Decline in Entrepreneurship: A Tale of Two Types of Entrepreneurs

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Abstract

Entrepreneurship in the United States has declined in recent decades. Using household survey data, I show that this decline is driven by the falling share of unincorporated self-employment (i.e., sole proprietorships and partnerships), while the share of incorporated self-employment (i.e., S and C corporations) has risen. This pattern is robust across demographic characteristics and data sources. To understand these trends, I build a general-equilibrium heterogeneous-agent model with occupational choices and two types of self-employment. To investigate the source of the aggregate trends in entrepreneurship, I conduct counterfactual experiments. I evaluate two potential factors observed in the data over the same period: (i) an investment-specific technological change and (ii) a decline in tax progressivity. The results show that the main driver of declining entrepreneurship is technological change, whereas the decline in tax progressivity played a minor role.

Keywords: Entrepreneurship, Self-employment, Incorporation, Occupational Choice
JEL codes: J24, L26, O33.

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1 Introduction

The share of self-employed workers in the United States has declined by about 20% during the recent four decades (Figure 1a).[1] This trend aligns with other indicators, such as the decline in the employment share by small firms and firm entry rates (Decker et al., 2014; Pugsley and Șahin, 2019), to support the notion of an entrepreneurial decline. Given the recognized role of entrepreneurship on economic growth and job creation (Audretsch et al., 2006; Haltiwanger et al., 2013), understanding the features of the entrepreneurial decline is of first-order importance for scholars and policymakers alike. This paper focuses on the decline from the point-of-view of the worker's decision to be self-employed in their primary job.[2]

In this paper, I first document that the decrease in entrepreneurship is driven by the falling share of unincorporated entrepreneurship (i.e., sole proprietorships and partnerships). In contrast, the share of incorporated entrepreneurship (i.e., S and C Corporations) has risen (see Figure 1b). Then, this paper studies how workers choose these two types of entrepreneurship and quantitatively evaluates two potential drivers of the secular decline in entrepreneurship by building a heterogeneous-agent dynamic general equilibrium model.

The divergent trends in Figure 1b are informative as the incorporation status is an important characteristic of businesses. The incorporation status pertains to the legal form of organization (LFO) of entrepreneurs' businesses. Although corporations are the most complex and costly forms of organization, they offer entrepreneurs advantages such as the highest personal liability protection and a separate legal identity, which, among other features, makes it easier for them to raise capital.

The incorporation status can be used as a proxy to identify two types of entrepreneurs. On the one hand, the benefits of corporations make them particularly attractive for entrepreneurs looking to undertake large, risky investments. On the other hand, although the LFO can change across a firm's life cycle, the empirical evidence shows that owners typically keep the choice made at the start-up moment.[3] Thus, their choice reflects unobserved aspirations and expecta-

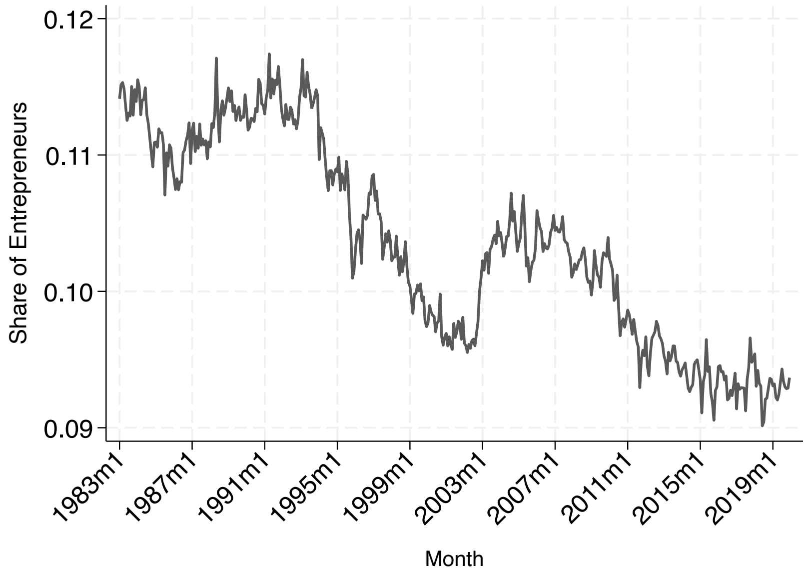
[1] This fact is based on workers' self-classification of their occupational status for their main job on the Current Population Survey, 1983-2019.

[2] Self-employment is a fundamental prerequisite for entrepreneurship (Glaeser et al., 2010) and I will use the terms interchangeably throughout the paper.

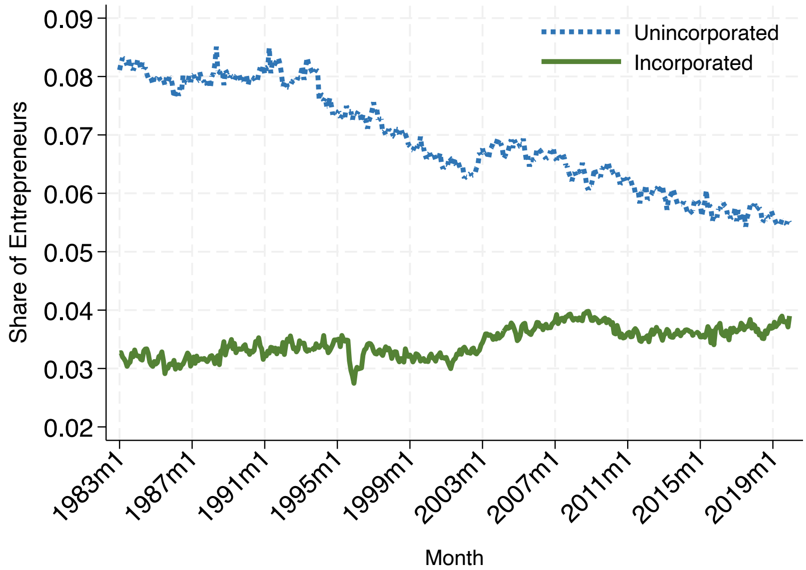
[3] Levine and Rubinstein (2017) study self-employment spells in the NLYS79 panel and find that, among those

Figure 1: Entrepreneurship Rate and Incorporation Status, 1983-2019.

(a) Entrepreneurship Rate



(b) Entrepreneurship Rate, by Incorporation



Source: Own calculations using monthly data from the Current Population Survey, 1983-2019.
Notes: Panel (a) plots the share of entrepreneurs (self-employed workers in their main job) in the sample of civilian non-farm workers aged 16 year or older. Panel (b) plots the same shares by incorporation status of the entrepreneur's business. All series were seasonally adjusted using the X-13ARIMA-SEATS Seasonal Adjustment Program.

tions of entrepreneurs rather than ex-post performance. Indeed, several papers have argued that incorporated self-employment serves as a desirable identifier of people commonly called "entrepreneurs" in popular writings, defined as highly skilled individuals taking risks in exchange for profit, compared to overall self-employment (see e.g., Fossen, 2021; Lazear, 2004; Levine and Rubinstein, 2017).

I document that incorporated entrepreneurs are considerably more likely to hire workers in both the extensive and intensive margins and are more likely to need and use startup capital. This evidence supports the view that the incorporation status effectively distinguishes between two different entrepreneurial activities.

On one end of entrepreneurship, many workers resort to self-employment as a low-scale operation, working by themselves in occupations with low entry costs and depending mainly on their human capital. They might earn more than if they were employees or might accept even lower earnings in exchange for enjoying the non-pecuniary benefits of self-employment (Hurst and Pugsley, 2011). Still, the idea is that their business is not organized for growth or to employ others. The flexibility and low cost of unincorporated LFOs better accommodate the needs of this type of entrepreneur. Conversely, other self-employed workers efficiently assemble human capital—not only theirs— and physical resources. The more complex corporations better serve these employer, growth-oriented businesses.

To study workers' occupational choice between the paid sector and these two types of entrepreneurship, I build a general equilibrium model with occupational choice along the lines of Lucas (1978) span-of-control model. Workers are heterogeneous in their productivity in the paid and entrepreneurial sectors, which are idiosyncratic, and each period choose one of three occupations: worker in the paid sector, unincorporated or incorporated entrepreneur. As their worker and entrepreneurial productivity are idiosyncratic, the model endogenously generates transitions between the three occupations. In addition to the static occupational choice, workers have the dynamic consumption-saving decision, generating an endogenous wealth distribution each period.

who started a spell as incorporated (unincorporated) self-employed, only 85% (2%) started being unincorporated (incorporated). Cole and Sokolyk (2018) find that less than 10% of the firms in the Kauffman Firm Survey change LFO during the first seven years of existence.

The unincorporated entrepreneurs are all solo workers whose business income depends solely on their human capital (entrepreneurial productivity). They also do not face any entry or fixed cost of setting up their firm. In contrast, the entrepreneur in the incorporated sector combines production factors such as hired labor and physical capital along with their entrepreneurial productivity. They also face fixed costs that represent the complexity of corporations and are collateral-constrained to rent capital. Thus, the wealth distribution will influence occupational choices in equilibrium as incorporated entrepreneurship is potentially constrained by workers' wealth.

I calibrate the model to match key features of the U.S. data in the mid-1980s, including the share of the unincorporated and incorporated entrepreneurship and focus on the steady-state equilibrium. I study the occupational sorting of workers in terms of productivity and wealth, which are the model's state variables, thus the occupational choice's main determinants. The model reproduces the positive entrepreneurial ability sorting to entrepreneurship typical of models of entrepreneurial choice (Cagetti and De Nardi, 2006; Lucas, 1978; Salgado, 2020). Workers with mid-level entrepreneurial ability sort into the unincorporated sector, and there is a strong negative relation between labor productivity and being an unincorporated entrepreneur. Workers with the highest entrepreneurial ability levels will sort into the incorporated sector, but the relation with labor productivity is not as strong as for the unincorporated sector. Indeed, the likelihood of being an incorporated entrepreneur is the highest for the most productive in the paid and entrepreneurial sectors.

I use the model to quantitatively assess the impact of two changes observed in the economy over this period in explaining the heterogeneous trends in entrepreneurship. The first is the investment-specific technological change (ISTC)— the development of new types of capital equipment and improvement of the quality of investment goods, particularly in the information and communications sectors. The ISTC benefits the productive sectors that are more capital-intensive. The literature has shown different types of technological change positively affecting wages in equilibrium (Jiang and Sohail, 2023; Salgado, 2020); thus, the paid sector becomes more attractive for workers. However, this technological change could increase profits in the entrepreneurial sector so long the entrepreneurs can take advantage of that technological progress.

The second change I implement in the model is a decline in tax progressivity. It can potentially affect the entrepreneurship rates as it can change the households' asset accumulation.

By comparing the model economy after the ISTC and lower tax progressivity in steady-state with the baseline economy, I find that the model predicts a larger decline in both entrepreneurship rates. However, the model predicts almost 100% of the change observed in the composition of the entrepreneurs by incorporation status. As the model predicts that the decrease in the unincorporated rate is more substantial than the decrease in the incorporated rate, the increase in the share of incorporated entrepreneurs is captured virtually perfectly by the model. Using counterfactual scenarios where I compare the model predictions about the effect of the ISTC and tax progressivity decline in isolation, I find that the former is the most important in explaining the shift towards incorporation observed during this period. The ISTC explains between 70% and 100% of the increase in the share of incorporation among the entrepreneurs. On the contrary, the tax progressivity alone would have slightly increased the unincorporated sector.

Related literature. This paper contributes to the growing literature that documents the decline in business dynamism and entrepreneurship in the United States. A large portion of this literature uses firm dynamics data and documents secular declining trends in firm entry rates, job reallocation, and employment share by small and young firms that are pervasive and persistent (see e.g., Decker et al., 2014; Pugsley and Şahin, 2019; Decker et al., 2016). More recent and closer to my paper are Jiang and Sohail (2023); Salgado (2020) and Kozeniauskas (2022), who use household survey data to study workers' entrepreneurship rates. I contribute to this literature by providing new evidence on the decline in the entrepreneurship rate by incorporation status.

My paper shows that the characteristics of firms, such as their incorporation status, are important to understanding the broader dynamics of entrepreneurship, potentially influencing the definition of the trend. If incorporated entrepreneurship is a better proxy for entrepreneurship, my results show that there has not been a decline in entrepreneurial activity. This interpretation would coincide with Guzman and Stern (2020) results that show that, although the quantity of newly registered firms has decreased, a quality-adjusted measure has a more cyclical, increasing trend.

Several factors have been raised as potential explanations for the entrepreneurial decline in the United States. One set of papers highlights the effect of demographic change on declining dynamism and entrepreneurship. Hopenhayn et al. (2022) and Karahan et al. (2019) provide quantitative evidence for the effect of declining population growth; others focus on the effect of changes in the age composition of the population through different mechanisms (Bornstein, 2021; Engbom, 2019; Liang, James et al., 2018). Akcigit and Ates (2021) argue that the decline in knowledge diffusion between frontier and laggard firms can jointly explain several macroeconomic trends, including the decrease in firm entry. At the same time, others have highlighted the role of different types of technological change, such as skill-neutral or skill-based technological change (SBTC) (Jiang and Sohail, 2023; Salgado, 2020; Kozeniauskas, 2022), entry costs (Kozeniauskas, 2022), and investment-specific technological change (Salgado, 2020). I contribute to this literature by providing evidence that the investment-specific technological change contributed not only to the overall decline but that it also contributed to changing the composition of small businesses by improving the perspectives of businesses that use capital and by showing that the effect of the decline in tax progressivity was not important. Neira and Singhania (2022) evaluate the effect of the decline in corporate taxes and find small effects.

The model builds on previous quantitative macro models of entrepreneurial choice (for instance, Buera and Shin (2011); Cagetti and De Nardi (2006); Quadrini (2000)). Within this literature, papers have modeled the entrepreneurial choice including two types of entrepreneurship (De Paula and Scheinkman, 2011; Gollin, 2008; Salas-Fumás et al., 2014), the incorporation decision—focusing on the limited liability differences (Alp, 2020; Glover and Short, 2011; Herranz et al., 2017); or the choice between different LFOs (Chen et al., 2018; Dyrda and Pugsley, 2018; Bilicka and Raei, 2023). This paper is the first to study the entrepreneurial decline of the last four decades from the perspective of two types of entrepreneurship, identified in the data with the incorporation status.

Finally, this paper is motivated by the literature that recognizes that entrepreneurs are not a homogeneous group, but different categorizations of them will contribute to a better understanding of their characteristics, outcomes, and policy needs (Aulet and Murray, 2013; Botelho et al., 2021). Conceptual separations, for instance, between the "entrepreneurs" and "other self-employed" or between "subsistence" and "transformational" entrepreneurship, have helped to understand why there seems to be a U-shaped relationship between ability and self-employment (Levine and Rubinstein, 2020; Poschke, 2013), or to understand cross-country differences in the outcomes of entrepreneurs (Schoar, 2010), or the relation between self-employment and the business cycle (Fairlie and Fossen, 2018). In this paper, I show that it also sheds light on potential explanations for the entrepreneurial decline.

An outline of the paper is as follows. Section 2 presents the data, definitions, and empirical findings. Section 3 details the model used for the quantitative exercise, and Section 4 details the calibration strategy. Section 5 describes the results of the quantitative analysis, and Section 6 concludes. Additional details about the data, figures, and details about the quantitative section are in the Appendix.

2 Empirical Evidence

After briefly describing the data, this section presents two sets of empirical evidence that inform the structural modeling choice in Section 3.[4] First, I document that the stylized fact in Figure 1 that the unincorporated sector drives the entrepreneurial decline is a robust feature of the US data. Second, differences in characteristics by incorporation status and, in particular, heterogeneity in the need for capital shed light on potential explanations of this decline.

2.1 Data sources

The CPS Data. To study the aggregate trends in entrepreneurship by incorporation status, I use the Current Population Survey (CPS), the primary source of labor force statistics in the United States. The sample consists of civilian non-farm workers aged 16 years or older.

I use survey responses to the following questions to identify entrepreneurship and incorporation status. First, workers are asked whether they were employed by the government, a private company, a non-profit organization, or self-employed. I identify entrepreneurs as those

[4] Appendix A provides additional details about the data sources used in this section.

who report themselves as self-employed. Second, self-employed workers are asked whether their business is incorporated, which directly measures the business incorporation status. The sample period of my analysis starts in 1983, as it is the first year the question about incorporation is available. The sample ends in 2019, as the COVID-19 pandemic brought enormous disruptions and new shocks to the labor market that are beyond the scope of this paper.

Workers who have multiple jobs are classified based on the job in which they worked the most hours (the main job); this is because I intend to exclude entrepreneurial efforts that are not the worker's main economic activity, such as secondary or side jobs, and business ownership where worker's predominant labor is not invested. The detail is important as it goes in line with the labor supply assumptions of my model where agents work in one type of job and business owners work in the firm they own. The focus on the main job also helps to reconcile the aggregate trends I document with seemingly at-odds evidence, using tax-based data, that self-employment has been on the rise (see e.g., Abraham et al., 2021; Collins et al., 2019).[5]

The SIPP Data. The Survey of Income and Program Participation (SIPP) provides information about the size and value of the businesses owned by self-employed workers, which the CPS lacks. I use the third wave of the 2004 panel, which is one wave where business module questions were asked. The sample corresponds to civilian nonfarm workers aged 16 years or older. The SIPP asks labor force questions such as the usual weekly work hours for up to two jobs (for an employer) and up to two businesses. I classify workers according to the activity where they worked the most hours and had the highest income (in case of a tie); thus, with the SIPP I focus only on the businesses that are worker's main job, as with the CPS sample.

The SBO Data. The Survey of Business Owners (SBO) samples around two million nonfarm businesses filing taxes as sole proprietorships, partnerships, or corporations with receipts of $1,000 or more; thus, it covers all the legal entities I am interested in. Although the incorpo-

[5]For instance, Collins et al. (2019) find that the rise in online platform work, which could be classified as self-employment by tax-based measures, is driven by jobs that are secondary and supplemental sources of income. Abraham et al. (2021), who document an increasing discrepancy between the number of workers who are not reported as self-employed in the CPS-ASEC but have self-employment income in tax records, find that around half of the increasing discrepancy is explained by those whose self-employment income is from a secondary job. Based on this evidence, I suspect the disagreement between the two sources is lower for the main job. However, the issue of the discrepancy needs to be taken with caution. Garin et al. (2022) find that the increase in taxpayer-reported self-employment income can be accounted for significantly by pure strategic reporting behavior rather than accurate labor supply responses, raising a cautionary tale about measuring labor market trends with tax-based administrative data.

ration status variable is not available in the SBO, I use the SBO to provide indirect evidence of the use of capital by business incorporation status, as explained in Section 2.3. To get closer to my sample of businesses covered in the CPS, I focus on the businesses in the SBO that are the primary source of income for at least one of the business owners or where at least one owner works full-time in the business. The SBO asks those questions to up to four owners; 67% and 27% of the businesses have one and two owners, respectively. This sample selection leaves me with 51% of the businesses with valid responses in the SBO.

2.2 The decline in entrepreneurship is driven by the unincorporated sector

While the decline in the U.S. self-employment rate since the 1980s has been widely documented (see e.g., Jiang and Sohail, 2023; Kozeniauskas, 2022; Salgado, 2020), Figure 1b shows a new finding: this decline is driven by unincorporated self-employment. Between 1983 and 2019, the self-employment rate declined by 2.1 pp, with a 2.7 pp decline in unincorporated self-employment, partially offset by a small increase in the incorporated self-employment rate. This heterogeneous decline by incorporation status means that 77% of the increase in the absolute number of entrepreneurs implied by the CPS over this period, around 4.1 million entrepreneurs, are entrepreneurs with incorporated businesses.[6] Although unincorporated self-employment remains the most common choice for self-employed workers, it is becoming less prominent given the divergent trends by incorporation status. The share of incorporated entrepreneurs among the self-employed increased from 28% to 41% over this period.

The finding in Figure 1 is a robust feature of the U.S. economy. Appendix B shows that similar trends are observed if we focus instead on the population aged 25-64 years old or use data from a similar sample in the American Community Survey (for a more recent period). It was also a pervasive change across demographic groups. I find that the decline in the unincorporated self-employment rate is significantly larger than the change in incorporated self-employment across demographic groups such as education, age, gender, and urban status. Consequently, the

[6] The self-employment *rate* has decreased but the total number of entrepreneurs grows due to labor supply growth.

share of incorporation among the self-employed has significantly increased for all these groups (See Figure 2 and Appendix Figure B3).

In particular, one feature of the entrepreneurial decline in the United States that has been documented in the recent literature is that it was more pronounced for workers with a college degree. The skill-biased technological change and the rise of the skill premium are important factors behind the skill-biased decline in entrepreneurship (Jiang and Sohail, 2023; Kozeniauskas, 2022; Salgado, 2020). Figure 2 panel (a) shows the aggregate trends in self-employment by incorporation status and college attainment. It shows that college graduates had a faster decline in unincorporated and incorporated self-employment rates than their non-college counterparts (the dotted lines are steeper than the solid lines of the same color). More importantly for this paper, the decline in self-employment is driven by the unincorporated rate for both college attainment groups (the blue line is steeper than the green line of the same pattern). Among entrepreneurs with and without a college degree, the share of incorporated entrepreneurs increased by 12 and 10 pp, respectively (Figure 2 panel (b)). This evidence supports the decision to abstract from the workers' college attainment dimension in the model to focus on forces that affect the heterogenous decline in entrepreneurship by incorporation status independently of their college level.

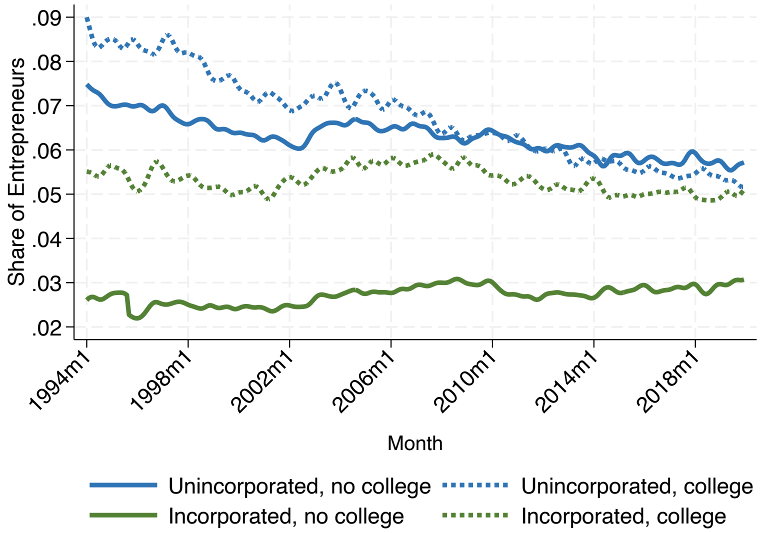
2.3 Significant differences between entrepreneurs and their businesses by incorporation status

This section documents two key differences between the unincorporated and incorporated entrepreneurial sectors observed for my sample of self-employed workers. This evidence is complemented by other findings in the literature to support my assumption that incorporation works as a proxy to differentiate two types of entrepreneurs, which I take directly to the model.

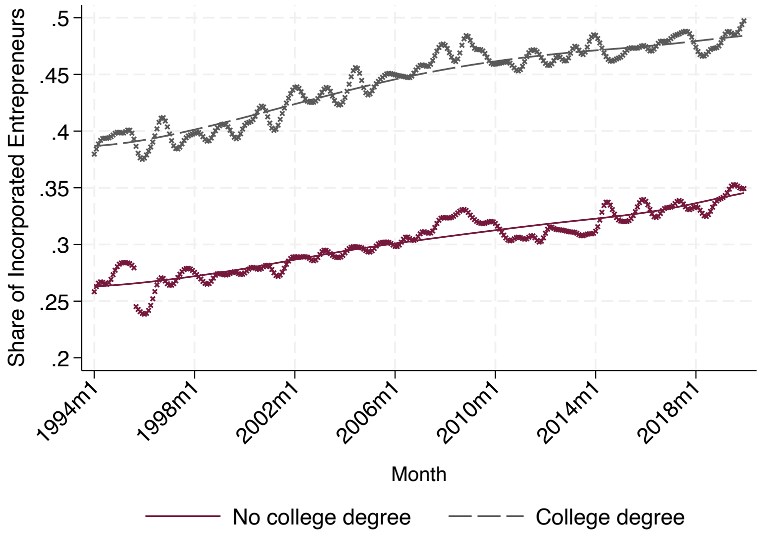
First, entrepreneurial businesses differ in the use of capital and labor. Many unincorporated businesses are sole proprietorships, meaning they do not hire any labor different from the one provided by the owner. Table 1 shows that the probability of having at least one employee (different than the owner) is significantly lower for unincorporated businesses. Incorporated businesses are almost three times more likely to have at least one paid employee. Among those

Figure 2: Self-employment rates by Incorporation Status and College Attainment, 1994-2019.

(a) Entrepreneurship Rate by Incorporation and College Attainment



(b) Incorporation Rate by College Attainment



Source: Own calculations using monthly data from the Current Population Survey, 1994-2019.
Notes: Panel a depicts the self-employment rates by incorporation status separately among workers with and without college degrees. Panel b plots the share of incorporated self-employed among all the self-employed separately among workers with and without college degrees. All series were seasonally adjusted using the X-13ARIMA-SEATS Seasonal Adjustment Program. See Appendix A for additional details.

with non-zero employment, the average employment of incorporated firms is almost twice that of their unincorporated counterpart.[7]

There is evidence that incorporated businesses are more likely to need startup capital, which

[7]Note that although, legally, all workers of a corporation, including the working shareholders, are considered employees, the statistic in the table refer to employees different to the owner(s).

Table 1: Business characteristics by incorporation status

	Unincorporated	Incorporated	Source
Employer business (%)	14.08	40.95	CPS
Mean number of employees (conditional)	5.15	9.41	CPS
Share of businesses that have more than 25 employees	0.011	0.084	SIPP
Mean gross value of business ($)	99,171	216,829	SIPP
Median gross value of business ($)	10,000	40,000	SIPP

Source: Own calculations based on SIPP panel 4 wave 3 and the CPS sample of self-employed workers for the period 2014-2019.

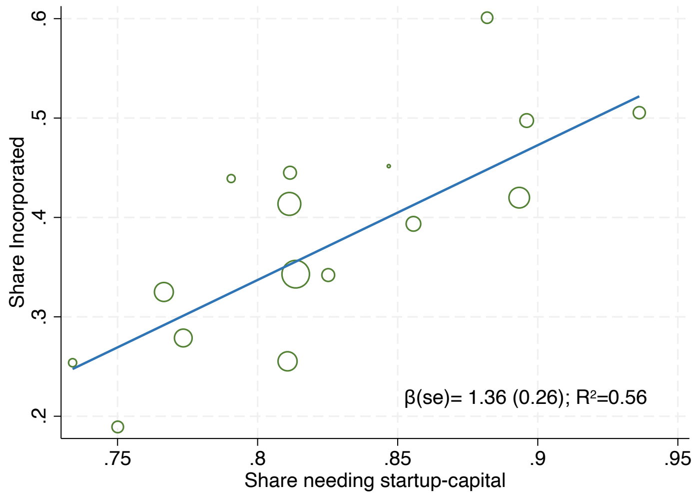
I take as evidence of a positive correlation between the use of capital and incorporation. To see this, the Survey of Business Owners is valuable as it asks business owners whether they needed startup capital. As the survey does not provide the firm's LFO or incorporation status, I look at this correlation at the aggregate level. To do so, first, I calculate the industry-level share of incorporated entrepreneurship among the entrepreneurs from the CPS. Second, from the SBO, I calculate two industry-level measures of capital use: i) the share of businesses that needed startup capital and ii) the share of businesses whose startup capital was at least $50,000 (conditional on needing startup capital). Then, I perform a cross-industry correlation between these two measures.

Figure 3 presents in two scatter plots the relation between the share of incorporation among the entrepreneurs and the share of businesses that needed startup capital (panel (a)) and the share of firms whose startup capital was $50,000 or higher (panel (b)). There is a positive significant correlation for each capital use measure: sectors in which the SBO respondents said they needed more capital in both the extensive and intensive margin are sectors where the self-employed are more likely to be incorporated. This evidence complements the evidence by Levine and Rubinstein (2020) who document from the National Longitudinal Survey of Youths 1979 that the typical incorporated business starts with almost ten times as much capital as the typical unincorporated business.

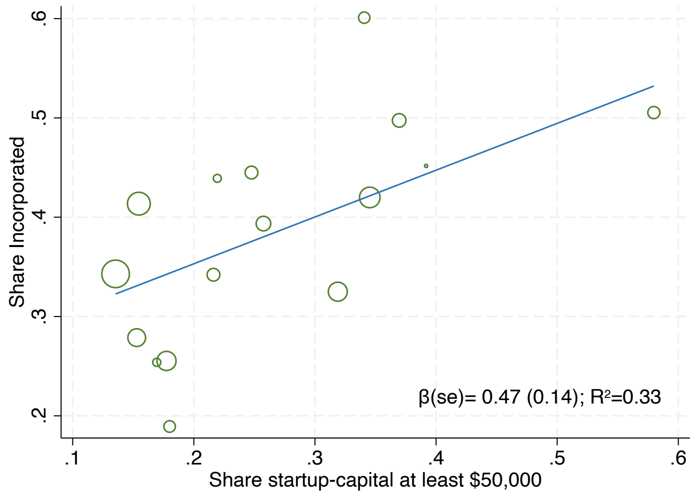
Thus, incorporated businesses are more likely to use labor and capital than their unincorporated counterparts. As a result, they are larger businesses with a higher value. Table 1 shows that the median incorporated business value is four times that of the typical unincorporated business. Now, I turn to the model, where I take the observed differences in the use of hired

Figure 3: Cross-Sector Correlations Between the Share of Incorporation and Use of Capital

(a) Need Startup Capital



(b) Startup capital was at least $50,000



Source: Own calculations using the 2007 Survey of Business Owners (PUMS) and the 2007 Current Population Survey.
Notes: Share Incorporated is the number of incorporated entrepreneurs as a share of the total number of entrepreneurs in each sector, from the CPS 2007 sample. The variables in the horizontal axis correspond to the share of business in the SBO that needed startup capital (panel (a)) and, conditional on needing startup capital, the share that needed at least $50,000 in startup capital (panel (b)). Each dot corresponds to one sector (for instance, "Accommodation and Food Services", "Construction", etc.). The size of each dot represents the number of entrepreneurs in the sector calculated from the CPS data. An OLS regression for each panel is run and the estimated beta coefficient and R-squared are shown.

labor and capital by incorporation status to the extreme and propose a model with two types of entrepreneurial sectors identified in the data with the incorporation status.

3 Model

A dynamic stochastic occupational choice model is developed to study workers' entrepreneurial choices. Based on the observed differences in the use of capital and labor between the unincorporated and incorporated entrepreneurs, the model builds an economy in which the consumption good is produced by three sectors: two entrepreneurial sectors and one non-entrepreneurial sector. The sectors differ in production technologies and financial constraints. The paper focuses on a steady-state analysis of the model.

Time is discrete, one period corresponds to one year.[8] There is no aggregate uncertainty, but there is uninsurable idiosyncratic risk due to stochastic labor productivities and incomplete markets. The government levies a tax on workers' personal income to fund a public good.

I adopt the setup of Greenwood et al. (1997) to formalize changes in the technology for producing capital goods or investment-specific technological change. One unit of the final good is converted into q units of the capital good to be used by firms. Thus, q represents the current state of the technology producing capital goods, which is exogenous, and $1/q$ can be interpreted as the relative cost of producing one additional good of the capital good in terms of the final output.

3.1 Workers

There is a continuum of workers of total measure one, heterogenous in their working productivities and asset holdings. They supply labor inelastically and decide on consumption, savings, and employment type.[9] They choose among three employment types: employee, unincorporated entrepreneur, and incorporated entrepreneur. They save on a risk-free asset (a), which rents interest r, and cannot borrow. To reflect the fact that the skillset needed as employees and as entrepreneurs is different (Cagetti and De Nardi, 2006; Hartog et al., 2010), workers possess two different labor productivities, one for the paid sector (y) and one for the two entrepreneurial sectors (θ). Both labor productivities are idiosyncratic, following two known Markov processes independent of each other. In each period, the workers know their realization when making the

[8]For notational convenience, the time subscript is omitted in the presentation of the model.

[9]The model abstracts from the labor supply choice as the model focuses on the entrepreneurial choice. Notice that the term "worker" refers to the decision agents, including the entrepreneurs.

occupational choice. As employees, they are paid a wage rate for their labor productivity.

All workers have the same preferences over private consumption of the final good, c. The period utility is $U(c)$, where $U(\cdot)$ satisfies the standard conditions. With probability $(1-\chi)$, workers are replaced by their offspring. The offspring inherit their parent's savings but not their labor productivities. They draw their productivities from the stationary distributions. Workers maximize their lifetime utility and might also care about their offspring's lifetime utility, putting a weight η to their offspring's utility. The future utility is discounted with the discount factor β, where $\beta \in (0.1)$.

3.2 Taxes

The government levies two types of taxes to fund a public good. First, I introduce a personal income tax. Later, I will analyze the effect on entrepreneurship via its effect on a household's capital accumulation. To test the effect of changes in the tax progressivity of the federal income tax in the U.S. system, I introduce a progressive tax scheme denoted by the tax function $T(\cdot)$. Taxable income is labor income (wages and profits) plus interest income. I treat all households, including the incorporated entrepreneurs, with the same tax function. The incorporated sector comprises two legal form of organizations (LFOs), S and C Corporations, which are taxed differently.[10] As my model is not about the S-C corporation choice, I treat all incorporated firms as S-corporations (pass-through entities). The reason for this is that the behavior of the incorporated sector is driven by the S sector, as the number of C-corporations has strongly declined.[11]

Second, I introduce payroll taxes to account for the difference in payroll taxation between the unincorporated and incorporated sectors. Payroll taxes are levied as a flat tax rate τ^p split equally between the employer and employee. The unincorporated entrepreneurs pay the complete tax rate (akin to the "self-employment" tax). The incorporated entrepreneurs pay payroll

[10]Similar to the unincorporated sector, the S-corporations are pass-through entities, whereas the C-corporations pay corporate taxes at the entity level, and their shareholders pay income tax on their dividends.

[11]The detailed LFO variable is not available for my CPS sample, but I suspect this is the case for my sample of workers given the strong trend observed using tax returns data. The share of S-corporations among corporations, measured through the number of returns, increased from 21% in 1983 to 73% in 2015, as the number of C-corp returns decreased by 32%, whereas the number of S-Corp returns had a seven-fold increase (Source: SOI Tax Stats - Integrated Business Data).

taxes on a portion v of their profits.[12]

3.3 Production technologies

Unincorporated entrepreneurial sector. Given that most unincorporated entrepreneurs are solo workers and are less likely to use capital than the incorporated, I assume the unincorporated entrepreneurs in the model produce according to a linear function that depends only on their entrepreneurial productivity. There is also zero operational cost of setting up an unincorporated business. Therefore, the profit in this sector is given by $\omega\theta$.

Incorporated entrepreneurial sector. Incorporated entrepreneurs hire workers and rent capital, and their entrepreneurial productivity affects how well they can combine those factors in order to produce according to the following production function:

$$f(\theta,n,k) = (n^{\alpha}k^{1-\alpha})^{\gamma}; \quad 0 < \alpha < 1 \text{ and } 0 < \gamma < 1 \tag{1}$$

Entrepreneurs face decreasing returns to scale, governed by γ, which captures the limited span of control of entrepreneurs as in Lucas (1978). Incorporated entrepreneurs face a collateral constraint that limits their capital demand. There are maintenance costs of having the business incorporated given by a fixed amount κ, which reflects record-keeping costs and filing fees that corporations face. The profit of an incorporated firm owned by an entrepreneur with productivity θ and current assets a is given by:

$$\pi(\theta,a) = \max_{n,k} \quad \theta[n^{\alpha}k^{1-\alpha}]^{\gamma} - (r+\delta)\frac{k}{q} - w(1+0.5\tau^{p})n - \kappa \tag{2}$$

$$\text{s.t., } \frac{k}{q} \leq \lambda a$$

Non-entrepreneurial sector. The non-entrepreneurial firms operate with the same technology as the incorporated entrepreneurial sector but without a limited span of control. They do not face any collateral constraints, and the problem is equivalent to having one non-entrepreneurial

[12] This is to reflect the tax treatment of S-corporations in reality. S-corporations pay "wages" to the shareholders that work in the firm and "distributions" as payments on account of capital. The way this split is done in practice is not evident, and I make a conservative calibration for the share subject to payroll taxes (Section 3.4).

firm with zero profits by solving:

$$\max_{N,K} \; N^{\alpha}K^{1-\alpha} - w(1+0.5\tau^{p})N - (r+\delta)\frac{K}{q} \tag{3}$$

3.4 Worker's problem

Now I formalize the worker's occupational choice problem (Roy, 1951). Worker's indexation will be omitted to economize on notation. The vector of individual state variables for a worker is given by her current wealth level, paid-sector productivity, and entrepreneurial productivity, $\Omega = (a, y, \theta)$. Workers choose the employment type that gives them the highest value, so the value function is given by the upper envelope of the choice-specific value functions:

$$V(\Omega) = \max\{V^{w}(\Omega), V^{u}(\Omega), V^{i}(\Omega)\}, \tag{4}$$

where V^{w} is the value of being an employee, V^{u} is the value of being an unincorporated entrepreneur and V^{i} is the value of being an incorporated entrepreneur. The choice-specific values are specified below. Note that the expectation of the next period value if they continue living is conditional on current entrepreneurial abilities, but it is unconditional if they are replaced by their offspring. The unconditional expectation will use the invariant distribution of the labor and entrepreneurial abilities.

The value of an unincorporated employee can be expressed as:

$$V^{w}(\Omega) = \max_{c,a'} \; U(c) + G + \beta[\chi E[V(\Omega')|y,\theta] + (1-\chi)\eta E[V(\Omega')]]$$

$$\text{s.t., } c + a' = (1+r)a + (1-0.5\tau^{p})wy - T(ra + (1-0.5\tau^{p})wy); \quad a' \geq 0.$$

The value of an unincorporated entrepreneur is:

$$V^{w}(\Omega) = \max_{c,a'}\{u(c) + G + \beta[\chi E[V(\Omega')|y,\theta] + (1-\chi)\eta E[V(\Omega')]]\}$$

$$\text{s.t., } c + a' = (1+r)a + (1-\tau^{p})\omega\theta - T(ra + (1-\tau^{p})\omega\theta); \qquad a' \geq 0.$$

The value of an incorporated entrepreneur is:

$$V^i(\Omega) = \max_{c,a'}\{u(c) + G + \beta[\chi E[V(\Omega')|y,\theta] + (1-\chi)\eta E[V(\Omega')]]\}$$

$$\text{s.t., } c + a' = (1+r)a + (1-v\tau^p)\pi(\theta,a) - T(ra + (1-v\tau^p)\pi(\theta,a)); \quad a' \geq 0,$$

where $\pi(\theta,a)$ is defined as in equation (2).

3.5 Equilibrium definition

I focus on the stationary equilibrium, where the distribution of workers over the state space is constant over time. The equilibrium consists of: (i) decision rules by workers $c(\Omega)$, $a(\Omega)$, $d(\Omega)$ about consumption, savings, and employment choice, respectively; (ii) factor demands by the incorporated entrepreneurial sector $n(\Omega)$, $k(\Omega)$ and by the non-entrepreneurial sector, N and K; (iii) wage w and interest rate r; and (iv) a distribution Φ^* such that:

1. Worker's decision rules and factor demands solve worker's optimization problem described above (Equation (4)).

2. The non-entrepreneurial sector's factor demands are optimal given the prices, i.e., they solve the problem in Equation (3).

3. Capital and labor markets clear:

$$\int a(\Omega)\, d\Phi^* = \frac{K}{q} + \int \frac{k(\Omega)}{q} I_{d=i}\, d\Phi^* \tag{5}$$

$$\int I_{d=w} y\, d\Phi^* = N + \int n(\Omega) I_{d=i}\, d\Phi^*, \tag{6}$$

   where $I_{d=i}$ is an indicator function that

4. The government budget is balanced; the public good provision equals the total tax rev-

enue.

$$G = \int \tau^p w y I_{d=w} + \tau^p \omega \theta I_{d=u} + v \tau^p \pi(\theta, a) d\Phi^* +$$
$$\int T(ra + (1-0.5\tau^p) wy) I_{d=w} + T(ra + (1-\tau^p)\omega\theta) I_{d=u} + T(ra + (1 - v\tau^p)\pi(\theta, a) I_{d=u} \, d\Phi^*. \tag{7}$$

4 Calibration

This section details the calibration of the model. The calibration is done in two steps. In the first step, I fix some parameters externally by taking values from the literature or additional assumptions. In the second step, I calibrate the remaining parameters through the simulated method of moments (SMM) to match some relevant data moments circa 1983.

4.1 Fixed parameters

Table 2 summarizes the parameters that were calibrated externally. In this section, I describe additional functional form assumptions and explain the logic behind the choice of parameters. Recall that one period in the model corresponds to one year. The probability of dying is set so that the average working life spans 45 years. The period utility over consumption is assumed to be $u(c) = \frac{c^{1-\sigma}-1}{1-\sigma}$, with constant relative risk aversion parameter $\sigma = 1.5$ taken from Cagetti and De Nardi (2006). The discount factor is set to 0.93, a sensible number in relation to different calibrations in the literature (e.g., Bassetto et al., 2015; Buera and Shin, 2011). I assume that workers are perfectly altruistic towards their children and set η to 1.

Based on the business-cycle literature, the capital depreciation rate is set to 0.06, and the labor share is set to 0.64. The span-of-control parameter is set to 0.88, the value estimated in Dinlersoz et al. (2019) for young firms in the manufacturing sector and also used by the calibration of Cagetti and De Nardi (2006). Following Dinlersoz et al. (2019), the collateral constraint parameter is set to 1.5, which means that entrepreneurs cannot rent capital whose value is more than 50% the value of their wealth. I assume that the labor productivity in the paid sector, y, follows a stationary first-order autoregressive process in logs, thus:

$$ln\, y_t = \mu_y(1-\rho_y) + \rho_y ln\, y_{t-1} + \varepsilon_t; \quad \varepsilon \sim N(0, \sigma_\varepsilon)$$

Where $|\rho_y| < 1$ and ε_t is a white noise process normally distributed in each period with variance σ_ε^2. The AR(1) process has mean μ_y equal to zero as a normalization (the process in levels has mean one). The other two parameters that characterize the process were taken from Dinlersoz et al. (2019); variance σ_ε^2 is set to 0.13, and the persistence parameter is set to 0.97. I approximate this continuous process through a discrete Markov process using the Rouwenhorst method.[13] For the progressive tax schedule T, I use the following nonlinear tax scheme, which has been shown to capture well the progressivity of statutory taxes in the United States. (Bénabou, 2002; Heathcote et al., 2017):

$$T(x) = x - \lambda_T x^{(1-\tau)}.$$

The parameter λ_T is related to the average tax rate; a larger λ_T leads to a lower average tax rate. The parameter τ captures the progressivity of the system. If $\tau = 0$, the scheme is a flat tax rate, $1 - \lambda_T$. $\tau > 0$ represents a progressive tax system and $\tau < 0$ a regressive tax system. The lower τ is, the less progressive the tax system is. Dyrda and Pugsley (2018) estimate the progressivity parameter before the 1986 Tax Reform to be around 0.14 using tax data; I use that number for the baseline calibration. That estimate coincides with the calibration in Gao and Zhang (2022) using a Panel Study of Income Dynamics (PSID) sample of households. For the average tax rate parameter, I use an estimate from Gao and Zhang (2022).

4.2 Internally calibrated parameters

The remaining five parameters are jointly calibrated to match features of the US data circa 1983, the baseline year. I follow the simulated method of moments and minimize the sum of the quadratic distances between the observed and data moments, weighing each moment

[13]The Rouwenhorst method is suitable for discretizing highly persistent AR(1) processes (Kopecky and Suen, 2010).

Table 2: Fixed parameters

Description	Parameter	Value	Basis
Probability of continue living	χ	0.978	Average working life of 45 years.
Risk aversion	σ	1.5	Cagetti and De Nardi (2006).
Capital depreciation rate	δ	0.06	Standard
Altruism towards children	η	1	Full
Price of capital	$1/q$	1	Normalization
Labor share	α	0.64	Standard
Span-of-control parameter	γ	0.88	Dinlersoz et al. (2019)
Discount factor	β	0.93	Standard
Borrowing constraint	λ	1.5	Dinlersoz et al. (2019)
Mean y productivity shock	μ_y	1	Normalization
SD of log y	σ_y	0.53	Dinlersoz et al. (2019)
Persistence parameter	ρ_y	0.97	Dinlersoz et al. (2019)
Average tax rate parameter	λ_T	0.908	Gao and Zhang (2022)
Tax progressivity parameter	τ	0.14	Dyrda and Pugsley (2018)

equally. I assume that the labor productivity in the entrepreneurial sectors, θ, follows an AR(1) process in logs:

$$ln\ \theta_t = \mu_\theta(1-\rho_\theta) + \rho_\theta ln\ \theta_{t-1} + \nu_t; \quad \nu \sim N(0, \sigma_\nu)$$

Where $|\rho_\theta| < 1$, ν_t is a white noise process normally distributed in each period with variance σ_ν^2. I approximate the process through a discrete-space Markov process using the Rouwenhorst method. The three parameters that characterize this process, μ_θ, ρ_θ and σ_θ are calibrated in the following way.

First, I estimate the persistence and variance parameter values from a sample of self-employed workers from the PSID from 1968 to 1994. I pool together unincorporated and incorporated self-employed as the model assumes the same entrepreneurial ability for both types and estimate the following equation:

$$x_{i,t} = \beta_0 + \rho_\theta\, x_{i,t-1} + \upsilon_{i,t}, \tag{8}$$

where $x_{i,t}$ is the residual real log labor earnings of the head of household i in year t after controlling for observable individual characteristics and year dummies, and $\upsilon_{i,t}$ is an error term.[14]

[14]Specifically, I run an OLS regression of the real log labor income of the self-employed on year dummies,

Note that the above regression is estimated using a sample of workers who might be potentially selected, as workers need to be self-employed for at least two consecutive years to be sampled. For instance, workers who are never self-employed or have short self-employment spells are excluded from the regression. If this sample of workers is not representative of all, we could infer the parameters for the process for the entrepreneurial ability with bias.

To reduce the potential bias due to this sample selection, I take the following approach. I assume that the entrepreneurial ability process is unobserved and that I can observe the selected process based on the sample of self-employed workers in the model as in the data. The parameters for the process in the data are taken from the estimation of equation (8) using the PSID sample, and the parameters for the process in the model are obtained by estimating the same equation for the realization of the entrepreneurial ability (in logs) among the workers who are self-employed for two consecutive periods in model-generated data.[15] I take the parameters estimated using the PSID as targets in my calibration strategy and minimize the distance between those estimates and those obtained from the model-generated data. This allows me to recover the parameters of the underlying entrepreneurial ability process as the process that minimize said distance.

Second, the overall mean of the entrepreneurial process is calibrated to match the incorporated self-employment rate, and the cost of incorporation κ is set to match the employment share by the incorporated sector. Finally, I set ω to match the unincorporated self-employment rate.

Table 3 lists the five parameters that were jointly calibrated. The model works well in matching the five moments—especially the occupational rates and the employment share by the incorporated sector. At the same time, the matching of the moments for the entrepreneurial ability is slightly off.

educational attainment, and gender dummies, and worker's age and its square to control for life-cycle effects. $x_{i,t}$ is the residual of this first-stage regression. See Appendix C for additional details about the sample selection and additional estimation details.

[15] See Appendix D for the complete algorithm to calibrate and solve the model.

Table 3: Calibrated parameters

Moment	Data	Model
Employment share by the incorporated	0.349	0.3355
Unincorporated self-employment rate	0.082	0.0826
Incorporated self-employment rate	0.032	0.0321
$\hat{\sigma}_\theta$	0.938	0.8687
$\hat{\rho}_\theta$	0.726	0.7758
Parameter	**Symbol**	**Value**
Fixed cost of incorporated entrepreneurship	κ	0.554
Unincorporated entrepreneurship technology	ω	0.403
Entrepreneurial productivity		
Mean	μ_θ	1.15
SD of log θ	σ_θ	1.37
Persistence	ρ_θ	0.79

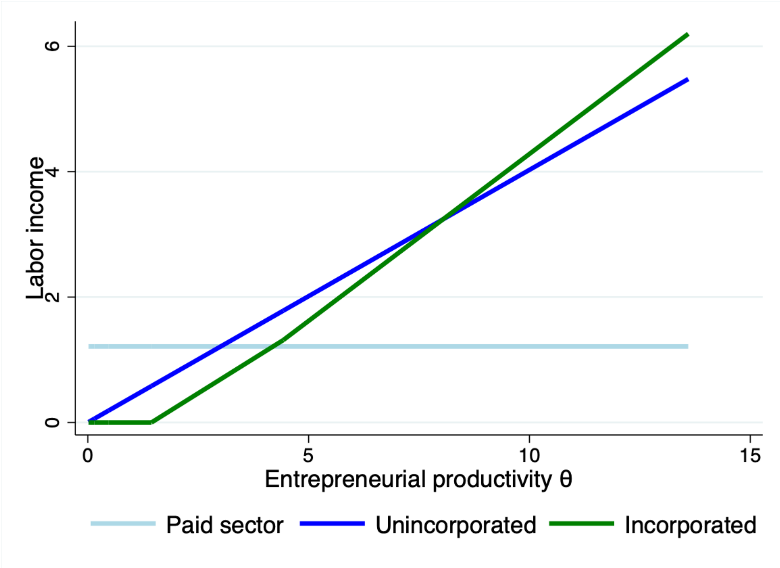
4.3 Occupational choice in the benchmark economy

This section sheds light on the determinants and barriers to entrepreneurship through the lens of this model. I start by studying the role of labor income in occupational choice. Although the choice is based on the value of each employment type, the differences in labor income between the employment types directly affect the value and, of course, the occupational choice. Figure 4 panel (a) plots the labor income by entrepreneurial ability holding wealth and labor productivity fixed at a given value selected as an example to see how the labor income depends on entrepreneurial ability. Figure 4 panel (b) plots the labor income by wealth, holding constant the labor productivity and entrepreneurial productivity fixed at a selected level.

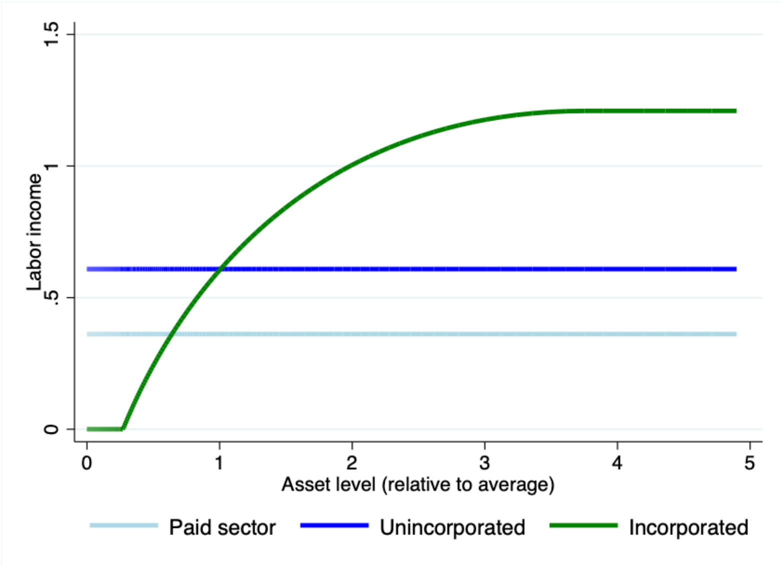
Labor income in the paid sector is flat with respect to entrepreneurial ability, as it only depends on the worker's specific productivity in that sector. Conversely, entrepreneurial productivity positively affects only the labor income in the entrepreneurial sectors. Given the model assumptions, a linear relationship exists between entrepreneurial productivity and labor income in the unincorporated sector. In contrast, the relationship is nonlinear in the incorporated sector. For workers with low entrepreneurial productivity levels, the firm's optimal size is such that it cannot cover the fixed cost of running an incorporated business. Therefore, they are better off not choosing the incorporated business. The unincorporated sector does not face fixed costs; thus, entering even at very low, non-zero levels of entrepreneurial productivity could be prof-

Figure 4: Labor Income in Each Occupational Choice

(a) By entrepreneurial productivity



(b) By wealth



Notes: The figure plots labor income by entrepreneurial productivity (panel a) and wealth (panel b). Note that the figures depend on the fixed levels of the other state variable and thus, for different fixed values the exact figure will be different but the general idea is the same.

itable for them. As income in the incorporated sector has increasing returns to entrepreneurial ability (after the firm covers the fixed costs), there is an entrepreneurial ability at which labor income in the incorporated sector is larger than in the unincorporated sector. Therefore, there is positive entrepreneurial productivity selection into both entrepreneurial sectors and, conditional on being an entrepreneur, a positive selection into the incorporated sector.

Turning to labor income and workers' wealth in Figure 4 panel b, there is a positive relationship between wealth and labor income only in the incorporated sector due to the collateral constraint. First, the fixed cost of incorporation and the need for a minimum firm scale to break even means that households with low wealth levels cannot finance the capital needed to reach this scale and, therefore, would not enter. Second, profit will increase with wealth for the workers whose collateral constraint binds. The constraint relaxes as the wealth level increases and entrepreneurs reach their unconstrained optimal capital demand, where profit no longer depends on the worker's wealth (the flat portion of the green line). This effect generates a positive sorting into incorporated entrepreneurship that is not observed for the unincorporated sector.

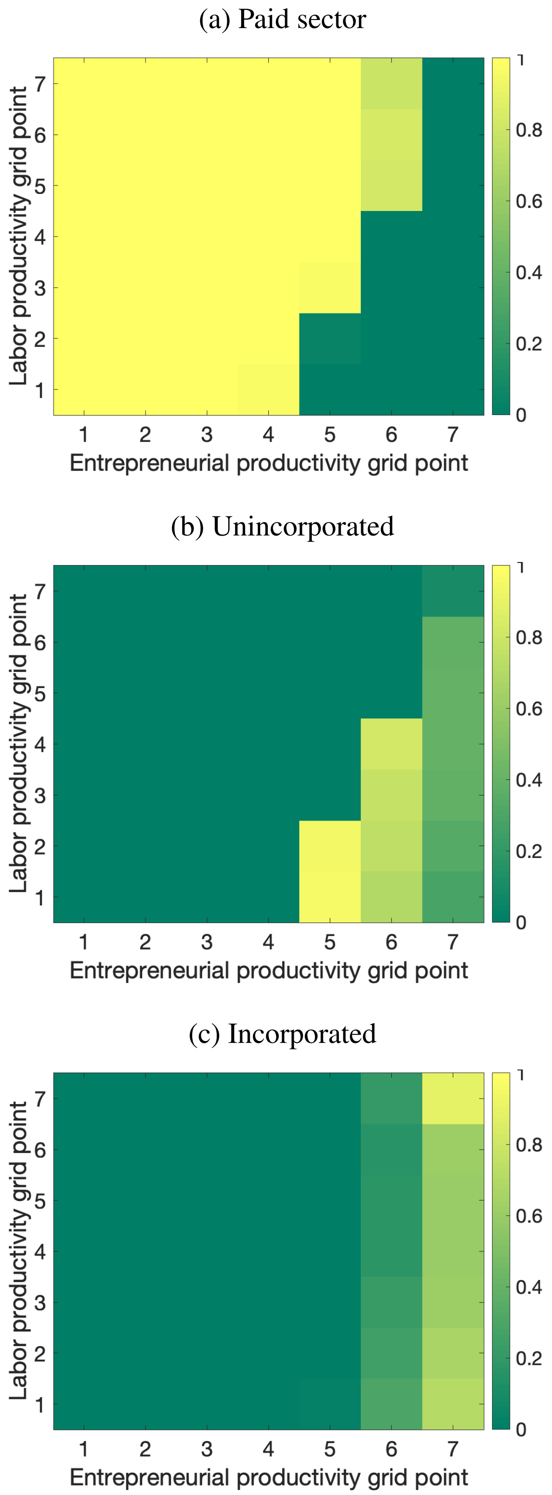
How are the actual choices of workers in equilibrium? Figure 5 summarizes workers' occupational choice given the steady state wealth distribution by plotting the distribution of workers by occupational choice for each labor-productivity combination. The model reproduces the positive entrepreneurial ability sorting to entrepreneurship typical of models of entrepreneurial choice. Only those within the three highest entrepreneurial levels are entrepreneurs.

Workers with mid-level entrepreneurial and low labor productivity are likelier to be unincorporated entrepreneurs, and the negative relation between labor productivity and unincorporated entrepreneurship is strong. The sorting to the incorporated sector is different. First, only those with the two highest entrepreneurial productivity go to the incorporated sector. Once you reach that level of entrepreneurial productivity, the relation with labor productivity is not as negative as for the unincorporated sector. Indeed, the likelihood of being an incorporated entrepreneur is the highest for the most productive in the paid and entrepreneurial sectors.

5 Quantitative analysis

In this section, I quantitatively assess the role of (i) the decline in the relative cost of capital and (ii) the decline in tax progressivity in explaining the secular decline in entrepreneurship, driven by the unincorporated sector, during 1983-2019.

Figure 5: Occupational Choice by Labor and Entrepreneurial Productivity



Notes: For each cell (labor-entrepreneurial productivity) the distribution of workers across the three occupational choices is shown in the three panels. Thus, the sum across-panels of the same cell adds up to one.

5.1 Investment-specific technological change

This period observed significant technological change associated with developing new types of capital equipment and improving the quality of investment goods, particularly in the sector of information and communication technologies (Cummins and Violante, 2002). This technical progress in the capital-producing industry is measured in the decrease of the relative cost of capital goods in terms of consumption goods: equipment and software became less expensive. In the model, this is formalized by a decrease in $1/q$ (a decrease in the relative price of capital). Measures of investment-specific technological change are the decrease of the ratio of a quality-adjusted price index for investment and a price index for consumption goods.[16] I take the most conservative measure in the data and decrease the relative price of capital by 45%.[17]

The reduction in the relative price of capital directly benefits the sectors of the economy that use capital to produce. Small-scale entrepreneurship is not capital-intensive (in the model, the assumption is taken to the extreme) and does not benefit from technological change. In general equilibrium, different types of technological change have been shown to reduce the entrepreneurship rate by improving wages in the paid sector (Jiang and Sohail, 2023; Salgado, 2020; Kozeniauskas, 2022), and the workers for which the increases in wages will be more attractive would be the ones that are not benefiting from the technical change if they were entrepreneurs.

5.2 Tax progressivity

Taxes can affect the incentive of workers to become entrepreneurs (Gentry and Hubbard, 2000). Although my baseline model abstracts from many features of the tax system that could affect the entrepreneurial choice (e.g., corporate taxes, top income taxes), the model features a progressive tax system that allows me to test the effect of decreasing tax progressivity observed in the U.S. (Piketty and Saez, 2007). Estimates of the tax progressivity parameter in the tax function (see e.g., Borella et al., 2023; Dyrda and Pugsley, 2018) show a decline in tax pro-

[16] The literature and statistical agencies attempt to construct series that adjust for quality improvement of existing equipment and structures (Cummins and Violante, 2002; Pakko, 2002)

[17] Figure C4 in the Appendix plots three such measures and shows the significant decline in the relative cost of capital. Depending on the measure, between 1983 and 2019, the relative cost of capital decreased by 45 to 65 percent, with the most significant decline observed for the measure focused on equipment and software.

gressivity, especially marked after the 1986 tax reform. I take advantage of the availability of the estimates in (Dyrda and Pugsley, 2018) and test the hypothesis that the decline of tax progressivity contributed to the heterogeneous decline in entrepreneurship.

5.3 Results

To assess the role of these two changes in the U.S. economy on workers' occupational choices, I focus on the change between 1983 and 2019 in three statistics: the unincorporated and incorporated self-employment rates and the share of incorporated entrepreneurs among the entrepreneurs. I assume the economy in 2019 is in the steady state and solve for the predicted occupational choices after the model is recalibrated with the observed lower relative price of capital and tax progressivity. I adjust the parameter related to the average tax rate so the government revenue as a share of GDP does not change when tax progressivity is reduced and keep the rest of the parameters unchanged. Table 4 shows the results of this quantitative exercise. Panel A shows the observed change, there was a decline in the unincorporated rate of 2.7 pp, and an increase of 0.6 pp in the incorporated rate. The share of incorporated entrepreneurs increased by 12.9 pp. Panel B shows the model-estimated statistics for the baseline and recalibrated steady states and their predicted change.

Although the model predicts that both entrepreneurship rates should have decreased more than the data shows, it captures the shift toward incorporation very well. In the case of the unincorporated self-employment rate, which fell to 5.5 percent, the model predicts it at 4.5 percent in 2019, a decrease almost 40% larger. In the case of the incorporated self-employment rate, which increased to 3.8%, the model predicts a slight decline in the incorporated self-employment rate. As the model predicts that the decrease in the unincorporated rate is more substantial than the decrease in the incorporated rate, the increase in the share of incorporated entrepreneurs to 40 percent is captured virtually perfectly by the model. I interpret this finding as evidence that these two broad economic changes experienced over the last 30 years are significant determinants of the heterogeneous trends in entrepreneurship.

What is the relative role of each determinant? Even though the model predicted change is the product of two forces in combination that are not additively separable, I take the following

Table 4: Change in Entrepreneurship

	Unincorporated entrepreneurship	Incorporated entrepreneurship	Incorporated, conditional
	Panel A: Data		
1983	0.082	0.032	0.280
2019	0.055	0.038	0.408
Observed change	-0.027	0.006	0.129
	Panel B: Model		
1983	0.083	0.032	0.280
2019	0.045	0.030	0.403
Predicted change	-0.038	-0.002	0.123
	Panel C: Counterfactuals		
Counterfactual 1. Only technological change			
Predicted rates	0.055	0.032	0.367
Change due to ISTC	-0.028	0.000	0.087
Change due to tax progressivity	-0.010	-0.001	0.036
% due to ISTC	0.738	0.190	0.707
% due to tax progressivity	0.262	0.810	0.293
Counterfactual 2. Only tax progressivity			
Predicted rates	0.083	0.031	0.272
Change due to ISTC	-0.038	-0.001	0.131
Change due to tax progressivity	0.000	-0.001	-0.008
% due to ISTC	1.001	0.301	1.064
% due to tax progressivity	-0.001	0.699	-0.064

approach to have an idea of the relative importance of each determinant. I compare the model predictions with those of two counterfactual economies. In the first one, I keep the tax progressivity in its baseline value, changing only the capital price and calculating the occupational choices under a new equilibrium. This counterfactual would show what would have been the effect of the decline in the price of capital in isolation, leaving the remaining difference with the originally predicted change to be the effect of the tax progressivity (assuming the interaction effects minimal). I can, therefore, decompose the original model predicted change between that caused by the decline in the price of capital and tax progressivity. The same analysis can be done with a second counterfactual: keeping the price of capital unchanged and changing the tax progressivity.

The result of this exercise is in Table 4 panel C. Consider, first, the unincorporated self-employment rate. By the first counterfactual, the decrease in the price of capital would have lowered the unincorporated rate to 5.5 percent, which is 74% of the total predicted change. Thus, reducing the relative price of capital has a relatively more important role than decreasing tax progressivity in reducing the unincorporated self-employment rate. The second counterfactual attributes an even more critical role to the decline in the price of capital: the unincorporated self-employment rate would not have decreased if only the tax progressivity had changed.

Now, I turn to understanding the mechanisms through which the investment-specific technological change and the declining tax progressivity explain the changes in the self-employment rates. I examine the endogenous interest rate, wage rate, and aggregate asset accumulation change. Table 5 shows the relative change in these three variables by showing the ratio between the variable in the new equilibrium and the baseline equilibrium. I evaluate the new equilibrium and the two counterfactuals as well.

Table 5: Predicted change in wage, interest rate and asset accumulation

	Model	Counterfactual 1	Counterfactual 2
Interest rate	1.146	1.346	0.849
Wage	1.373	1.339	1.021
Asset accumulation	1.361	1.255	1.060

Considering the first counterfactual, the equilibrium as if only the ISTC had occurred. The decline in the relative price of capital increases the demand for capital via the direct price effect and relaxation of the collateral constraint. Still, the demand for labor also expands due to the complementarity between labor and capital. In equilibrium, both the interest rate and the wage rate increase, and there is a higher accumulation of assets in the economy (due to the higher interest rate). As the wage rate increases, the entrepreneurship rate decreases, particularly from the unincorporated sector that did not benefit from the technological progress. The incorporated sector benefits directly from the reduced cost of capital and the relaxation of the collateral constraint but also faces higher wages. As a result, the model predicts no change in the incorporated entrepreneurship rate.

Considering the second counterfactual, we know its effect is smaller, but still, we observe changes in the endogenous variables. The decline in tax progressivity does increase asset accumulation, but in the new equilibrium, the interest rate is lower, reflecting that the demand for capital did not increase as much. Wages increase; thus, for incorporated entrepreneurs, the increase in the labor cost dominates the positive effect of higher collateral, and their rate decreases. Conversely, the unincorporated rate does not change much as some move to the paid sector, but others that were incorporated before shift to the unincorporated sector.

6 Conclusion

This paper documents new evidence of a heterogeneous entrepreneurship decline as the unincorporated sector drives it. I show that this pattern of declining entrepreneurship is pervasive across demographic characteristics and is a robust feature of U.S. survey data.

The incorporation status of entrepreneurs serves as a proxy for distinguishing two types of entrepreneurship. The unincorporated sector is almost entirely made up of non-employers, who are less likely to need start-up capital for their business and have smaller firms. To study the trends by incorporation status, I extend an otherwise standard model of occupational choice with heterogeneous agents to include an entrepreneurial sector in which entrepreneurs face no entry costs and do not hire a production factor, similar to the unincorporated sector.

Using a calibrated version of the model and counterfactual exercises, the ISTC can explain the trends observed in the United States, where more entrepreneurs are now incorporated. First, technological progress exerts downward pressure on entrepreneurship as it improves their outside option (wage increases). However, the entrepreneurs who can take advantage of the technological change because they have very good ideas – high entrepreneurial productivity – and have the wealth needed to finance their firm do not face such significant trade-offs with the paid sector as those who do not use any capital in their firm and do not take advantage of the ISTC (more likely, unincorporated). I find that the general equilibrium effects lead to higher asset accumulation and a higher share of the entrepreneurs can finance incorporated-type entrepreneurial firms.

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Appendix

A Additional details about the data samples used in the empirical section

CPS data. The Current Population Survey (CPS) surveys about 60,000 households from all 50 states and the District of Columbia. The institutionalized population (people in prisons, long-term care hospitals, and nursing homes) is not surveyed, and the labor force questions focus on all individuals aged 14 or 15 and over (depending on the survey year). Generally, one person in the household, the "reference person," responds to questions about all eligible household members. The reference person is usually the person who either owns or rents the housing unit; however, if the reference person is not knowledgeable about the employment status of any other member of the household, attempts to contact the member directly are made. I access the data through the IPUMS-CPS harmonization project of the Minnesota Population Center.

Entrepreneurship definition. The exact question used to identify entrepreneurship and incorporation status is:""Were you employed by government, a private company, a nonprofit organization, or were you self-employed?". The universe of the question is the eligible person who ever worked, and the question refers to her current or previous job (in case the person is not employed). I focus only on the individuals ages 16 and over classified as currently employed by the CPS. Respondents who say that were self-employed are asked, "Is this business incorporated?" Those who answer yes to this question are classified as incorporated, and those who answer no are the unincorporated self-employed.

CPS 1994 redesign. The CPS had an important redesign in 1994 that included a new questionnaire and modernization of the data collection methods. The redesign could affect the comparability of some labor force measures pre and post-1994. Indeed, the redesign involved changing the ordering of the question used to establish the class of worker (wage employed, self-employed, etc.), moving it from being asked after the occupation and industry information is recorded. The problem was that the previous ordering could induce interviewers to fill out the class of worker questions without asking the question to the respondent (Polivka and Rothgeb, 1993). To be able to use the information starting in 1983, which is the year that the incorporation status variable is available, I use the multiplicative adjustment factors calculated by Polivka and Miller (1998) for the total self-employment rate and for the self-employment rates by incorporation status. These factors are calculated using information from a parallel survey run from July 1992 to December 1993 that uses the new methodology. This allows them to estimate the "survey effect" on aggregate labor force measures and a comparable series without the survey effect. I use the adjustment factor to make the series pre-1994 comparable to the post-redesign series. I use the multiplicative factors as they are recommended for comparisons over long periods. For series where the adjustment factors are unavailable (for instance, the self-employment rate by college attainment), I only use the data starting in 1994.

SIPP data. I access the SIPP data through NBER's Public Use Data Archive.

Entrepreneurship definition. The Survey of Income and Program Participation (SIPP) asks the adults in the household (those 15 years old or older) whether they had at least one paid job at some point during the reference period. The reference period covers the 4 months prior to the survey interview. Next, they are asked whether the job was for an employer, self-employed, or both. Workers, those who did any paid job, are then surveyed about up to two jobs for an employer (those where they worked the most hours) and up to two businesses (those which produced the highest earnings before expenses during the reference period). Among the questions about the business is "Is (was) this business incorporated?" which we use for identifying the incorporated businesses. The universe for the latter question is formed by the businesses that had past or anticipated gross earnings of at least $2500 over the last 12 months or future 12 months, which is probably not biding for my focus on businesses that are workers' main economic activity.

Value of business definition. The value of the business comes from the following question: "As of the last day of the reference period, what was the total value of the business before figuring in any debts that might be owed against it?". The universe for the question is formed by the businesses owned by the worker on the last day of the reference period or sold on that day or later. Thus, the statistics presented in Section 2.3 cover the businesses that are workers' main job, which are owned on the last day of the reference period and had past or anticipated annual gross earnings of $2500 or more.

SBO data. I access the data through the SBO – PUMS file made available by the Census corresponding to the 2007 SBO.

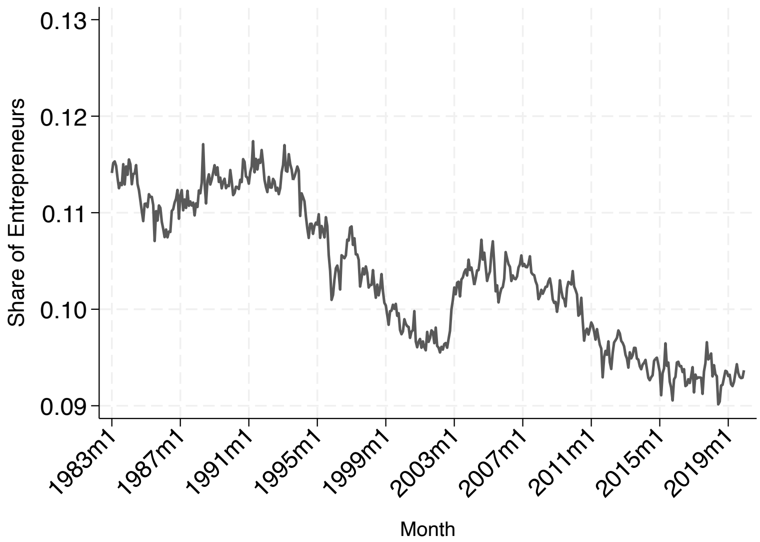
B Robustness empirical results

B.1 Shift towards incorporation across different samples

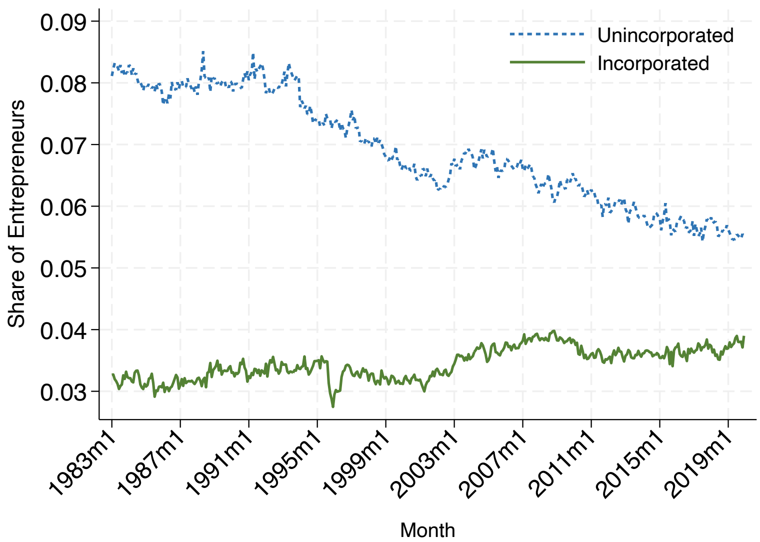
The following figures present additional evidence to support the claim that the observed shift towards incorporation driven by a stronger decrease of the unincorporated sector is a robust future of the U.S. economy. The same finding is observed when focusing only on the sample of workers ages 25 to 64 years old (Figure B1), when using data from the American Community Survey (ACS), available for 2001-2019 (Figure B2) or across different demographic groups— using the original CPS sample— such us age group, sex and rural status (Figure B3).

Figure B1: Entrepreneurship Rate and Incorporation Status, 1983-2019, Sample Ages 25-64 y.o.

(a) Entrepreneurship Rate



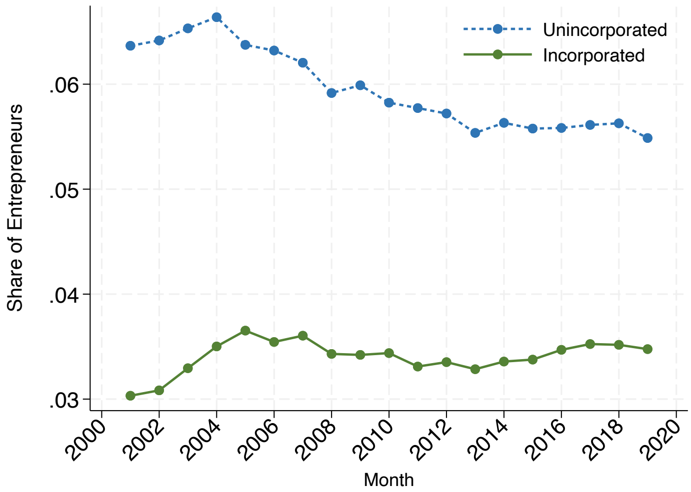
(b) Entrepreneurship Rate, by Incorporation



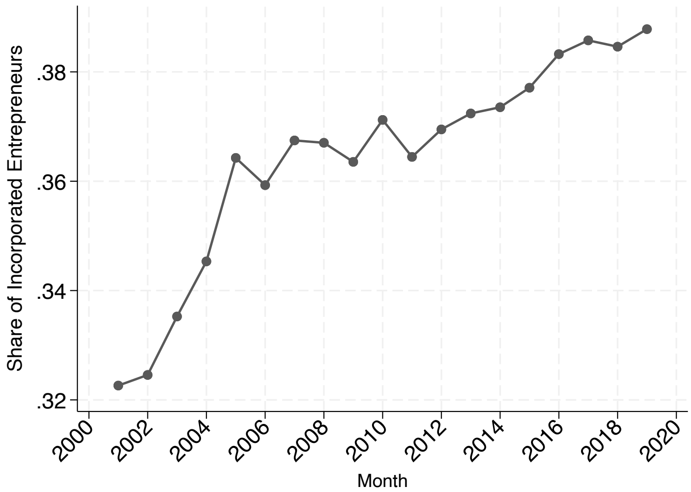
Source: Own calculations using monthly data from the Current Population Survey, 1983-2019.
Notes: Panel (a) plots the share of entrepreneurs (self-employed workers in their main job) in the sample of civilian non-farm workers aged 25-64 years old. Panel (b) plots the same shares by incorporation status of the entrepreneur's business. All series were seasonally adjusted using the X-13ARIMA-SEATS Seasonal Adjustment Program.

Figure B2: Entrepreneurship Rate and Incorporation Status, 2001-2019, American Community Survey

(a) Entrepreneurship Rate, by Incorporation



(b) Share of Incorporated, among Entrepreneurs



Source: Own calculations using data from the American Community Survey
Notes: Panel (a) plots the share of unincorporated and incorporated entrepreneurs in the sample of entrepreneurs (self-employed) in the sample of civilian non-farm workers aged 16 years or older. Panel (b) plots the share of incorporated entrepreneurs among all entrepreneurs.

C Data for calibration

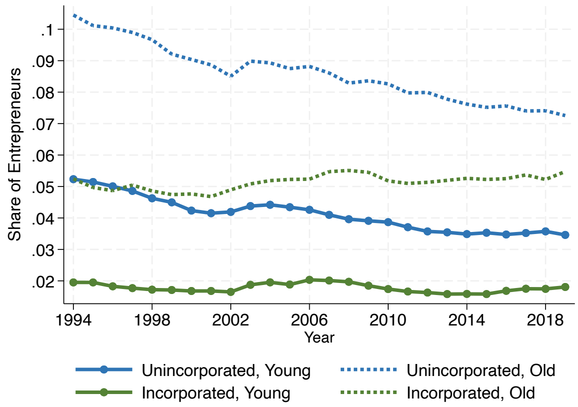
Entrepreneurial ability process

PSID sample: The sample is formed for household heads ages 18 or older who declared to be working, on temporary layoff (including sick or maternity leave), or otherwise declared to be doing any work for money. Self-employed workers are identified from the question: "On your main job, are you self-employed, employed by someone else, or both?". I keep those

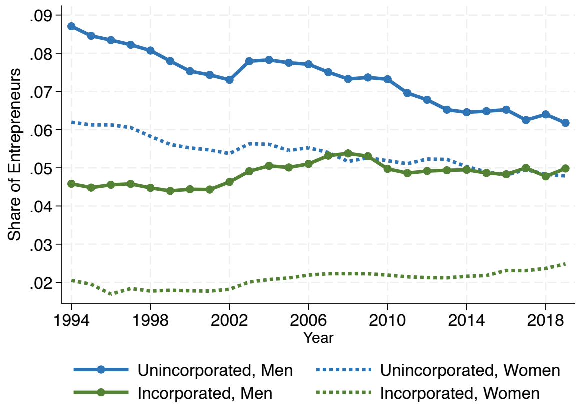
Figure B3: Entrepreneurship Rate and Incorporation Status, 2001-2019, CPS

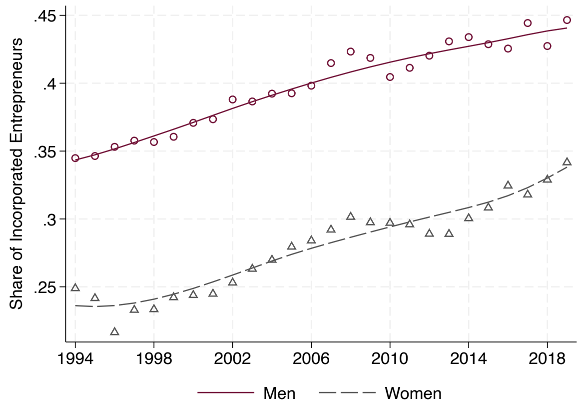
Entrepreneurship Rate, by Incorporation | Share of Incorporated, among Entrepreneurs

(a) By Age Group

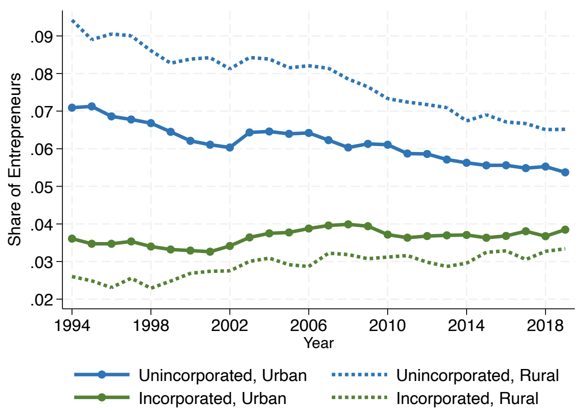


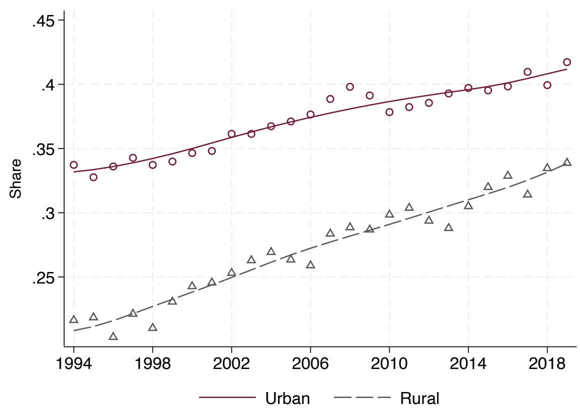
(b) By Sex





(c) By Location (urban / rural)





Source: Own calculations using data from the Current Population Survey, 1994-2019.
Notes: The figures in the left column plot the unincorporated and incorporated entrepreneurship rates by the corresponding binary demographic groups in the panel's title. The figures in the right column plot for each demographic group, the share of incorporated entrepreneurs among all entrepreneurs. Sample: Civilian non-farm workers aged 16 years or older. The data started in 1994 because of the CPS redesign (See Appendix A).

who are only self-employed as there is no way to separate income for each job. The self-employment question corresponds to the current year, but the income variable refers to income in the previous year. I take advantage of the panel structure of the survey and match the income information in the survey in year t with the occupation classification in survey year $t-1$.

The dependent variable in the first stage is the log of the real hourly labor income. Total annual labor income includes labor part of income from business, wages, tips, income from professional practice,

Occupational shares

The occupational shares I use as targets in calibrating the benchmark economy are the annual average of the monthly unincorporated and incorporated self-employment rates in 1983 using the CPS monthly sample. With these values and the corresponding values for 2019, I calculate the change in occupational choice.

Employment share by the incorporated entrepreneurs

I approximate the employment share by incorporated entrepreneurs because I don't observe it for the sample of self-employed workers in the CPS. The CPS provides only bracketed information about the number of employees. I could approximate the number using the employment share by small firms from sources like the Quarterly Census of Employment and Wages (QCEW). Still, it has the drawback that even small firms or establishments might not be owned and managed by self-employed workers. For reference, the private employment share by small firms (less than 99 employees per establishment) in the 1990 QCEW is 51%.

I approximate the share of employment by incorporated entrepreneurs, combining information from the PSID and the CPS in 1985 as follows. (i) Data on the number of employees (firm size) for the incorporated self-employed is available only for the 1985 PSID. This sample of self-employed workers includes only the household heads, and the variable is capped at 99 employees. I tabulate this variable and obtain the firm size distribution for this sample of workers. (ii) From the CPS, I calculate how many workers and incorporated self-employed heads, in absolute value, are in the economy, using the CPS expansion factors. (iii) I combine the information in the first two steps and calculate the total number of workers hired by the entrepreneurs. For instance, suppose that the PSID firm size distribution implies that 5% of entrepreneurs have two employees. Then, the number of workers hired by entrepreneurial firms with two employees is 2*0.05*total number of entrepreneurs. In the same way, the calculation can be done for entrepreneurial firms of all sizes up to 99. (iv) The final share of employment by the incorporated entrepreneurs is the total number of workers hired by the incorporated entrepreneurs divided by the total number of workers.

Given the assumptions, the method estimates the number of workers in entrepreneurial firms owned by heads of households that are small (less than 99 employees). In this sense, it is an underestimation of the true value. But at the same time, it assumes that every firm is owned by only one entrepreneur, and in this sense, it overestimates the employment share. In any case, I find the employment share at 34%, which is a sensible value given the employment share in small firms implied by the QCEW data.

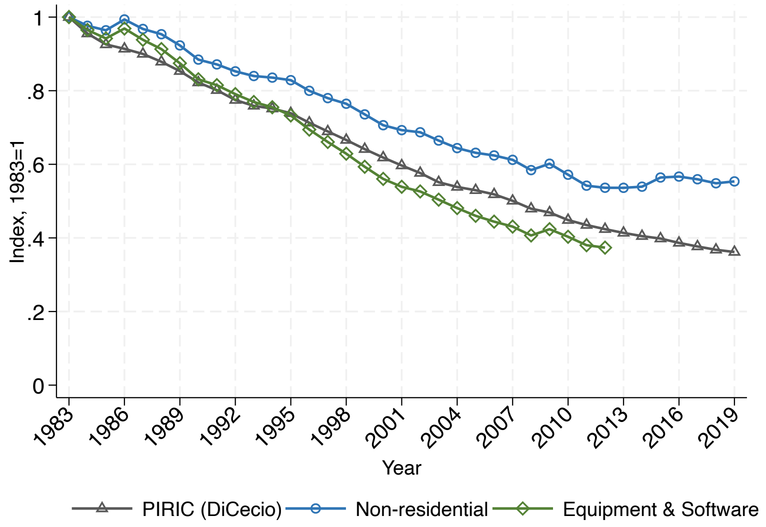
Relative cost of capital ($\frac{1}{q}$)

Measures for the relative price of investment goods are constructed as the ratio of the investment deflator and consumption deflator. Figure C4 plots three alternative measures for the relative price of capital that evidence a downward trend. All the series use data from the Federal Reserve Bank of St. Louis' data repository, FRED. The first measure corresponds to the relative price of investment as available in FRED (PIRIC series), which is based on DiCecio (2009) methodology for constructing the investment and consumption deflator series. Alternatively, one could calculate the relative investment price as the ratio of the deflator for investment in non-residential structures and the price index for personal consumption expenditure (PCE) non-durable goods. Finally, the ratio of the price index for Equipment and Software and the same price index for consumption is presented.

D Algorithm

I explain the algorithm to solve the model in this section. I focus on the steady-state equilibrium for the baseline and counterfactual results. Before solving the model, I discretize the state space (a, y, θ). I set a 280-point grid for the asset level in the [0,2000] range. The asset grid is not equidistant but denser at lower asset levels, where most of the population is located. I set a 7-point grid for labor and entrepreneurial ability after discretizing the processes using the

Figure C4: Relative Price of Capital



Source: Own calculations based on data from FRED.
Notes: "PIRIC" corresponds to the annual average of the series PIRIC on FRED. "Non-residential" is the nonresidential investment deflator (series: A008RD3Q086SBEA) divided by the consumption in non-durables deflator (series CUUR0000SAN). "Equipment and Software" is the equipment and software deflator (series Y033RD3A086NBEA) divided by the consumption in non-durable goods deflator.

Rouwenhorst method. This procedure sets the state space and Markov transition matrix from which the corresponding invariant distributions are obtained. The invariant distribution is used for the productivity draws of the newborn. The algorithm to find the steady state, given a completely parameterized model, is as follows:

1. Guess the vector of prices r and w. First, guess the interest rate, r, and then set $w = w(r)$. The wage rate will depend only on the guessed interest rate and parameters per the optimization problem of the non-entrepreneurial sector, considering that for a given allocation to be optimal, there must be a unique mapping between w and r. This allows me to iterate only on the equilibrium for one market (capital) instead of two markets. I found the mapping as follows.

   The two first order conditions of the non-entrepreneurial sector are:

$$\alpha N^{\alpha-1}K^{1-\alpha} - w(1+0.5\tau^{p}) = 0 \quad \text{(D.1)}$$

$$(1-\alpha)N^{\alpha}K^{-\alpha} - \tilde{r} = 0, \quad \text{where} \quad \tilde{r} = (r+\delta)\frac{1}{q} \quad \text{(D.2)}$$

From (D.1) and (D.2), the optimal capital labor ratio can be expressed as: $\frac{K}{N} = \frac{1-\alpha}{\alpha}\frac{w(1+0.5\tau^p)}{\tilde{r}}$. After inserting this equation for $\frac{K}{N}$ on equation (D.1) we can solve for w in terms of parameters and r:

$$w(r) = \left[\frac{1-\alpha}{\tilde{r}}\right]^{\frac{1-\alpha}{\alpha}} \frac{\alpha}{1+0.5\tau^p} \tag{D.3}$$

2. Given the prices, solve the optimization problem of the households. This includes finding the policy functions for consumption, savings, and occupation. I use the Endogenous Grid Method adapted to optimization problems with discrete choice (Rust et al.), which significantly improves computational time with respect to value function iteration. This method involves finding the consumption and policy function for each of the three occupational choices by interpolating the policy rule for consumption using the mapping between an exogenous grid for savings and optimal consumption derived from the first-order condition. Using the first-order condition instead of a root-finding algorithm significantly improves the computation time.

3. Find the stationary distribution of the households over the discrete state space. Starting from an initial distribution of individuals over the state space, I iterate until convergence using the decision rules, transition matrices, and invariant distributions for the ability process.

4. Calculate the following aggregates: the supply of capital by households, the demand for capital by the incorporated entrepreneurs, the total supply of labor in efficiency units, and the total demand for labor by the incorporated entrepreneurs. Calculate the demand for capital and labor, K and N, by the non-entrepreneurial sector as the difference between the supply and demand by the incorporated entrepreneurs. If either value is negative, update the initial guess and repeat from step 1.

5. Check that the allocation for the non-entrepreneurial sector is optimal using the first-order condition with respect to capital. I calculate the interest rate so that the capital-labor ratio is optimal, the "implied" interest rate $r^* = \frac{(1-\alpha)q}{(K/N)^\alpha} - \delta$ and check the following condition: $(r - r*)/r < 0.01$. If the condition is not satisfied, guess a new interest rate and repeat from step 1. If the condition is satisfied, a stationary equilibrium has been found.

Steps 1 to 5 are followed to solve the model and find a stationary equilibrium given the complete set of parameters. To calibrate the five parameters, I use the Nelder-Mead routine to search over different parameter candidates and minimize the distance between the target and model-generated moments.

I take the code provided by Alan Miller for Fotran 90 (https://jblevins.org/mirror/amiller/)