are passed-through to the entrepreneur's income and there is no legal distinction between liabilities of the business and owner. The second consists of Sub-Chapter C Corporations, in which business profits are taxed at corporate rates and can be either retained or distributed, and in which each owner is liable only up to the equity injected into the business. The final type consists of Sub-Chapter S Corporations, in which profits are passed-through as income, but liability is limited. We will call sole-proprietors "unincorporated entrepreneurs" and single-owner corporations "incorporated entrepreneurs."

We segment aggregate activity with these definitions in mind. The entrepreneurial sector as defined composed 18% of private non-farm GDP in 2003[1]. Of this, 8% was produced by unincorporated entrepreneurs and 10% by incorporated entrepreneurs. These shares are similar to what one would get using national income accounts, although it is impossible to slice NIPA in the same way.

We next look at the cross-section of entrepreneurs. Using data from the 2003 waves of the Survey of Small Business Finances (SSBF) and Survey of Consumer Finances (SCF), we find that, while de-

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[1]We use IRS SOI data to construct value added, with some extrapolations from the SSBF. Full details are available upon request

mographically very similar, incorporated entrepreneurs were much more successful and wealthier than unincorporated entrepreneurs: revenue for was seven times greater, profits were three times greater, wealth to income was 40% greater, and interest rates on debts were on average 70 basis points lower. Importantly, however, incorporated entrepreneurs paid a $40 - 70$ basis point interest rate premium on business debts. These observations inform our inclusion of unilateral default and and incorporation as key modeling ingredients.

1.2 Description of Theory

We model entrepreneurs as households who have a persistent ability to produce, but face idiosyncratic shocks and forgo labor income if they choose to do so. An entrepreneur faces shocks to both their ability, as well as shocks to installed capital. The first represents shocks that affect management ability (such as illness) or shifts in demand for the entrepreneur's product. The second represents a combination of shocks, such as business specific investments that turn sour (e.g. building and designing a restaurant which turns out to be in a poor location) or judgements against the entrepreneur due to negligence. Note that the second source of shocks can be catastrophic, thereby causing losses greater than revenue. As detailed below, these are the types of shocks that entrepreneurs identify as the causes for bankruptcy.

As a result of these shocks, entrepreneurs sometimes find it optimal to default. In our theory this resembles Chapter 7 bankruptcy. If entrepreneurs ever exercise this option, then banks charge interest rate premia above the risk free rate on business loans (as in Eaton and Gersovitz [1981], Chatterjee et al. [2007]. For unincorporated entrepreneurs, bankruptcy also entails seizure of personal assets up to the exemption level and exclusion from financial markets for a period (in this way, our bankruptcy resembles a "fresh start" as in Livshits et al. [2007]). Incorporated entrepreneurs, on the other hand, can keep the entirety of personal assets, and maintain access to financial markets.

Since incorporated entrepreneurs are "punished" less in the event of bankruptcy, they naturally default more frequently than unincorporated entrepreneurs. Therefore, they pay even higher interest rates on debt than would an identical unincorporated entrepreneur, as we see in the data. This also implies that a given incorporated entrepreneur saves more than if she were unincorporated. First, since fewer personal assets are seized in the event of bankruptcy, the implicit rate of return on personal savings is higher for incorporated entrepreneurs. Second, the covariance between income and returns on personal savings is zero for incorporated entrepreneurs, while it is positive for unincorporated entrepreneurs. Finally, debt is more expensive for incorporated entrepreneurs, and so self financing is more attractive.

Whether the theory can generate greater revenue and lower average interest rates for incorporated entrepreneurs hinges on whether more productive entrepreneurs select into incorporation. For a fixed level of resources, a more productive entrepreneur wishes to install more capital than an unproductive entrepreneur, and so more expensive debt discourages them from incorporating. On the other hand, more productive entrepreneurs have more income and therefore wish to hold more personal savings than what is protected by personal exemptions, which may not be the case for low productivity entrepreneurs. Thus the model can generate positive selection if the financing motive is weaker than the insurance motive, which makes the calibration in table 7 non-trivial.

1.3 Applying the Model

We emphasize that the world faced by entrepreneurs in our model is radically different than in the rest of the literature. Previous researchers think of entrepreneurial risk as individual specific productivity shocks, so that in the worst states of the world an entrepreneur who fully funds production via debt still has non-negative net equity in her business. In our world, net equity after the most adverse shocks is equal to the level of debt. We find that our specification of risk is necessary to get the wealthiest

entrepreneurs to incorporate, as we observe in the data. We also use the model to measure how large these risks are in consumption equivalence terms, and find that an annual increase in consumption of 5.9% is needed to make an entrepreneur indifferent between starting a business in the presence of investment risk and a world with none. Indicating that investment risk is a *big* source of risk for entrepreneurs. For comparison, Storesletten et al. [2001] find the welfare gains from eliminating idiosyncratic labor income risk to be 1.17% annual consumption.

We use the model to conduct two policy experiments that are relevant to many actual legal changes made in the last twenty years. We first ask what happens when incorporation becomes cheaper. Since the only form of incorporation in our model has pass-through income, this resembles the introduction of recent legal forms such as Limited Liability Corporations, as well as bestowing more and more benefits to S-Corporations that were once reserved for C-Corporations. We find that this increases the entrepreneurship rate, which increases aggregate income by 0.5%, but also increases income and wealth inequality.

A similar exercise, which has been the focus of previous papers on entrepreneurship and default (Meh and Terajima [2008], Athreya et al. [2009]), explores the effects of changing personal bankruptcy exemptions. Since in our model an entrepreneur can attain full exemptions by incorporating, we find that changing personal exemptions has a much smaller impact than either of these previous studies.

It is important to note that our model gives indeterminant welfare conclusions with respect to these policies. This is because some fraction of the expenditure shocks are modeled as damages to third parties, and entrepreneurs are absolved of reimbursing these expenses in bankruptcy. Furthermore, while lenders will price their expected losses due to bankruptcy, damages due to negligence will still not be internalized. This is because secured creditors are paid first in bankruptcy proceedings.

Because entrepreneurs can generate large expenses to third parties (in 2003, 6% of total entrepreneurial output, one third of which was uninsured). This creates a trade-off for society. On one hand, the the insurance provided by incorporation encourages entrepreneurial activity, which has high marginal product. On the other hand, limited liability also enables these entrepreneurs to avoid accountability. Because the average net damages to each household depends on the number of entrepreneurs, as well as their incorporation status and level of exemptions, we find a non-monotonic relationship between welfare and entrepreneurship rates.

1.4   Literature Review

Our theory bridges the literature on entrepreneurship in macroeconomics with the literature on personal default. The default decision increases the interest rate on business debt, which creates the fundamental friction in Quadrini [2000] and Cagetti and De Nardi [2006], but is an improvement over their modeling choices since it is endogenous (as opposed to Quadrini [2000]) and is an observable feature of contracts (as opposed to Cagetti and De Nardi [2006]). We are not the first researchers to realize this, however: Meh and Terajima [2008] study an environment in which default risk generates such a premium. Our additional value over their paper is to use the incorporation choice to inform us of the risks faced by entrepreneurs.

We also focus on the tradeoff between insuring entrepreneurs from business risk, versus allowing them to avoid responsibility for negligence. While we are the first to develop this tradeoff, previous researchers have studied the effect of insurance on entrepreneurial behavior in these models. Meh and Terajima [2008] conduct policy experiments in which the exemption levels of assets under personal bankruptcy affect the extensive margin on entrepreneurial choice, and Athreya et al. [2009] look at the individual trade-off between insurance through limited liability and costly financing. Neither paper, however, allows the entrepreneur to incorporate and receive full limited liability.

To our knowledge, the paper that comes closest to allowing for an incorporation decision is Herranz et al. [2009]. While not giving entrepreneurs the option of incorporating, they point out that less risk averse entrepreneurs, because they operate larger more risky projects and therefore would gain the most from limited liability, are those who would most likely incorporate if given the option. We differ from them in that we explicitly have the decision to incorporate, and we stay more loyal to the conventions of the literature on entrepreneurs.

The rest of the paper is organized as follows: Section 2 documents the important differences between unincorporated and incorporated entrepreneurs, and provides evidence supporting the specific margins in the model. Sections 3 through 6 develop a quantitative model of occupational choice, choice of legal form of business and default decisions, which respects the U.S. legal framework of incorporation and bankruptcy. Section 7 describes the calibration procedure. Section 8 uses the calibrated model to assess the value of limited liability by performing policy experiments on bankruptcy exemptions and direct costs of incorporation. Section 9 summarizes the results and concludes.

2 Data

We study the characteristics of owners and businesses using the Survey of Small Business Finances (SSBF) and the Survey of Consumer Finances (SCF). The SSBF provides information about a nationally representative sample of non-financial, non-farm, non-subsidiary businesses with fewer than 500 employees. We focus primarily on the 2003 survey, which contains information from a sample of 4,420 businesses, which represent 6.3 million small businesses in the United States.

Since we focus only on how limited liability affects the decision to incorporate, we further restrict the sample to businesses in which there is a single owner who owns and operates the business. Therefore, for the purpose of this paper we define an entrepreneur as an individual who owns a business and has an active management role in that business. Incorporated entrepreneurs are entrepreneurs who have undertaken a costly legal procedure to establish their business as a separate legal entity, thereby creating a legal separation of business and personal assets (i.e. limited liability). The restriction to solely owned businesses mitigates the influence of financial benefits, such as issuing equity, which might lead individuals to incorporate above and beyond access to limited liability. As a result of this restriction the sample size is reduced to 1,846 firms, of which 37% are incorporated.

2.1 Legal Differences and Costs

Unincorporated entrepreneurs are individuals operating sole-proprietorships; a business structure in which the individual and business are considered a legal entity for both tax and liability purposes, that is the owner is inseparable from the business and is liable for any business debts. In contrast, incorporated entrepreneurs are individuals operating corporations[2], which are separate legal entities. There are three distinct characteristics of a corporation: (i) Legal existence - a corporation can own property, enter into contracts, can bring suits against others and be sued by them. (ii) Limited liability - owners liability is limited to the value of their investment in the corporation. (iii) Continued existence - the corporations' existence is not limited to that of its owners.

The cost of incorporation can be significant; the direct costs of state fees and franchise taxes range from $1,050 to $1,450 depending on the state in which the entrepreneur incorporates[3]. In addition to

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[2]This includes both subchapter S and C corporations. In our sample the majority (73%) of the incorporated entrepreneurs are S corporations.

[3]Bebchuk and Cohen [2003] find that firms display a substantial home-state preference when incorporating.

these taxes and fees, there are initial costs associated with the necessary accounting and legal paperwork (tax filing, articles of incorporation, bylaws, etc.) involved in establishing the corporation. Estimates of these costs range from $500 to $5,000[4]. The Small Business Administration (SBA) estimates yearly time and financial costs of tax filing for home-based corporations to be approximately $3,250 (approximately 3.5 times larger than unincorporated home-based businesses). To give a sense of the magnitude, these direct costs are upwards of 10.2% of 2003 median earnings in the U.S.

2.2 Limited Liability and Bankruptcy

Given the inherent riskiness of operating a business, entrepreneurs must consider their position in the contingency that the business fails. In particular, as Meh and Terajima [2008] and Sullivan et al. [1999] document, these businesses can often fail with large amounts of debt. The extent to which the entrepreneur is liable for these debts is a first order concern. State and Federal bankruptcy law stipulates certain exemptions on personal wealth, the largest being the homestead exemption; these exemption levels vary widely across states. Using the variation in homestead exemptions across states, Fan and White [2003] examine how homestead exemptions affect the decision for families to become entrepreneurs. They find the probability of homeowners owning a business is 35% higher in states with unlimited homestead exemptions. Suggesting that limited liability is an important consideration when individuals are deciding whether to operate a business.

Not only do bankruptcy exemptions influence the decision to own a business; once an individual is operating a business, these exemptions will affect the bankruptcy choice of the entrepreneur. Agarwal et al. [2005] use panel data on 43,000 small business credit card holder over a two year period to estimate a proportional hazard model to measure the impact of bankruptcy exemption laws on the likelihood of bankruptcy. They find that an increase of $10,000 in homestead exemptions increases the likelihood of small business owners declaring bankruptcy by 8%; and, $1,000 increase in personal property exemptions increases the risk of bankruptcy by 4%. In a related study, Agarwal et al. [2003] find that bankruptcy exemptions are also positively related to individuals decisions to declare bankruptcy.

Lawless and Warren [2005] estimate that 17.4% of bankruptcy filings in 2003 involve the failure of a business[5]. Since entrepreneurs are only 12.4%[6] of the population, they are over-represented in bankruptcy filings. Businesses may file bankruptcy for a variety of reasons, and knowing the source of these bankruptcies is important in guiding modeling choices about the type of shocks that entrepreneurs face. Sullivan et al. [1999] survey a sample of non-farm businesses which filed bankruptcy in 1994 to determine the causes of bankruptcy. They find that the most common reasons given for bankruptcy where associated with business conditions; such as new competition, a bad location, mismanagement of business and inability to collect accounts receivables. In particular, they find that 11.4% of businesses report a pending legal action, such as a lawsuit, as the reason for filing. In addition, Dunn and Bradstreet report that 6.0% of business failures in 1994 resulted from disasters, such as .

2.3 Aggregate

Output

Using data from the Internal Revenue Service, we construct private non-farm GDP by computing the value-added for businesses across four groups: (i) sole-proprietors (ii) partnerships (iii) incorporated

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[4]Estimates of the administrative (accounting and legal) are provided by allbusiness.com, a subsidiary of Dunn and Bradstreet Company.

[5]The 17.4% includes businesses with single and multiple owners.

[6]SCF 2004

entrepreneurs (single owner corporations) and (iv) multiple shareholder corporation. Not surprisingly, we find that corporations with multiple shareholders (corporate sector) produce 70% of private non-farm GDP. Sole-proprietors produce 8%, and incorporated entrepreneurs another 10%. The remaining portion, 12%, is produced by partnerships. Together, single-owner businesses produce 18% of private non-farm GDP. In addition, we find that for young businesses (under 5 years) about 3% of sole-proprietors incorporate their business (i.e. transition to incorporated entrepreneurs). This percent falls over the age of the business. Considering the contribution to GDP, the stark legal differences and position in the transition between entrepreneur and corporate sector, we find it surprising that the literature has largely ignored incorporated entrepreneurs, either pooling them with sole-proprietors or large corporations.

Damages

The operation of businesses can often negatively impact third parties; for example, faulty wiring in pacemakers or use of lead based paint or asbestos. In 2003, aggregate tort costs for small businesses were 6% of total small business output; roughly one-third of these costs are uninsured[7]. These tort costs consist of (i) payments to third parties (settlements) (ii) defense costs (iii) administrative expenses. Comparing the tort costs of small businesses to the aggregate tort costs of the U.S., which are 1.5% of total output of all businesses, suggests that small businesses are particularly damaging. The Bureau of Justice Statistics reports that for 2001, 31% of all tort trials involved a business defendant (only 3% of tort trials involved a business plaintiff). Litigation can be very costly for businesses; the median final damage awards for tort trials involving business defendants was approximately $75,000 in 2001. In addition, the median length from filing to judgment for tort litigation is 22 months; for product liability cases, the median is 29 months.

2.4 Cross-Section

We now focus on the cross-sectional differences between unincorporated and incorporated entrepreneurs. We find that incorporated entrepreneurs differ significantly from their unincorporated peers in three dimensions: (i) size of their business (ii) accumulated wealth (iii) interest rates on external financing.

In regards to the business operations of incorporated entrepreneurs relative to unincorporated, table 1 provides details on how they differ. Specifically, we look at size by sales, profits, assets, equity, and employment. We see that the single-owner incorporated businesses are considerably larger across all of these measures. In particular, they exhibit higher sales (by a factor of seven), they are 2.6 times as profitable and on average employ three times as many employees as sole-proprietorships. In addition, these businesses have over three times as much assets and twice as much net equity.

Table 1: Firm Characteristics by Legal Form

	UE	IE
Firm Age	15.1	13.6
Sales (000s)	181	1,264
Profits	68	176
Assets	124	438
Equity	87	171
Employees		
–Total	3.0	9.6

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[7]Towers Perrin, a consulting firm, provides estimates of aggregate tort costs for the U.S. in their annual report.

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In addition to operating larger businesses, incorporate entrepreneurs accumulate greater levels of wealth. Table 2 provides the mean net worth and income by legal form of business. Incorporated entrepreneurs have a wealth to income ratio 40% times greater than the unincorporated entrepreneur.

Table 2: Mean Net Worth and Income by Legal Form

	UE	IE
- Net Worth	753	2,741
- Income	91	224
Wealth to Income Ratios		
	UE	IE
- Net Worth/Income	8.29	12.24

Source: SCF 2003

Interestingly unincorporated and incorporated entrepreneurs do not differ significantly in their demographics. Table 3 provides a demographic comparison of the owners. We find that IE are somewhat more likely to have a college degree, whereas experience and age are approximately equal. This suggests that differences within the firm are a consequence of the legal form, rather than specific attributes of the owner.

Table 3: Demographics of Owners by Legal Form

Education		
	U	I
- share with associate degree or higher	0.59	0.62
Experience and Age		
	U	I
- ave. years of experience	19.0	19.5
- ave. age of owners	51.7	50.7

Lastly, we look at the different interest rates that these entrepreneurs face. We find that the unconditional interest rates for incorporated entrepreneurs are lower than for unincorporated. However, if we condition on a characteristics of the firm, loan and owner; we find that incorporated entrepreneurs pay higher interest rates. In particular, the interest rate premium for business loans is 0.40 percentage points, and for credit cards the premium is 0.79 percentage points. Table 4 contains these findings.

Table 4: Interest Rates by Legal Form

	UE	IE
Unconditional Interest Rates	7.0	6.3
	UE	IE
Conditional Interest Rates		
- business loans	-	+0.40 (0.19)
- business credit cards	-	+0.79 (0.23)

The difference in conditional interest rates is found by regressing the interest rate on the most recent loan that the firm received on a host of control variables, and the full regression results can be found in tables 11 and 12. A complete discussion of the control variables that are included is provided in the appendix.

In the model, this interest rate premium will be determined endogenously. In particular, our theory suggests that this interest rate premium paid by incorporated entrepreneurs results from a contraction in the supply of credit associated with incorporation. In a perfectly competitive banking industry, banks make zero expected profits on each loan. The interest rate charged is thus a function of (1) the risk of the entrepreneur defaulting on the loan and (2) the fraction of the loan that the bank can recover upon default. We expect an increase in (1) to be associated with an increase in the interest rate, and just the opposite for (2). Thus, limited liability induces entrepreneurs to default more frequently and reduces the amount of assets the bank can recover in the event of default leading to higher interest rates for incorporated businesses.

On the demand side, the protection provided by limited liability means that at a given interest rate, an entrepreneur will demand a greater amount of debt upon incorporation. Therefore, if we observe a fall in the amount of debt a business has upon incorporation, this provides evidence that supply contracts upon incorporation, supporting our theory. We test for this evidence using panel data on firms from the Kauffmann Firm Survey (KFS).

Formally, we are interested in the estimation of the simultaneous system of supply and demand for debt and the shift effect of incorporation on these two curves. A linear specification of this problem is standard:

$$d_{i,t} = \beta_1 o_{i,t} + \beta_2 r_{i,t} + \beta_3 \pi_{i,t} + \beta_4 A_{i,t} + \beta_5 d_{i,t-1} + \beta \mathbb{X}_i + \epsilon_{i,t} \tag{1}$$

$$r_{i,t} = \alpha_1 o_{i,t} + \alpha_2 d_{i,t} + \alpha_3 \pi_{i,t} + \alpha_4 A_{i,t} + \alpha \mathbb{X}_i + \eta_{i,t} \tag{2}$$

Where d is debt, o is legal status of business, r is interest rate, π is profit, A is assets, X is a vector of observable and unobservable traits that do not change over time, and (ϵ, η) are errors that are uncorrelated with regressors from their equations.

We do not have information on the interest rates in the KFS, and therefore estimating the above model is impossible. However, we are really interested in the sign of β_1. Fortunately, under reasonable assumptions on α_1, α_2, and β_2, specifically that incorporation increases demand and that the supply and demand curves have the "correct" slopes, we can test whether $\beta_1 > 0$ from the reduced form:

$$d_{i,t} = \frac{\beta_1 + \beta_2 \alpha_1}{1 - \beta_2 \alpha_2} o_{i,t} + \tilde{\beta}_3 \pi_{i,t} + \tilde{\beta}_4 A_{i,t} + \beta_5 d_{i,t-1} + \tilde{\beta} \mathbb{X}_i + \nu_{i,t} \tag{3}$$

Where coefficients of form $\tilde{\beta}$ are found via algebra and are uninteresting to us. Now, we still have the issue of unobserved $\mathbb{X}$ variables possibly being correlated with o, so we take differences to get:

$$\Delta d_{i,t} = \frac{\beta_1 + \beta_2 \alpha_1}{1 - \beta_2 \alpha_2} \Delta o_{i,t} + \tilde{\beta}_3 \Delta \pi_{i,t} + \tilde{\beta}_4 \Delta A_{i,t} + \beta_5 \Delta d_{i,t-1} + \Delta \nu_{i,t} \tag{4}$$

So, if we assume that limited liability increases loan demand ($\beta_1 > 0$) as well as downward sloping demand and upward sloping supply curves ($\beta_2 < 0$ and $\alpha_2 > 0$) then an estimate of a negative coefficient on the change in legal status implies an estimate of $\alpha_1 > 0$.

Since we do not have the continuous variables available in the public release of the KFS, we reformulate the model as a discrete choice of whether or not to increase bank debts. We estimate a logit model on the odds of an entrepreneur decreasing their bank debt of the form:

$$\text{odds of } \hat{d}_{i,t+1} \leq \hat{d}_{i,t} = \frac{e^{z_{i,t+1}}}{1 + e^{z_{i,t+1}}}$$

and

$$z_{i,t+1} = \gamma_0 + \gamma_1 \Delta o_{i,t+1} + \gamma_2 \hat{d}_{i,t} + \gamma_3 \hat{A}_{i,t} + \gamma_4 \hat{A}^{\uparrow}_{i,t+1} + \gamma_5 \hat{A}^{\downarrow}_{i,t+1} + \gamma_6 \hat{\pi}_{i,t} + \gamma_7 \hat{\pi}^{\uparrow}_{i,t+1} + \gamma_8 \hat{\pi}^{\downarrow}_{i,t+1}$$

Where hat variables are the categorical versions of their continuous counterparts and superscripted up or down arrows indicate whether or not the variable moved up a category or down a category. For each age, we restrict attention to those entrepreneurs who start that year unincorporated, and so $\Delta o_{i,t+1}$ takes value zero if the business remains unincorporated and value 1 if it becomes incorporated.

We find that incorporating significantly increases the probability that an entrepreneur reduces her level of bank debt between each age of the business. The estimates are in table 2.4.

Estimation Results		
Age	Coeff on Incorp	P-Value
0	1.38	0.9%
1	2.05	0.5%
2	1.26	13.5%

We therefore find evidence in favor of the limited liability default risk theory of incorporation using the publicly available KFS. Estimates indicate that, for each age, incorporation increases the odds of an entrepreneur decreasing or maintaining her bank debt. Furthermore, for the first two years of existence these estimates are significant at the 1% level.

3 Theory

There is a unit measure of households in the economy. In each period households decide whether to operate a risky entrepreneurial project or to inelastically supply their labor to the market. In addition to the households' occupational choice, upon deciding to operate the entrepreneurial project the household must choose the projects legal form, unincorporated or incorporated. The latter requires a one time fix cost and provides limited liability in the case of bankruptcy. Finally, upon realization of idiosyncratic shocks to the entrepreneurial project, the entrepreneur decides whether to unilaterally default on debt obligations.

3.1 Preferences

Households receive utility from consumption and maximize the expected lifetime utility:

$$E_0\{\sum_{t=o}^{\infty} \beta^t u(c_t)\}$$

and discount the future at rate β. The utility function, $u(c_t)$, is assumed to be continuous, strictly concave and satisfy $\lim_{c\to\infty} u'(c) = 0$ and $\lim_{c\to 0} u'(c) = \infty$.

3.2 Endowments

Households are endowed with 1 unit of labor, which they either supply to the market and receive wage, w, or used in their entrepreneurial project. In addition to labor, the household is endowed with an entrepreneurial project, denoted by $z \in \mathbb{Z}$, which governs the average and marginal returns on capital (modeled as Lucas's "span of control") invested in the project as specified below. The project quality, z, follows a first-order Markov process with transition matrix, $\Gamma(z'|z)$.

3.3 Technology

As in Quadrini (2000), we model production in two sectors both producing a homogeneous good. The first sector comprises smaller units of production operated by individual entrepreneurs, which face uninsurable idiosyncratic risk and face individual-specific prices on debt, specifics of these contracts are described below. The second, corporate, sector consists of large firms which can borrow and invest capital at the exogenous interest rate $\bar{r}$. In addition to the financial differences, these two sectors differ in the technologies.

Entrepreneurial Technology

If a household decides to implement their entrepreneurial project, they choose a level of capital input $k > 0$. It is important to note that if a household chooses capital input $k = 0$, then she is considered a worker, receives wage w and is not exposed to any risk associated with operating a business. If the household implements a positive level of capital, then they receive revenue plus undepreciated capital given by:

$$y(z, k, \eta) = z \cdot k^{\nu} + (1 - \delta - \eta)k \qquad 0 < \nu < 1$$

where η is an idiosyncratic capital embodied shock which is unknown at the time of the investment decision. The shock η is independent over time and individuals and has a two parameter cdf $H(\eta)$ with mean μ_{η} and variance σ_{η}^{2}. The specification of the capital shock has the important feature that additional investment in capital does not provide insurance from the downside risk of the business; that is, the entrepreneur can not accumulate her way out of risk. This feature is crucial in matching the cross sectional feature of the data. In a model without investment risk, the largest and wealthiest entrepreneurs can insure themselves against productivity/demand risk and therefore would not value the insurance provided by incorporation, counter to the data. Notice that the technology does not depend on the legal form of the entrepreneur.

Corporate Technology

The technology in the corporate sector is given by a standard constant returns to scale technology:

$$F(K_c, N_c) = K_c^{\alpha} N_c^{1-\alpha}$$

where K_c and N_c are the capital and labor inputs, respectively. Corporate sector capital depreciates deterministically at rate δ.

3.4 Financial Intermediation

The financial intermediation sector consists of a large number of banks that price loans competitively. Households can save, $a \geq 0$, at the exogenous risk free rate $\bar{r}$. The price financial intermediaries charge on debt are individual-specific, as in Chatterjee et al. [2007] and Livshits et al. [2007]. That is, intermediaries can observe the households savings, capital, debt ($S = (a, k, D) \in \mathbb{R}_+^3$), current period project quality and the legal form of the business, $n \in \{U, I\}$.

When an entrepreneur purchases a loan value of D at price $q^n(S, z)$, the bank must borrow $q^n(S, z) \cdot D$ at the risk free interest rate $1 + \bar{r}$. Hence, making such a loan costs the bank $(1 + \bar{r}) \cdot q^n(S, z) \cdot D$. The bank expects to get receipts of D in the event that the entrepreneur does not default, which occurs if $\eta \in \mathbb{B}(S, z)$ which occurs with probability $\Omega^n(S, z)$. If default occurs, which happens with probability

$1 - \Omega^n(S, z)$, then the bank receives liquidation value $\Phi^n(S, z, \eta)$. The zero profit condition for a loan contract indexed by (S, z, n) is therefore:

$$(1 + r) \cdot q^n(S, z) \cdot D = \Omega^n(S, z) \cdot D + (1 - \Omega^n(S, z)) \cdot \mathbb{E}[\Phi^n(S, z, \eta)|\eta \in \mathbb{B}(S, z)]$$

Differences in the interest rates for unincorporated and incorporated entrepreneurs will emerge through two channels, the probability of default, $\Omega^n(S, z)$, and the recoverable amount in bankruptcy. We impose structure on the Φ function in accordance with bankruptcy law and explore the properties that this equation imposes on interest rates below.

3.5 Involuntary Claims on Entrepreneurial Resources

Our specification of η leaves open the interpretation of what happens to the resources when an entrepreneur experiences the shock. Specifically, motivated by the reasons for entrepreneurial default discussed above, we will assume that some fraction λ of this shock is due to damages caused to third parties by the entrepreneur's actions. We model it as a constant amount of damages incurred by each household in the economy, with payments to cover these damages received after financial intermediaries recover resources. The net transfer, which includes incorporation fees, damages and payments, appear in each household's budget constraint as T and will be defined in equilibrium. They will depend on the number of entrepreneurs in the economy, the bankruptcy decisions of the entrepreneurs, and the incorporation rate.

4 Individual Decisions

4.1 Timing

A household enters the period with resources R, historical project quality z, legal form n, and a flag b for whether or not they filed bankruptcy in the previous period. The legal form is held regardless of whether or not the household installs capital, so that the incorporation status is maintained even during periods as a worker. The first decision is then whether or not to operate a business as an entrepreneur, or to be a worker and receive the market wage.

If the household elects to operate a business, then they must decide what legal form to operate under. A previously unincorporated household must pay legal and administrative fees, f, in order to become incorporated, whereas a previously incorporated household can operate as either legal form without incurring these costs. The incorporation decision will determine which pricing function for debt that the household faces.

The household must then decide how to allocate the available resources. An unincorporated entrepreneur chooses between consumption, capital, and personal assets, as well as how much to borrow. Note that, with bankruptcy exemptions as exist in most states, personal assets and debt must be accounted for separately even for unincorporated entrepreneurs. If the entrepreneur is incorporated, then they instead have two distinct choices. On the personal side they choose between consumption, savings, and how much equity to inject into the business. On the business side, they decide how much capital to install, with anything beyond their own equity being financed via debt.

After capital is installed, a new value of z is realized and production occurs. In the process of production the η shock is realized. At this point, given the gross return on capital, the entrepreneur must decide whether or not to file for bankruptcy. For an unincorporated entrepreneur, bankruptcy entails a complete seizure of all business and personal assets up to the exemption level. In addition, they will carry the bankruptcy flag into the next period and be excluded from financial markets, a consequence

Figure 1: Timing
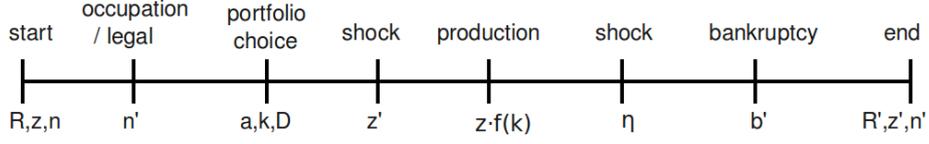
of which is that they have to be a worker for one period. For an incorporated entrepreneur only business assets are seized. They also lose their incorporation status, but they enter the next period without the bankruptcy flag, thereby maintaining access to financial markets.

The timing is illustrated in figure 1:

4.2 Decision Problem

We describe the household decision problems recursively. Consider first the problem of an unincorporated household which filed for bankruptcy in the previous period. The household cannot access financial markets, and so must consume whatever is on hand. They enter the next period with zero resources and a fresh start without the bankruptcy flag:

$$V^U(R, z, 1) = u(R + w + T) + \beta \sum_{z'} \Gamma(z'|z) V^U(0, z', 0)$$

Which brings us to the unincorporated entrepreneur who remained solvent in the previous period. For convenience, we define two intermediate problems conditional upon whether or not the entrepreneur decides to incorporate. If they remain unincorporated, then they face q^U, but in the event of bankruptcy are left with only an exemption level of assets, given by the function $\chi(a)$.

$$\widehat{V}^U(R, z) = \max_{c, S, b(\cdot)} u(c) + \ldots$$

$$\beta \int_{\underline{\eta}}^{\bar{\eta}} \sum_{z'} \left(b(z', \eta) V^U(\chi(a), z', 1) + (1 - b(z', \eta)) V^U(R', z', 0) \right) \Gamma(z'|z) dH(\eta)$$

s.t.

$$R = c + \frac{a}{1 + \bar{r}} - q^U(S, z)D + T$$

$$R' = z'k^\nu + (1 - \delta - \eta)k + a - D$$

If a previously unincorporated entrepreneur incorporates then they pay a fixed cost, face the price function q^I, and keep the entirety of personal assets in bankruptcy.

$$\widehat{V}^I(R, z) = \max_{c, S, b(\cdot)} u(c) + \ldots$$

$$\beta \int_{\underline{\eta}}^{\bar{\eta}} \sum_{z'} \left(b(z', \eta) V^U(a, z', 0) + (1 - b(z', \eta)) V^I(R', z') \right) \Gamma(z'|z) dH(\eta)$$

s.t.

$$R = c + \frac{a}{1 + \bar{r}} - q^I(S, z)D + T + f$$

$$R' = (z')k^\nu + (1 - \delta - \eta)k + a - D$$

13

Using these intermediate value functions allows us to write the final function as the max over remaining unincorporated or incorporating. It is:

$$V^U(R, z, 0) = \max_{n \in \{U, I\}} \widehat{V}^n(R, z)$$

The incorporated entrepreneur has similar intermediate value functions, with the exception that they do not pay the fixed cost f if they choose to remain incorporated. The problems are similar enough that we omit them here.

The value functions have been defined assuming a solution. We now state the proposition that this is a valid assumption, with the proof forthcoming using standard techniques from dynamic programming.

Proposition 4.1. *Given pricing functions and an exemption function χ, there exists a unique couplet of value functions V^U, V^I that solve the above problems. These functions are increasing in R and z, and have the property that $V^I(R, z) \geq V^U(R, z)$ for all (R, z) ($>$ if the support of η is unbounded above). Furthermore, the policies that attain the maximum values of the Bellman equations are compact, upper hemi-continuous correspondences. In addition, if the utility from zero consumption is assumed small enough and $w + T > 0$ then consumption will always be strictly positive, since default is always feasible.*

Full proofs of the existence and uniqueness of the value functions, along with the properties of the policy correspondences, are forthcoming but involve standard dynamic programming techniques. The interesting result in proposition **?** is that it is always better to enter a period incorporated. The reason for this is straight forward. The unincorporated value cannot be strictly higher, because the incorporated entrepreneur can costlessly unincorporate and attain the exact same value. Hence, $V^I \geq V^U$. Suppose instead that the unincorporated entrepreneur would file bankruptcy at this state (such a state is guaranteed by the assumption that η can take arbitrarily high values). If $a = \chi(a)$ then, by also filing, the incorporated attains exactly the same value. If instead $a > \chi(a)$ then the incorporated entrepreneur must be strictly better off. This is because she retains at least as much of her assets (such an a exists by the assumption that $\frac{d\chi}{da} < 1$) and also retains the ability to save. In short, because the incorporated entrepreneur can always at least mimic the unincorporated entrepreneur and faces a more favorable future when filing for bankruptcy, limited liability gives rise to a positive value of incorporation.

5   Equilibrium

We are now ready to define equilibrium given exemption functions χ, $(\Phi^n)_{n \in \{U, I\}}$. For this economy, a stationary recursive competitive equilibrium consists of:

1. Value functions as described in the household problems.

2. Policies:

    - $g_S = (g_a, g_k, g_D) : \mathbb{R} \times \mathbb{Z} \times \{U, I\} \to \mathbb{S} = \{(a, k, D) \in \mathbb{R}_+^3\}$
    - $g_n : \mathbb{R} \times \mathbb{Z} \times \{U, I\} \to \{U, I\}$
    - $g_b : \mathbb{R} \times \{U, I\} \times \mathbb{S} \times \mathbb{Z} \to \{0, 1\}$

3. Solvency function: $\Omega : \mathbb{S} \times \mathbb{Z} \times \{U, I\} \to [0, 1]$

4. Pricing functions: $q : \mathbb{S} \times \mathbb{Z} \times \{U, I\} \to \left[0, \frac{1}{1+r}\right]$

5. A stationary distribution: $\psi : \mathbb{R}_+ \times \mathbb{Z} \times \{U, I\} \times \{0, 1\} \to \mathbb{R}_+ \times \mathbb{Z} \times \{U, I\} \times \{0, 1\}$

6. Net transfers: T

7. Wage: w

8. Labor and capital in corporate sector: N_c, K_c

Equilibrium requires that the policies attain the values of the value functions taking pricing functions and exemptions as given. The solvency function is generated by the bankruptcy policy according to the condition:

$$\Omega^n(S,z) = \int_{\underline{\eta}}^{\bar{\eta}} \sum_{z'} \left(1 - g_b^n(\eta, S, z)\right) \Gamma(z'|z) dH(\eta)$$

Pricing functions must solve the intermediary zero profit condition given the above solvency functions and the recovery functions Φ.

The stationary distribution is intuitive. We must first map the true states, (R, z, n), to the choice of legal form and allocation of resources across business and personal accounts in the current period. The g_S and g_n functions accomplish this. We then have to integrate over η and z' to get the flows into bankruptcy, and then final resources, legal form, and bankruptcy flag at the end of the period.

$$\psi(R', z', n', b') = \int_{R, z, \eta} \sum_{n, b} \mathbb{I}_{\{(R', n', b')' \in g(S, z, \eta, n, b)\}} d\Gamma(z'|z) dH(\eta) \psi(dR, dz, n, b)$$

Using the stationary distribution we can define the components of net transfers. Denoting $\mathbb{E}_\psi$ as the average over the stationary distribution gives:

$$
\begin{aligned}
T_d &= \mathbb{E}_\psi[g_k^n(S, z) \int_{\underline{\eta}}^{\bar{\eta}} \lambda \cdot \eta \, dH(\eta)] \\
T_p &= \mathbb{E}_{\psi, z', \eta}[(1 - g_b^n(\eta, S, z')) \lambda \eta g_k^n(S, z) + \\
&\quad g_b^n(\eta, S, z') \max(0, y(z', k, \eta) + (1 - n)(a - \chi(a)) - \Phi^n(S, z', \eta))] \\
T_f &= \mathbb{E}_\psi[\mathbb{I}_{\{g_n^U(S, z) = I\}}]
\end{aligned}
$$

The formula for T_d just says that if each unit of entrepreneurial capital causes on average $\lambda \times \eta$ units of negligent damages, then the total such damages is the sum of these damages over all entrepreneurs. The formula for the paid damages, T_p, says that if an entrepreneur doesn't file for bankruptcy then she pays the entire damage caused, whereas if she files for bankruptcy then the only payments made are those less than the remaining resources in the business after exemptions and bank's recovery. Lastly, T_f is the amount of fees paid by the unincorporated entrepreneurs who incorporate.

Notice two things about these transfers. First, T_d is increasing in the fraction of entrepreneurs. Second, T_p is decreasing in the incorporation rate, in so far as incorporated entrepreneurs file for bankruptcy more and are able to protect personal savings from seizure.

The corporate sector faces the exogenous risk free rate $\bar{r}$. Hence, $K_c = N_c \left(\frac{\alpha_c A_c}{\delta + \bar{r}}\right)^{\frac{1}{1 - \alpha_c}}$. The labor utilized in the corporate sectors is just the measure of households not operating businesses:

$$N_c = 1 - \mathbb{E}_\psi[\mathbb{I}_{\{g_k^n(S, z) > 0\}}]$$

Thus we can normalize the wage to 1 by choosing A_c correctly. We therefore measure everything in average wage units.

6 Characterization

At this point we do not have a full proof of existence, although we can compute equilibria readily. We believe that we can get a general proof following the strategies in Chatterjee et al. [2007]. Existence boils

down to getting a fixed point for the correspondence that maps the space of cross-sectional distributions and prices into itself. An important obstacle in way of doing so is the discrete choice of whether or not to file for bankruptcy, which can create discontinuities of the stationary distribution with respect to the debt prices.

7 Calibration

7.1 Households

We assume households' period utility function is of the form

$$u(c_t) = \frac{c^{1-\sigma}}{1-\sigma},$$

and assume the risk aversion coefficient σ to be 1.5. We also assume that the discount factor β to be 0.96. These values are taken from Cagetti and De Nardi (2006) and are in the range of those typically used.

For the baseline model, we assume that there are three possible values for project quality, $\{z_0, z_1, z_2\}$ with transition matrix Γ_z. We assume that the lowest project quality is $z_0 = 0$ (i.e. no project). Furthermore, we restrict the transition matrix to be of the following form:

$$\Gamma_z = \begin{bmatrix} \gamma_0 & 1 - \gamma_0 & 0 \\ 1 - \gamma_1 - \gamma_{12} & \gamma_1 & \gamma_{12} \\ 1 - \gamma_2 & 0 & \gamma_2 \end{bmatrix}$$

We make the assumption of three productivity levels to allow for the possibility of positive selection that we observe in the cross-section of unincorporated and incorporated entrepreneurs. We therefore need to have two positive values of the project quality in order to allow for such a phenomenon. We follow Quadrini by assuming the ladder structure of the transition matrix, with the exception that we allow for the lower quality project to fall to zero with some probability. We calibrate these parameters by targeting the cross-sectional differences in output, interest rates and wealth to incomes of unincorporated and incorporated entrepreneurs, as well as aggregate entrepreneur share of output, fraction of entrepreneurs and bankruptcy and incorporation rates.

7.2 Technology

Corporate Technology

The corporate sector is represented by a constant returns to scale technology of the form $F(K, N) = A_c K_c^\alpha N_c^{1-\alpha}$. We set the capital income share parameter α to be .33, and choose A to normalize the wage to 1.

Entrepreneurial Technology

For the entrepreneurial technology, we need to choose the decreasing returns parameter, ν. Cagetti and De Nardi [2006] calibrate the capital income share in a model where entrepreneurial technology uses both capital and labor. However, assuming labor is hired in spot markets, there is a one to one mapping between their parameters. Therefore, we use their calibrated values, and set ν to be 0.708[8].

Lastly, following standard business cycle literature, we set the depreciation rate δ to be 0.068.

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[8]See the appendix for details.

7.3 Financial Intermediation

We will assume that the losses associated with η are covered before debt is repaid to banks. Therefore, the recoverable amount, Φ, is given by

$$\Phi^U(S, z, \eta) = \min\{D, \max\{z \cdot f(k) + (1 - \delta)k - \eta \cdot k + (a - \xi(a)), 0\}\},$$

for unincorporated entrepreneurs, and

$$\Phi^I(S, z, \eta) = \min\{D, \max\{z \cdot f(k) + (1 - \delta)k - \eta \cdot k, 0\}\}$$

for incorporated entrepreneurs. The assumption on the order of payment implies that all risk in the economy will be priced by financial intermediaries.

McGrattan et al. [2000] estimate the average return on capital to be 4%, therefore set the risk-free rate, $\bar{r}$, to be 4%.

7.4 Bankruptcy

The U.S. bankruptcy laws impose the following functional form for the exemption function:

$$\xi(a) = \min\{\xi, a\}.$$

Following Meh and Terajima [2008], we use a weighted average of state homestead and personal bankruptcy exemptions to calibrate the the exemption level ξ. To calibrate the fixed cost of incorporation, f, we target the fraction of incorporated entrepreneurs, 3.1%.

7.5 Business Shocks

For calibration, we will interpret the capital shocks as disasters in which the capital is lost. We will restrict the distribution to have support $\{0, \bar{\eta}\}$; therefore, we have two parameters to calibrate, $\bar{\eta}$, the severity of the disaster and, p_η, the probability of a disaster occurring. In addition, since the capital is destroyed, we will assume $\lambda = 0$ and there will be no transfers associated with the capital shocks. We target the bankruptcy rate of entrepreneurs and the fraction of bankruptcies resulting from disaster reported by Dunn and Bradstreet.

7.6 Benchmark Results

Table 7 present the current calibration of the model. While the fit is currently being improved, the current calibration captures many of the features in the data. In particular, the positive selection of higher productivity entrepreneurs into incorporation. In the benchmark model, incorporated entrepreneurs have larger businesses and accumulate greater wealth. In addition, table 8 shows the unconditional interest rates in the benchmark model. The unconditional interest rate for incorporated entrepreneurs, which we did not target in the calibration, is lower than the unincorporated, as it is in the data.

Table 5: Calibrated Parameters

Parameters		Values
Fixed Parameters		
σ	relative risk aversion	2.0
β	discount rate	0.96
α	capital income share (corporate)	0.33
ν	returns to scale (entrepreneur)	0.71
δ	depreciation rate	0.068
$\bar{r}$	risk free rate	0.04
ξ	bankruptcy exemption	0.15
Calibrated Parameters		
z_1	project scale	0.34
z_2	project scale	0.45
γ_0	persistence of no project, z_0	0.989
γ_1	persistence of z_1	0.969
γ_{12}	$\Gamma(z_2|z_1)$	0.02
γ_2	persistence of z_2	0.99
f	fixed cost of incorporation	3.35
p_η	probability of $\bar{\eta}$	0.01
$\bar{\eta}$	capital shock	1.00

Table 6: Targeted Moments

Moment	Values
Cross-Sectional Moments	
Wealth to Incomes	
Unincorporated	8.30
Incorporated	12.20
Ratio of IE to UE Output	6.98
Unconditional Interest Rate	
Unincorporated	7.00
Aggregate Moments	
Fraction of Entrepreneurs	0.083
Fraction of Incorporated Entrepreneurs	0.031
Entrepreneur Share of Output	0.180
Entrepreneur Bankruptcy Rate	0.023
Incorporation Rate	0.01
Bankruptcies due to Disaster	0.063

8 Investment Risk and Consumption

We use the model to measure the importance of the investment risk and the value of incorporation to the entrepreneurs. We do this by following Lucas [1987] and Storesletten et al. [2001], and measure the risk and value of incorporation by comparing the welfare across alternative economies.

How much investment risk?

Consider two economies, one in which the entrepreneur faces both the output risk from movements in z and the investment risk, η; and the the other an economy in which the entrepreneur faces only the output risk from z. In both economies, the entrepreneurs has the option to incorporate their business. We calculate the annual % increase in consumption required to make an entrepreneur indifferent between

Table 7: Baseline Economy

Moment	Data	Model
Cross-Sectional Moments		
Wealth to Incomes		
Unincorporated	8.30	6.33
Incorporated	12.20	12.41
Ratio of IE to UE Output	6.98	4.14
Unconditional Interest Rate		
Unincorporated	7.00	7.31
Aggregate Moments		
Fraction of Entrepreneurs	0.083	0.089
Fraction of Incorporated Entrepreneurs	0.031	0.022
Entrepreneur Share of Output	0.180	0.325
Entrepreneur Bankruptcy Rate	0.023	0.005
Incorporation Rate	0.009	0.010
Bankruptcies due to Disaster	0.063	0.043

Table 8: Interest Rates by Legal Form

	UE	IE
Unconditional Interest Rates	7.3	7.2

starting her business in the presence of the investment risk and in a world with none. Let $V_{\text{start-up}}(\cdot)$ denote the value function for an individual enters the period as a worker and installs capital for the following period (i.e. becomes an entrepreneur this period). Furthermore, let $V_{\text{start-up}}^{\eta}(\cdot)$ denote the start-up value in the economy with the investment risk, η, and $V_{\text{start-up}}^{0}(\cdot)$, the start-up value in the economy with no investment risk. We compute the necessary adjustment to consumption in the economy with the investment risk, ρ, which equates the average utility in the two economies:

$$\mathbb{E}_{\psi}[(V_{\text{start-up}}^{\eta}(R,z) - V_{\text{start-up}}^{0}(R,z))\mathbb{I}_{\{g_k^n(S,z)>0|k=0\}}] = 0$$

Note that an individual who would start a business in the economy with investment risk, would also do so in the economy without investment risk. Therefore, we average over the stationary distribution in the economy with investment risk. We find that that the entrepreneur would require an additional 5.9% of consumption annually in order to make her indifferent. This suggests that investment risk is a large source of risk for entrepreneurs. Using 2003 U.S. per capita consumption, in absolute terms, 5.6% of consumption is approximately $1,600$ per year. In comparison, Lucas [1987] finds that the welfare gains from eliminating business cycles amounts to less than a fraction of a percent of consumption annually. Similarly, Storesletten et al. [2001] consider the welfare gains from eliminating idiosyncratic labor income risk and find that the necessary adjustment to consumption is 1.17% annually.

How much insurance is provided by limited liability?

We perform a similar exercise to measure the value of limited liability to entrepreneurs. Consider two economies, one in which the entrepreneur has the option to incorporate her business, and in the other economy, the entrepreneur can not incorporate. In both economies, the entrepreneur faces the output and investment risks. We again focus on the start-up value of a business for new entrepreneurs. We compute the annual consumption an entrepreneur would demand at start-up in response to eliminating the ability

to incorporate. Since more individuals start businesses in the economy where they can incorporate, we average over the stationary distribution of the economy *without* incorporation. Thus, our calculation ignores the extensive margin associated with allowing for incorporation, and is a lower bound on the consumption equivalent value of limited liability. We find the required additional annually consumption from eliminating incorporation to be 0.81%.

9 Policy

We use the model to conduct two policy experiments that are relevant to many actual legal changes made in the last twenty years. We first ask what happens when incorporation becomes cheaper. Since the only form of incorporation in our model has pass-through income, this resembles the introduction of recent legal forms such as Limited Liability Corporations, as well as bestowing more and more benefits to S-Corporations that were once reserved for C-Corporations. In particular, we reduce the fixed costs by 50% and find that this reduction increase aggregate income of 0.5%, but also increases income and wealth inequality. However, we find that the fraction of entrepreneurs does not change very much. We believe that this is a result of the coarseness of our grid when solving the model. The effects of lowering the fixed costs are in Table 9.

Table 9: 50% Reduction in Fixed Costs

Moment	Baseline	Lower f
Cross-Sectional Moments		
Wealth to Incomes		
Unincorporated	3.85	1.71
Incorporated	7.12	6.67
Ratio of IE to UE Output	2.52	2.04
Unconditional Interest Rate		
Unincorporated	14.53	14.75
Aggregate Moments		
Fraction of Entrepreneurs	0.159	0.159
Fraction of Incorporated Entrepreneurs	0.081	0.108
Entrepreneur Share of Output	0.263	0.265
Entrepreneur Bankruptcy Rate	0.089	0.100
Incorporation Rate	0.05	0.13
Uninsured Tort Costs (Share of Entrepreneur Output)	0.015	0.015

A similar exercise, which has been the focus of previous papers on entrepreneurship and default (Athreya et al. [2009], Meh and Terajima [2008]), explores the effects of changing personal bankruptcy exemptions. Since in our model an entrepreneur can attain full exemptions by incorporating, we find that changing personal exemptions has a much smaller impact than either of these previous studies. We find that doubling the exemption level decreases aggregate income by .1%; again we believe these results to be sensitive to the coarseness of our grid. The effects of lowering the fixed costs are in Table 10.

It is important to note that our model gives indeterminant welfare conclusions with respect to these policies. This is because some fraction of the expenditure shocks are modeled as damages to third parties, and entrepreneurs are absolved of reimbursing these expenses in bankruptcy. Furthermore, while lenders will price their expected losses due to bankruptcy, damages due to negligence will still not be internalized. This is because secured creditors are paid first in bankruptcy proceedings.

Because entrepreneurs can generate large expenses to third parties (in 2003, 6% of total entrepreneurial output, one third of which was uninsured). This creates a trade-off for society. On one hand, the the in-

Table 10: Doubling of Exemption Levels

Moment	Baseline	Double ξ
Cross-Sectional Moments		
Wealth to Incomes		
Unincorporated	3.85	4.48
Incorporated	7.12	6.35
Ratio of IE to UE Output	2.52	2.58
Unconditional Interest Rate		
Unincorporated	14.53	15.06
Aggregate Moments		
Fraction of Entrepreneurs	0.159	0.159
Fraction of Incorporated Entrepreneurs	0.081	0.084
Entrepreneur Share of Output	0.263	0.263
Entrepreneur Bankruptcy Rate	0.089	0.087
Incorporation Rate	0.05	0.06
Uninsured Tort Costs (Share of Entrepreneur Output)	0.015	0.015

surance provided by incorporation encourages entrepreneurial activity, which has high marginal product. On the other hand, limited liability also enables these entrepreneurs to avoid accountability. Because the average net damages to each household depends on the number of entrepreneurs, as well as their incorporation status and level of exemptions, we find a non-monotonic relationship between welfare and entrepreneurship rates.

10 Conclusion

In this paper, we embed the U.S. bankruptcy and incorporation legal systems in a quantitative macroeconomic theory of occupational, incorporation, and default choices that accounts for the cross-sectional facts. In the model, as in the U.S., incorporation provides insurance via limited liability beyond personal bankruptcy exemptions, at the expense of administrative burdens and an endogenous interest rate premium. We discipline the model using cross-sectional differences by legal form and several aggregate moments of the U.S. economy. The model is able to capture all of these features. In addition, our model suggests that capital shocks are important entrepreneurial risks.

We use the model to conduct two policy experiments that are relevant to many actual legal changes made in the last twenty years: (i) A reduction in the costs of incorporation, meant to capture the introduction of recent legal forms such as Limited Liability Corporations, as well as bestowing more and more benefits to S-Corporations that were once reserved for C-Corporations. (ii) Increasing the personal bankruptcy exemption levels. We find that reductions in the cost of incorporation increase aggregate income by 0.5%, but also increases income and wealth inequality. In regards to the second policy, we find that doubling the exemption level decreases aggregate income by .1%.

Lastly, by studying the decision of an entrepreneur to incorporate their business, this paper contributes towards developing a theory that can bridge the entrepreneurial and corporate sectors; and allow us to better understand and study the process in which individuals start businesses and how some of those businesses subsequently transition to the corporate sector. Furthermore, a deeper theory of these extensive margins will allow for more comprehensive answers to questions regarding firm entry and exit; in particular, questions regarding financial markets and tax policies; for example, changes to the personal and/or corporate tax structures will influence the decision of individuals to move between the different legal forms, and therefore the environments in which these businesses operate.

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11 Appendix

11.1 Mapping $f(z, k, n)$ to $F(z, k) = f(z, k, n^*(z, k))$

We want to use an entrepreneurial technology without labor, but use parameters from Cagetti and De Nardi [2006]. This can be seen as a shortcut, since if labor is hired in spot markets then it is easy to solve for the optimal level of labor demand and substitute out, making a new production function that depends only on capital. The only thing that needs to change is the labor market clearing condition. However, care must be taken when using previous calibrated parameters for the scale of production, since profits and optimal levels of capital are extremely sensitive to this parameter.

They use a production function of the form: $y = f(z, k, n) = z(n^\theta k^{1-\theta})^\nu$. Thus profits are given by $\pi(z, k, n) = f(z, k, n) - (r + \delta)k - wn$. Take the first order condition wrt labor to get that $n^*(z, k) = \left(\frac{z\nu\theta k^{\nu(1-\theta)}}{w}\right)^{\frac{1}{1-\nu\theta}}$. Substituting this into the production function gives $\pi(z, k, n^*(z, k)) = \tilde{z}k^\alpha - (r + \delta)k$, where the transformed variables take the values $\tilde{z} = (1 - \nu\theta)\left(\frac{\nu\theta}{w}\right)^{\frac{\nu\theta}{1-\nu\theta}} z^{\frac{1}{1-\nu\theta}}$ and $\alpha = \frac{\nu(1-\theta)}{1-\nu\theta}$.

Cagetti and De Nardi use $\nu = 0.88$ and $\theta = 0.67$. Using their calibration in a model without capital would imply a value of $\nu = \frac{0.88(1-0.67)}{1-0.67 \times 0.88} = 0.708$, which is what we use.

11.2 Interest Rate Regressions

A preview of the theoretical loan supply schedule is useful for understanding why each control variable was included. In a perfectly competitive banking industry, banks make zero profits on each loan. The interest rate charged is thus a function of (1) the risk of the entrepreneur defaulting on the loan and (2) the fraction of the loan that the bank can recover upon default. We expect an increase in (1) to be associated with an increase in the interest rate, and just the opposite for (2). We explore what variables would affect these two items and whether or not the correlations uncovered by our regressions confirm these expectations. We emphasize that these regressions are not meant to be structural in nature, but rather descriptive of what happens to the equilibrium interest rate when keeping quantity constant and changing factors that would shift supply or demand.

We first include proxies of the business's current productivity or demand. Higher levels of either should decrease (1) and increase (2) since the levels of these variables at the time the loan comes due are likely positively correlated with their levels at the time the loan is made. These considerations lead us to include sales, whether the owner went to college, and the age of the firm as controls. We find that each is associated with a decrease in interest rates, as we would expect, but that the coefficient on sales is not significantly different from zero in neither magnitude or the statistical sense.

While we do not model reputation directly, we think it is important to include proxies for such a variable in light of (1). We therefore include the length of the relationship between the entrepreneur and the lending bank, the entrepreneur's credit score, and whether or not the owner/business has made late payments or filed bankruptcy in the last three years. The regression supports our expectations of negative coefficients on relationship length and credit score and a positive coefficient for payment delinquency. Bankruptcy could theoretically have either a positive or negative sign, but turns out to be positive, which echoes previous studies by Berkowitz and White [2004].

We also include controls that directly affect how much the bank could recover in the event of bankruptcy. These include whether or not the entrepreneur owns a home as well as whether a guarantee or collateral were provided by the entrepreneur. We would expect each of these to have a negative coefficient, which is confirmed strongly in both magnitudes and statistical significance.

Finally, we include many things that we do not try to model but are likely to affect both (1) and (2). These include industry and location variables, aspects of the loan contract such as whether or not it is

fixed or variable rate, and a measure of how competitive the banking industry is in the city in which the loan originated. Clearly industry and urbanicity are likely to affect the liquidation value of the firm, as well as the variance of demand and technology shocks. It is also clear that variable interest rate loans should have lower rates than fixed rates whenever there is inflation risk. We include the measure of competitiveness because we model markets as competitive out of convenience, not faith. Interestingly, a more competitive banking sector is associated with nearly a full interest point reduction, which suggests that introducing monopolistic competition to models of default may be fruitful in future work.

Table 11: Estimation results : Regression of Business Loan Interest Rate on Observables

Variable	Coefficient	(Std. Err.)
Incorporation	0.398	(0.190)
log(sales)	-0.007	(0.078)
log(capital)	-0.021	(0.044)
log(employment)	-0.337	(0.091)
length of relationship with bank	-0.164	(0.056)
Loan Type (Line of Credit)	0.899	(0.161)
In Person	-0.429	(0.144)
Guarantee	-0.618	(0.141)
Collateral	-0.677	(0.143)
Fixed Maturity	-1.779	(0.341)
Fixed Interest Rate	1.249	(0.145)
Age of Owner	-0.022	(0.008)
College Education	-0.317	(0.141)
Homeowner	-1.868	(0.373)
D&B Credit Score	-0.141	(0.177)
Bankruptcy	0.109	(0.411)
Late Payment	0.987	(0.239)
Herfindahl-Hirschman Index	-0.934	(0.171)
Urban Area	0.086	(0.174)
Industry - Mining	-1.769	(0.305)
Industry - Construction	-0.967	(0.283)
Industry - Manufacturing	-0.092	(0.232)
Industry - Trans./Utilities	0.907	(0.319)
Industry - Wholesale Trade	-0.490	(0.289)
Industry - Retail Trade	-0.427	(0.216)
Industry - Finance/Insurance/RealEst	-1.332	(0.246)
Intercept*	12.578	(1.389)

*The baseline industry is services.

Table 12: Estimation results : Regression of Business Credit Card Interest Rate on Observables

Variable	Coefficient	(Std. Err.)
Incorporation	0.738	(0.230)
log(sales)	-0.253	(0.095)
log(capital)	-0.105	(0.068)
log(employment)	0.334	(0.129)
Monthly Charges	-0.008	(0.002)
Rolling Balance	0.152	(0.079)
Pay Balance	-0.390	(0.243)
Age of Owner	-0.015	(0.010)
College Education	0.253	(0.193)
Homeowner	-0.975	(0.287)
Urban Area	-1.142	(0.254)
D&B Credit Score	-0.182	(0.254)
Bankruptcy	1.435	(0.431)
Late Payment	3.513	(0.414)
Industry - Mining	-1.181	(0.343)
Industry - Construction	1.294	(0.345)
Industry - Manufacturing	-0.597	(0.388)
Industry - Trans./Utilities	0.411	(0.450)
Industry - Wholesale Trade	0.586	(0.368)
Industry - Retail Trade	0.398	(0.276)
Industry - Finance/Insurance/RealEst	0.145	(0.359)
Intercept*	17.427	(1.238)

*The baseline industry is services.