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What's driving the decline in entrepreneurship?[☆]

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A B S T R A C T

Why has there been a steady decline in entrepreneurship in the US in recent decades? To answer this question, I develop a general equilibrium occupation choice model and combine it with data on these choices. Skill-biased technical change can account for much of the decline in the relative entrepreneurship rate of more educated people, but cannot explain the decline in the aggregate level of entrepreneurship. The major factors in the decline in the share of people who are entrepreneurs, the firm entry rate, and the size of the entrepreneur sector are rising entry costs and outsized productivity gains by large non-entrepreneur firms.

1. Introduction

The US is famous for providing an environment that fosters entrepreneurship and for its high degree of competition that ensures that the best firms flourish. Research supports the idea that entrepreneurship plays an important role in the economy by identifying its relevance for growth, job creation, income and wealth inequality, and economic mobility.[1] Entrepreneurship also receives considerable policy attention, for example through the Small Business Administration, and discussion in the media. In light of this, research documenting that measures of entrepreneurship in the US have declined in recent decades (e.g. Davis et al., 2006; Decker et al., 2014a,b; Pugsley and Sahin, 2019) have generated considerable concern.[2]

The purpose of this paper is to address the question, why has there been a decline in entrepreneurship? Answering this question is important for two reasons. First, it is a step towards understanding the economic consequences of this trend, because different explanations will have different implications. For example, if the decline in entrepreneurship is due to regulations impeding business

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1 For growth of the economy see, for example, Luttmer (2011), Acemoglu et al. (2018), Akcigit and Kerr (2018), Garcia-Macia et al. (2019). For job creation see Haltiwanger et al. (2013), Adelino et al. (2017). For inequality and economic mobility see, for example, Quadrini (2000) and Cagetti and De Nardi (2006).

2 For discussion of this trend in leading media outlets see Weissmann (2012); Casselman (2014), Anon (2014), Harrison (2015).

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creation then the consequences are likely to be worse than if changes in technology have made it optimal to have fewer, but larger, firms. Second, different causes will have different policy implications. Identifying the cause is necessary for determining whether any policy response is appropriate and, if so, what.[3]

To answer this question I develop a general equilibrium occupational choice model to capture peoples' decisions about whether to run a business, and study corresponding choices in the data. The occupational choice perspective provides new empirical facts about the decline in entrepreneurship, which allow me to evaluate a range of potential explanations. Simultaneously evaluating several explanations has an advantage when some of the explanations are difficult to measure directly. A common approach is to fit a model to match the change in a particular moment of the data, and then assess the performance of the explanation with respect to changes in other moments. This risks overfitting the model to the targeted moment, and thereby overestimating the quantitative power of the explanation in question. Considering a range of explanations simultaneously, reduces this issue.

Empirically, I consider three dimensions of entrepreneurship: the share of the labor force who own and operate a business (the *entrepreneur share*), the size of entrepreneurial businesses, and the entry rate of new firms in the economy. While the decline in the entry rate is a widely documented fact (see, for example, Decker et al., 2014a,b; Pugsley and Sahin, 2019), the other facts come from looking at occupational choice data. I show that the entrepreneur share has declined by 16%–24%, depending on the definition used, between 1987 and 2015. Additionally, the businesses of entrepreneurs have not grown in size to offset this decline, implying that economic activity has shifted towards non-entrepreneurial firms over time, such as large publicly-listed firms. A further striking feature of the data is that the decline in the entrepreneur share has been much larger for more educated people.

To interpret these changes in the data, I use a dynamic, general equilibrium, occupation choice model that contains a number of potential explanations for the empirical facts. A natural consideration for the larger decline in entrepreneurship for the more educated is skill-biased technical change (SBTC). This force has pushed up the wages of high-skill people making dependent employment more attractive. SBTC is modeled in a standard way with two types of capital and changes in their prices shifting labor demand.[4] Other types of technical changes are also promising. The 'superstar firms' idea (Autor et al., 2020) is that technological developments have disproportionately advantaged larger firms, which I model as increasing productivity in the non-entrepreneur sector.[5] Another line of thinking links productivity increases with larger fixed or entry costs (see Aghion et al., 2023; Hsieh and Rossi-Hansberg, 2023; De Ridder, 2024; Weiss, 2020). There are other potential causes of rises in these costs, including increases in regulations covering areas such as occupation licensing, environmental protection, occupational health and safety, and food safety.[6]

SBTC is most promising as an explanation for the empirical changes in entrepreneurship because it increases the high-skill wage. This decreases the entrepreneur share of high-skill people as well as the aggregate entrepreneur share. However, it is important to consider the origin of this wage change and its other effects. The decrease in the price of IT capital that drives SBTC also decreases the low-skill wage because these two inputs are relatively substitutable. The decreases in this price and wage increase profits for all entrepreneurs, pushing the entrepreneur share up. When the model is carefully estimated, SBTC explains much of the decline in the *relative* entrepreneur share of more educated people, but it cannot explain the decline in the aggregate entrepreneur share.

For increases in fixed costs, entry costs and the productivity of non-entrepreneur firms, there are two key distinctions between their effects on entrepreneurship. First, all of these changes decrease the entrepreneur share and the size of the entrepreneur sector. However, increasing fixed and entry costs decrease wages, while increasing non-entrepreneur productivity increases wages, so they have different effects on the extensive margin of entrepreneurship (number of entrepreneurs) and the intensive one (size of entrepreneur firms). Second, I show that while entry costs decrease the entry rate, rising fixed costs increase it. This analysis shows that changes in these parameters have independent effects on our three moments of entrepreneurship, providing an identification strategy for estimating their changes.[7] Quantitatively, all of these changes to the economy have some explanatory power for the data, but none of them is a home run on its own. Increasing entry costs are the dominant factor in generating the decline in the firm entry rate, increasing productivity of non-entrepreneur firms accounts for most of the shift in employment to the non-entrepreneur sector, and all three factors contribute significantly to the decline in the entrepreneur share.

A robustness exercise considers how allowing for changes in labor force growth to affect entrepreneurship, as argued by Karahan et al. (2024), Hopenhayn et al. (2022) and Peters and Walsh (2021), affects the results. By construction this decreases the magnitude of the changes in the data to account for, but the messages about the relative roles of the mechanisms studied in this paper hold.

As preliminary guidance on the underlying cause of the rise in fixed and entry costs, I provide cross-sectional evidence that supports roles for rising regulation and technological change driven by increasing adoption of IT.[8] The final section of the paper considers policies that could boost entrepreneurship. A subsidy for the creation of new firms is more effective than a subsidy to all entrepreneurs or a tax on the non-entrepreneur sector because it is more targeted towards people who would not otherwise be entrepreneurs. It not only increases entrepreneurship more relative to cost, but also increases aggregate consumption and output the most.

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[3] For discussion of the decrease in firm entry by a policy maker see Yellen (2014).

[4] See Krusell et al. (2000) and Autor et al. (2003).

[5] See Davis and Haltiwanger (2014) for discussion of this idea. While it is beyond the scope of this paper to assess why exactly this has occurred — I model it in a general way — ideas include that new technologies have enabled people to better compare prices and qualities which advantages the most productive firms, or larger firms are better placed to take advantage of new technologies because of their size or better access to financing.

[6] See Decker et al. (2014a), Davis and Haltiwanger (2014) and Davis (2017) for discussions of increasing regulation as an explanation for changes in business dynamism. Kleiner (2015) shows that the prevalence of occupational licenses has increased over time. Some other possibilities for rising fixed and entry costs include increases in the cost of finding a new idea (Bloom et al., 2020) or increasing market entry costs, such as the cost of establishing a customer base (Bornstein, 2021).

[7] Independence is in the linear algebra sense of the term.

[8] Existing research has argued that this technology is associated with higher upfront costs and lower marginal costs. See Aghion et al. (2023), Hsieh and Rossi-Hansberg (2023) and De Ridder (2024).

Contribution to the literature. The main contribution of the paper is to further our understanding of what has caused the decrease in entrepreneurship. Empirically, evidence of declining entrepreneurship has been documented in some recent papers (see Davis et al., 2006; Decker et al., 2014a,b; Pugsley and Sahin, 2019; Hyatt and Spletzer, 2013). This research primarily focuses on measuring entrepreneurship with the firm entry rate and uses firm microdata to study the phenomenon. By using occupational choice data I provide new facts that are useful for evaluating competing theories. The decline in the share of people who are entrepreneurs and the skill-biased nature of this decline are contributions that are shared with Salgado (2019) and Jiang and Sohail (2023). These papers were developed simultaneously with, and independently of, the present paper. Evidence that the size distribution of entrepreneur firms has been stable over time is unique to this paper, and plays a key role in distinguishing between alternative explanations.

In evaluating the causes of the decline of entrepreneurship, the main contributions are to assess the relevance of SBTC and to quantify the contribution of a range of explanations in a unified framework. Salgado (2019) and Jiang and Sohail (2023) also evaluate SBTC in their contemporaneous work. Relative to these papers I evaluate SBTC alongside other potential explanations, and identify the contribution of each of these by bringing the model and data together. In contrast to these papers, I find that neither SBTC or increasing productivity of superstar firms are able to explain the decline in the range of entrepreneurship moments that I consider and that, instead, rising entry costs are key to understanding the changes that we have seen.

The relevance of rising fixed or entry costs for the decline in some measures of entrepreneurship, as well as other macroeconomic trends, are considered by De Ridder (2024), Barkai and Panageas (2021) and Gutiérrez et al. (2021). The present paper considers these factors alongside others, in a unified framework, and evaluates them using a broad range of entrepreneurship moments. Hsieh and Rossi-Hansberg (2023) and Weiss (2020) consider rises in these costs for other macroeconomic trends.

Karahan et al. (2024), Hopenhayn et al. (2022) and Peters and Walsh (2021) evaluate the effect of a decreasing labor force growth rate on the firm entry rate. A robustness exercise considers the impact of this explanation on the results. There are also demographic theories based on the aging of the population (Kopecky, 2017; Engbom, 2017),[9] research into the relevance of changes in market power (De Loecker et al., 2021), and analysis of the effect of increasing inertia in customer bases (Bornstein, 2021). Akcigit and Ates (2023, 2021) study the effect of a range of changes to the economy in an innovation model. Methodologically, De Loecker et al. (2021) and Akcigit and Ates (2023) are closest to this paper. They also use a range of data moments to disentangle competing explanations.

This paper also contributes to the literature on skill-biased, and routine-biased, technical change (e.g. Krusell et al., 2000; Autor et al., 2003; Acemoglu and Autor, 2011; Autor and Dorn, 2013; Lee and Shin, 2016) by showing that these changes to the economy affect entrepreneurship as well the jobs and wages of employees.

From here, Section 2 provides empirical facts and Section 3 the model. Section 4 evaluates explanations for the decline in entrepreneurship theoretically. Section 5 calibrates the model, quantitative results are presented in Section 6, and Section 7 evaluates policies for boosting entrepreneurship.

2. Empirics

2.1. Data description

The data is the Current Population Survey (CPS). For the majority of the analysis I use the Annual Social and Economic Supplement (the March supplement) for 1988–2016 and focus on the civilian non-institutionalized population of people aged 25–65 who are not working in the agriculture or government sectors.[10] This provides cross-sectional samples taken in March each year that, once weighted, are representative of this population. The surveys ask respondents about their employment experience in the previous year, so the data covers 1987–2015. The sample size ranges from 63,019 to 105,283 individuals with an average of 87,292.

For the empirical analysis I define an entrepreneur to be a person who is self-employed and has at least 10 employees in their business. The paper focuses on classifying people according to their main job in the calendar year prior to when each survey was conducted, since the March supplement provides information on income and firm size for these jobs.[11] The CPS classifies peoples' main jobs into five categories depending on who the work was for: the government; a private for profit company; a non-profit organization, including tax exempt and charitable organizations; self-employment; or for a family business.[12] In defining an entrepreneur I place a size threshold on their business to focus attention on the most economically significant businesses and avoid concern that any of the results are driven by very small businesses. I choose a threshold of 10 employees since this is the smallest threshold (other than zero) that is available for most of the sample period (1991–2015). All results hold without this size threshold.[13]

[9] The empirical evidence underlying these is controversial as the aging of the population implies an increase in the entrepreneur share and the entry rate over time, based on estimates of these rates, conditional on age, from the Current Population Survey and Azoulay et al. (2020).

[10] The data has been accessed from the Integrated Public Use Microdata Series (Flood et al., 2015), commonly known as IPUMS. Data prior to 1988 is omitted because the pre-1988 survey does not allow for a consistent measure of self-employment over time. See the Appendix for a discussion of this. I use ages 25–65 to reduce the effect of changes in education and retirement decisions over time. I exclude the agriculture sector since there has been a significant decline in self-employment in this sector over time and want to eliminate concern that any of the results are driven by this.

[11] A person's main job is their longest job in the previous year. Over the sample period, employed people earned an average of 96.4% of their self-employment and dependent employment income in the previous calendar year from their longest job.

[12] In recent years the wording of the question that determines this has been: were you employed by government, by a PRIVATE company, a nonprofit organization, or were you self-employed or working in a family business? (Capitalization in original.).

[13] For those not presented in the main text, see the Appendix.

Table 1
Size distribution of self-employed businesses and firms, 1997. The Self-employed column is the number of self-employed people with businesses in each size category (CPS and BLS). The Firms column is the number of firms in each size category (Business Dynamics Statistics and Non-employer Statistics). Agriculture and public administration sectors are excluded where relevant.

Firm size (employees)	*Self-employed (000's)*	*Firms (000's)*
<10	8,205.5	18,750.8
10–99	1,040.3	1,035.1
100–499	135.0	75.3
500–999	26.2	8.0
1000+	133.3	9.5

To give a sense of what component of the economy self-employed people account for, Table 1 presents information on the size distribution of the businesses of the self-employed and the size distribution of all firms in the economy for an example year, 1997. The *Self-employed* column provides the number of self-employed people with businesses in five size categories, measured with the number of employees, while the *Firms* column provides the number of firms in the whole economy in these categories. Self-employed people account for a little less than half of the smallest businesses (<10 employees). Assuming that the self-employed in this size category have one firm each, which the data supports,[14] there are approximately 8.2 million business in this size category associated with a self-employed person, and 10.5 million without. The latter can arise because of people owning businesses which they do not run as their main occupation. For medium sized businesses (10–99 employees), self-employed people account for most of them: there is an average of 1.35 owners per firm so the self-employed account for 770 thousand out of the 1.04 million firms.[15] For large businesses (100+ employees) there are many more self-employed people than firms: 133,300 compared to 9,500. While I do not have an estimate of the number of owners per firm in this category these numbers indicate that there are many self-employed people running large businesses.[16]

2.2. *Aggregate entrepreneur share*

I define the aggregate entrepreneur share to be the share of the labor force who are entrepreneurs.[17] I use the labor force as the denominator rather than the population to abstract from the effect of changes in labor force participation over time. I define the self-employed share analogously. These two shares are presented in Fig. 1(a). The entrepreneur share (right hand axis) has declined from 1.56% to 1.19%, a 24% decrease, while the self-employed share (left hand axis) has declined from 11.4% to 9.6%, a decrease of 16%. Both rates have cyclical fluctuations but downward trends.

There are a number of factors that could explain this fact, which would not imply that there has been a general decline in entrepreneurship. The aggregate decline could be the result of composition effects, it could be driven by the small number of sectors, it could be due to a decreasing share of entrepreneurs being captured by the definition over time because of changes in time allocation between occupations or ownership structure. In the Appendix I show that the fact is robust to these considerations.

2.3. *Entrepreneur firm size*

The second fact is that the size distribution of entrepreneur firms has been stable over time. Fig. 1(b) presents the share of self-employed people with firms in different size categories for 1991–2015.[18] It shows that the shares in each category have been approximately flat over time. There is an uptick in the share of the self-employed with businesses with 500–999 employees at the end of the sample, but this is only in the last three years and so does not establish a long run upward trend.

This fact has two important implications. First, it means that the decline in entrepreneurship has not been concentrated among the smallest businesses that are likely to have the least economic impact. The trend appears to apply to businesses evenly across the size distribution. Second, the fact that the size distribution has been fairly stable and the share of the labor force who are self-employed has decreased indicates that over time there has been a shift in economic activity towards firms that are not run by a self-employed people. I will call these *non-entrepreneur* firms.

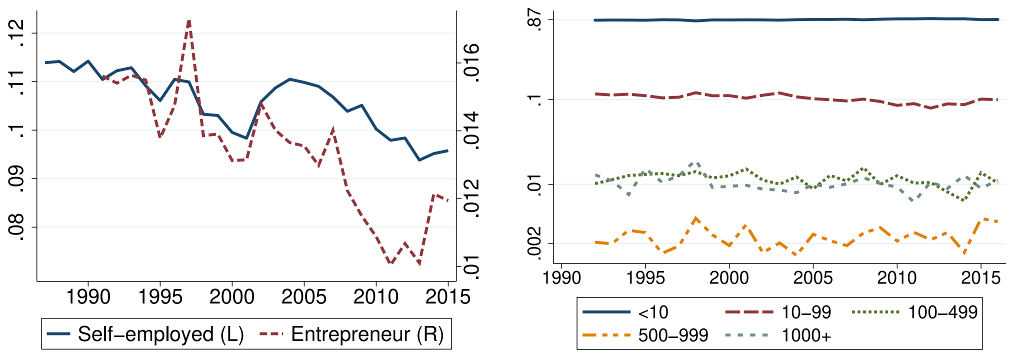
[14] In 1992 there was 1.07 owners per business for businesses with less that 10 employees in the US. Assuming that most of these owners work in their business as their main job, which seems reasonable for small businesses, this supports that there is approximately one self-employed person per business in this size category. The data source for this is discussed in the Appendix.

[15] See the Appendix for a discussion of this owners per firm estimate.

[16] The Survey of Business Owners does not provide a useful estimate of the number of owners per firm in this size category because it omits C corporations, which are relevant in this size category.

[17] See the Appendix for the details of the labor force definition.

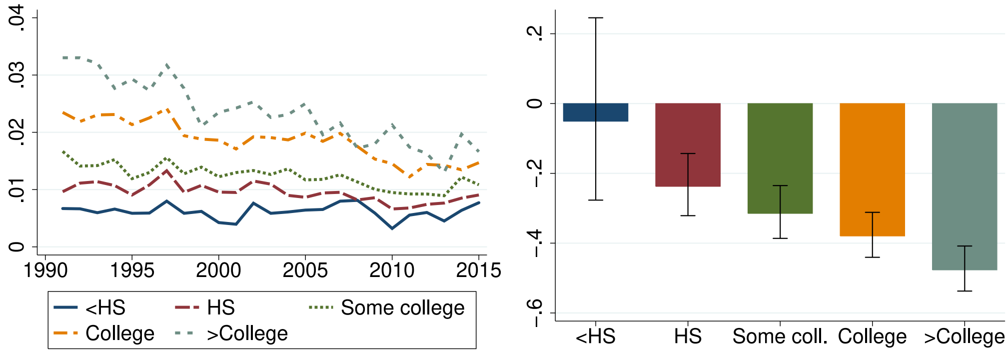
[18] I omit 1987–90 since the size categories are different for this period.



(a) Entrepreneur and self-employed shares

(b) Size distribution of businesses

Fig. 1. Entrepreneur share and size distribution of businesses. The self-employed and entrepreneur shares are the shares of the labor force who are self-employed and entrepreneurs, respectively. Their values are presented on the left and right axes of panel (a), respectively. The scales are such that the relative values of the two axes are constant. Panel (b) presents the distribution of the number of employees of businesses of the self-employed (log scale).



(a) Entrepreneur share, 1991–2015

(b) Percentage change, 1991/94–2012/15

Fig. 2. Entrepreneur share by education and percentage change. Panel (a) is the share of the labor force for each education level who are entrepreneurs. Panel (b) is the relative change in the entrepreneur share from 1991–94 (pooled date) to 2012–15 for each education group (i.e. −0.1 is a decline of 10%). The whiskers are 95% confidence intervals estimated by Poisson regression.

2.4. Changes in entrepreneurship by education

The third fact is about how the decrease in the entrepreneur share has differed across the education distribution. For this analysis I divide the sample into five groups according to the highest level of education that each person has completed: less than high school (<HS), high school (HS), some college education but less than a bachelor's degree (some college), a bachelor's degree (college) and more education than a bachelor's degree (>college). Fig. 2(a) shows that the entrepreneur share is higher for more educated people throughout the period of analysis and has been decreasing more rapidly. To compare the changes in entrepreneur shares across these groups, panel (b) presents the percentage change in the entrepreneur share from 1991–94 to 2012–15 for each group. I pool data across years at the end points to smooth out year to year volatility. It shows a clear pattern of larger decreases in the entrepreneur share for higher education levels. At less than a high school education the decrease is 5.1% while for more than a college education the decrease is 47.7%.

The larger decline in entrepreneurship for more educated people is robust to a number of considerations, which are explored in detail in the Appendix. The fact holds when the self-employed share is used instead of the entrepreneur share, so it applies for people with smaller business as well as larger ones. The professional services, and finance, insurance and real estate sectors, account for a relatively high share of employment for higher education groups, so it could be that these sectors are driving the result. This would be the case, for example, if the fact was due to lots of lawyers, doctors and accountants switching from running their own businesses to working for someone else. However, the fact holds when these sectors are dropped from the sample, and the magnitudes of the declines conditional on education remain very similar.

To summarize, the share of the labor force who are entrepreneurs has declined and, since entrepreneurial firms have not increased in size, that labor has shifted towards the non-entrepreneurial sector. In addition to these two margins of entrepreneurship declining, it is well known that the rate at which new businesses are being formed has also declined (see, for example, Decker et al., 2014b; Pugsley and Sahin, 2019). The decline has been skill-biased, with a larger fall in the entrepreneur share for more educated people. These four moments of the data will form the basis for evaluating potential explanations.

3. Model

3.1. Environment

Time is discrete and infinite, and there is a unit mass of agents. When an agent is born it has a type, high or low-skill, which is fixed for life. With probability θ_h an agent is a high type, and otherwise they are a low type. An agent that is a high type draws a productivity z_h for doing high-skill work at birth, and if they are a low type then they draw a productivity for low-skill work z_l. Each agent also receives an entrepreneurial productivity z_e at birth. To simplify notation going forward, let $\mathbf{z} = [z_s, z_e]$ be the productivity vector of an agent, with $s \in \{l, h\}$. At birth this productivity vector is drawn from a distribution $G^s(\mathbf{z})$ for a type s agent. It then evolves stochastically over time according to a Markov chain, $G^s(\mathbf{z}'|\mathbf{z})$. The distribution for initial draws, $G^s(\mathbf{z})$, is the stationary distribution of the Markov chain. Agents discount the future at rate β and each agent dies at the end of each period with probability δ. An agent that dies is replaced by a new agent at the start of the next period.

For the quantitative exercise later in the paper, θ_h and the productivity distributions will be allowed to depend on an agent's education level so that the model can be mapped to the data. Education will be taken as given. For now, education is suppressed, as it is not essential for the theory.

Each period agents must choose whether to work and what kind of work to do: their *occupational choice*. If an agent chooses not to work they receive b units of consumption, which can be thought of as the output of home production, consumption-equivalent units of leisure, or a combination of both. If an agent has low-skill productivity $z_l > 0$ then they can work as a low-skill employee. They will provide z_l efficiency units of low-skill labor and earn income $z_l w_l$, where w_l is the low-skill wage per efficiency unit. If an agent has high-skill productivity $z_h > 0$, then they can work as a high-skill worker and earn $z_h w_h$, with these variables interpreted analogously to z_l and w_l. Finally agents can choose to be entrepreneurs. If an agent was not an entrepreneur last period then they need to pay an entry cost ψ_e. Then each period of entrepreneurship the agent pays a fixed operating cost, ψ, and can run a production technology $f(z_e, k_o, k_i, \ell_l, \ell_h)$. It is assumed that being an entrepreneur is a full-time occupation so that an entrepreneur cannot also be an employee.[19] As an entrepreneur the agent hires inputs to produce and keeps the profits from the operation.

There are four production inputs. The two types of capital, IT capital k_i and all other capital k_o. These can be rented at rates r_o and r_i, respectively. The two labor inputs are high and low-skill labor measured in efficiency units, ℓ_l and ℓ_h, which have prices w_l and w_h. These inputs are combined in the following way:

$$f(z, k_o, k_i, \ell_l, \ell_h) = z k_o^{\eta} \left[\phi \ell_h^{\gamma} + (1-\phi)(\lambda k_i^{\tau} + (1-\lambda)\ell_l^{\tau})^{\frac{\gamma}{\tau}} \right]^{\frac{\alpha}{\gamma}}, \tag{1}$$

where $\eta, \phi, \lambda, \alpha \in (0,1)$; $\alpha + \eta < 1$; and $\tau, \gamma < 1$. This technology follows the nested CES structure used in Krusell et al. (2000), Vom Lehn (2020), Eden and Gaggl (2018) to embody SBTC. The key features are that there are two elasticity of substitution parameters that control the degree of substitutability/complimentary between the two types of labor and IT capital. With appropriate values for these, the technology captures the idea that improvements in capital technology have allowed capital to substitute for lower skill labor, and increased demand for higher skill workers (Krusell et al., 2000; Autor et al., 2003; Autor and Dorn, 2013).[20]

The objective of each agent is to maximize the present discounted value of utility. The utility function is $u(c)$, satisfying $u'(c) > 0$, $u''(c) < 0$ and $\lim_{c\to 0} u'(c) = \infty$. Agents consume what they earn each period.[21]

There is also a non-entrepreneurial sector, modeled by a representative non-entrepreneur firm. It has productivity z_f and produces using the same production function as entrepreneurs, $f(z_f, k_o, k_i, \ell_l, \ell_h)$.[22] This firm should be thought of as representing large firms in the economy, such as public firms, that do not have an owner who runs them.[23] In contrast to entrepreneurial firms, the productivities of non-entrepreneurial firms are assumed to be intrinsic to the firm, embodied in the ideas and institutional structures that have been developed over time rather than being attached to an owner-manager.[24] The representative non-entrepreneur firm is owned equally by all agents and is operated to maximize the present discounted value of profits.

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19 The data supports this approach. For every year in the CPS from 1987 to 2015, the average share of annual income from a person's main job is over 95% for both the self-employed and the dependent employed.

20 While SBTC is sometimes modeled directly as a change in the relative productivity of high-skill workers, this paper takes changes in IT capital technology as the microfoundation for this, as discussed in Violante (2008).

21 Saving is abstracted from since its not central to the mechanisms being studied.

22 In the Appendix I show that it would be equivalent to have a continuum of non-entrepreneur firms with heterogeneous productivities and each one using the same production function as entrepreneurs. They would aggregate to a representative firm in this form. An implication of this is that despite the non-entrepreneur sector having a decreasing returns to scale production function, with $\alpha \in (0,1)$, the analysis will permit a constant returns to scale expansion of this sector over time. α can be thought of as the returns to scale for a single production unit (e.g. an establishment). This sector can expand in a constant returns to scale (CRS) fashion over time by increasing the mass of production units, and this is equivalent to an increase in the productivity of the representative firm. An important benefit of this approach is that it will allow us to disentangle the effects of SBTC from skill-neutral productivity growth, as discussed in Section 6.1.

23 I abstract from fixed and entry costs for this sector, since it is composed of large firms for whom these costs would be insignificant.

24 An alternative approach would be to allow non-entrepreneur firms to have managers whose entrepreneurial productivities affect the productivities of these firms. However, the number of non-entrepreneur firms in the economy is small, so, if you were to count such people as entrepreneurs, it would not be quantitatively important for moments of entrepreneurship. For example, in the quantitative exercise the non-entrepreneur sector is estimated to account for 50% of employment in the economy in 1987. In that year in the data, this share of the economy was accounted for by the largest 0.7% of firms (Business Dynamics Statistics).

3.2. Optimization problems and equilibrium

Let $\epsilon \in \{0,1\}$ be an indicator for whether an agent was an entrepreneur in the previous period. The value function of a type s agent at the start of a period is denoted $V^s(\mathbf{z},\epsilon)$.[25] The value functions for being out of the labor force, an employee, and an entrepreneur are, respectively:

$$V^s_{\text{olf}}(\mathbf{z},\epsilon) = u(b+\pi_f) + \beta(1-\delta)\mathbb{E}[V^s(\mathbf{z}',0)|\mathbf{z}], \tag{2}$$

$$V^s_s(\mathbf{z},\epsilon) = u(z_s w_s+\pi_f) + \beta(1-\delta)\mathbb{E}[V^s(\mathbf{z}',0)|\mathbf{z}], \tag{3}$$

$$V^s_e(\mathbf{z},\epsilon) = u(\pi(z_e,\epsilon)+\pi_f) + \beta(1-\delta)\mathbb{E}[V^s(\mathbf{z}',1)|\mathbf{z}]. \tag{4}$$

π_f is the profit of the non-entrepreneur sector and the profit of an entrepreneur is

$$\pi(z_e,\epsilon) = \max_{\{k_o,k_i,\ell_l,\ell_h\}} \left\{ f(z_e,k_o,k_i,\ell_l,\ell_h) - w_l\ell_l - w_h\ell_h - r_ok_o - r_ik_i - \mathbb{1}_\epsilon(0)\psi_e - \psi \right\}.$$

$\mathbb{1}_a(A)$ is the indicator function for whether variable a has value A. The optimal choice for input x and the resulting profit function are

$$x(z_e) = \Gamma_x z_e^{\frac{1}{1-\alpha-\eta}}, \tag{5}$$

$$\pi_e(z_e,\epsilon) = \Gamma_\pi z_e^{\frac{1}{1-\alpha-\eta}} - \mathbb{1}_\epsilon(0)\psi_e - \psi,$$

where the Γ's are functions of parameters and prices provided in the Appendix. Let the output of a firm be denoted $y(z_e)$.

Denote the set of possible occupations $\mathcal{O}^s \equiv \{\text{olf}, s, e\}$ where the notation corresponds to the subscripts on the relevant value functions. The value function and occupation choice function satisfy:

$$V^s(\mathbf{z},\epsilon) = \max_{x\in\mathcal{O}^s} V^s_x(\mathbf{z},\epsilon),$$

$$o^s(\mathbf{z},\epsilon) = \operatorname*{argmax}_{x\in\mathcal{O}^s} V^s_x(\mathbf{z},\epsilon). \tag{6}$$

Let $o(s,\mathbf{z},\epsilon) \equiv \mathbb{1}_s(l)o^l(\mathbf{z},\epsilon) + \mathbb{1}_s(h)o^h(\mathbf{z},\epsilon)$.

The production problem for the representative non-entrepreneur firm is

$$\pi_f = \max_{\{k_o,k_i,\ell_l,\ell_h\}} \left\{ f(z_f,k_o,k_i,\ell_l,\ell_h) - w_l\ell_l - w_h\ell_h - r_ok_o - r_ik_i \right\},$$

which yields the same functions for input choices and output as for entrepreneur firms, $x(z_f)$ and $y(z_f)$, and the profit is $\pi_f = \Gamma_\pi z_f^{\frac{1}{1-\alpha-\eta}}$.

Agents in the model are distributed over the states $(s,\mathbf{z},\epsilon) \in \{l,h\}\times\mathbb{R}^2_+\times\{0,1\} \equiv \mathbb{Z}$. There will be a stationary distribution of agents over these states, $Q : \Sigma_\mathbb{Z} \to [0,1]$, where $\Sigma_\mathbb{Z}$ is the relevant σ-algebra on the state space.[26] The market clearing conditions are:

$$\int_\mathbb{Z} \mathbb{1}_o(s) z_s \, dQ = \int_\mathbb{Z} \mathbb{1}_o(e)\ell_s(z_e)\, dQ + \ell_s(z_f), \text{ for } s\in\{l,h\}, \tag{7}$$

$$\int_\mathbb{Z} \mathbb{1}_o(e)\Big(\pi_e(z_e,\epsilon) + w_l\ell_l(z_e) + w_h\ell_h(z_e) + r_ok_o(z_e) + r_ik_i(z_e) + \mathbb{1}_\epsilon(0)\psi_e + \psi\Big)\, dQ$$
$$+ \pi_f(z_f) + w_l\ell_l(z_f) + w_h\ell_h(z_f) + r_ok_o(z_f) + r_ik_i(z_f) = \int_\mathbb{Z} \mathbb{1}_o(e)y(z_e)dQ + y(z_f). \tag{8}$$

The analysis will focus on the stationary equilibrium of the model, which is defined as follows.

Equilibrium. A stationary equilibrium is a pair of wages $\{w_l,w_h\}$, a function for occupational choice $o^s(\mathbf{z},\epsilon)$ for each skill type $s\in\{l,h\}$, production input decisions for entrepreneurs and non-entrepreneur firms $\{\ell_l(z),\ell_h(z),k_o(z),k_i(z)\}$ with $z=z_e$ for entrepreneurs and $z=z_f$ for non-entrepreneurs, and a distribution Q of agents over idiosyncratic states, such that: the production input decisions of entrepreneurs and non-entrepreneur firms satisfy (5); occupational choices satisfy (6); the distribution of agents Q is stationary; and the markets for low-skill labor, high-skill labor and the final good clear in accordance with (7) and *(8).*

4. Sources of declining entrepreneurship

The analysis of declining entrepreneurship focuses on theories guided by the empirical facts presented in Section 2 or proposed in the literature. The first is SBTC. This force has pushed up the wages of higher skill people, in a way that could decrease their entrepreneur share, and thereby the aggregate entrepreneur share as well. The second idea is that there have been other changes in

[25] The value function of course depends on the aggregate state as well. Since the focus will be on the stationary equilibrium in which the aggregate state is constant, this state variable is suppressed.

[26] The mathematical details of the stationary distribution are standard and are available on request.

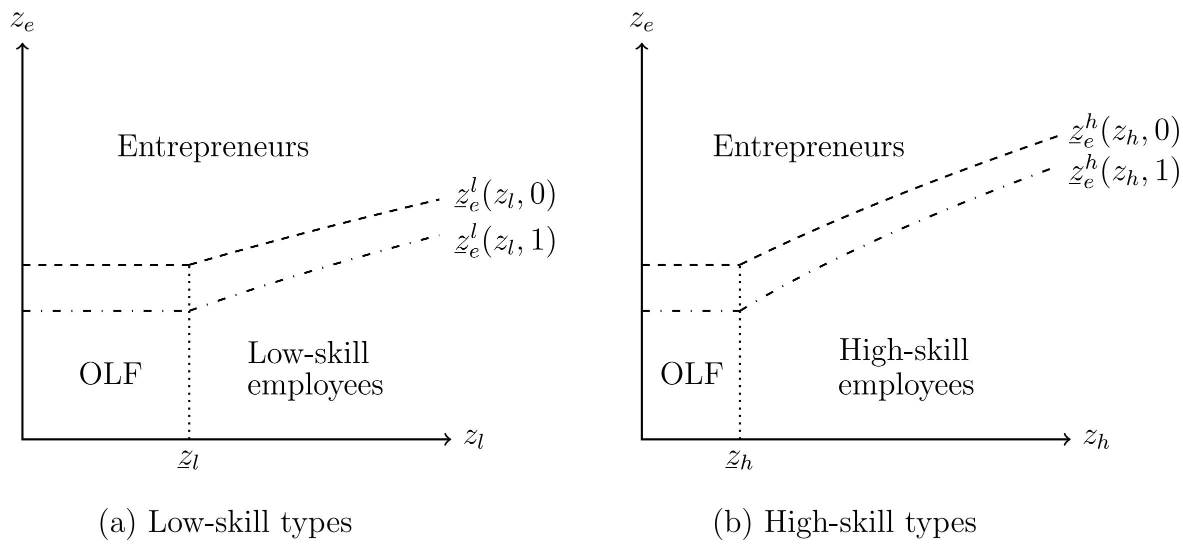


Fig. 3. Equilibrium occupational choices. $\underline{z}_e^s(z_s, \epsilon)$ is the threshold value of z_e above which agents of skill type $s \in \{l, h\}$, worker productivity z_s, and business endowment state ϵ, choose to be an entrepreneur. $\underline{z}_s$ is the minimum employee productivity level for which an agent of skill type s could choose to be an employee.

technology that have advantaged the largest firms and resulted in production becoming increasingly concentrated among them.[27] I model this as an increase in the productivity of the non-entrepreneur sector. A third class of explanations relates to increasing fixed and entry costs. These disproportionately burden smaller firms. One possible reason for their increase is that the extent of regulation, which has a large fixed cost of compliance, has increased.[28] Another reason is that changes in technology could have increased the fixed cost component of production, generating an advantage for larger firms (Aghion et al., 2023; Hsieh and Rossi-Hansberg, 2023; De Ridder, 2024).[29]

4.1. Occupational sorting in a simplified model

Consider a version of the model with a single period. Agents are either low or high-skill, and each is endowed with a vector of productivities $\mathbf{z}$. Agents choose their occupation and the payoffs are given by Eqs. (2)–(4) with $\beta = 0$. To maintain the effect of the entry cost on the occupation decision, it is assumed that a fraction of agents have $\epsilon = 1$ so that they do not have to pay the entry cost to be entrepreneurs and the remainder of agents do face this cost ($\epsilon = 0$). Agents with $\epsilon = 1$ can be thought of as being endowed with a business, while other agents have to set one up if they want to be an entrepreneur.

Fig. 3 presents the occupational choice policies in this version of the model. First consider low types whose occupational choices are presented in panel (a). The productivity of an agent when working as an employee is on the horizontal axis and their productivity as an entrepreneur is on the vertical axis. If both productivities are sufficiently low then an agent chooses to be out of the labor force. For a low z_e, an agent will work as a low-skill employee if z_l is above a threshold ($\underline{z}_l = b/w_l$). To be an entrepreneur, the threshold level of z_e depends on whether the agent is endowed with a business or not, and their employee productivity, z_l. $\underline{z}_e^l(z_l, 0)$ and $\underline{z}_e^l(z_l, 1)$ are the thresholds for an agent without a business ($\epsilon = 0$) and with a business ($\epsilon = 1$), respectively. The threshold is higher for an agent without a business because they need to pay the entry cost. In the region in which agents are choosing between being an entrepreneur or employee, these thresholds slope up because the value of being a worker increases in z_l.[30] In the dynamic model, $\underline{z}_e^l(z_l, 0)$ corresponds to the threshold for entering entrepreneurship, while $\underline{z}_e^l(z_l, 1)$ corresponds to the exit threshold. For high-skill types the tradeoffs are the same except that the value of being an employee is $z_h w_h$ instead of $z_l w_l$. The functional form

[27] Technology improvements may have advantaged the largest firms because by enabling people to better compare prices and quantities, or because larger firms are better placed to adopt new technologies because of their size or better access to financing. See Davis and Haltiwanger (2014) for a discussion of this idea. It is also possible that this is linked to the changes in IT technology underlying SBTC, see Lashkari et al. (2024).

[28] See Decker et al. (2014a), Davis and Haltiwanger (2014) and Davis (2017) for discussions of this explanation. Kleiner (2015) analyzes occupational licensing and Hsieh and Moretti (2019) study zoning restrictions.

[29] An example is firms like Amazon and Walmart that have sophisticated logistic systems (fixed costs) that allow them to deliver products with low variable cost. Another example is restaurant chains centralizing the development of menus and the training of chefs (Hsieh and Rossi-Hansberg, 2023). Bloom et al. (2020) and Bornstein (2021) provide evidence of rising costs of finding new ideas and establishing customer bases, respectively, which can thought of as part of entry costs.

[30] The threshold is concave because the return to being an employee is linear in z_l while the return to being an entrepreneur is convex in z_e.

for the entrepreneurship boundaries for an agent with skill type $s \in \{l, h\}$ is:

$$\underline{z}_e^s(z_s, \epsilon) = \begin{cases} \left(\dfrac{b + \psi + \mathbb{1}_\epsilon(0)\psi_e}{\Gamma_\pi} \right)^{1-\alpha-\eta} & \text{for } z_s \in (0, \underline{z}_s], \\ \left(\dfrac{z_s w_s + \psi + \mathbb{1}_\epsilon(0)\psi_e}{\Gamma_\pi} \right)^{1-\alpha-\eta} & \text{for } z_s > \underline{z}_s. \end{cases} \tag{9}$$

Finally note that the size of the regions in Fig. 3 do not necessarily represent the relative shares of the occupation categories. This depends on the distribution of agents over the productivity space.

4.2. Skill-biased technical change

The force driving SBTC in the model is a decrease in the rental rate of IT capital, r_i. As is well understood from the technical change literature (e.g. Krusell et al., 2000) this will affect the equilibrium low and high-skill wages, with the changes depending on the values of the two elasticity of substitution parameters for the production function. For the period of time being studied, the main change in wages was an increase in the high-skill wage. So the following proposition characterizes the effects of decreasing r_i and increasing w_h on agents' decisions about whether to be entrepreneurs. Derivatives that are conditional on $\mathbf{w}$ hold wages fixed. Otherwise they express equilibrium relationships. All proofs are in the Appendix.

Proposition 1. *The effects of changes in the IT capital rental rate and the high-skill wage on the entrepreneur thresholds are as follows.*

(a) For all $s \in \{l, h\}$, $\epsilon \in \{0, 1\}$ and $z_s > 0$,

$$\left.\frac{\partial \underline{z}_e^s(z_s, \epsilon)}{\partial r_i}\right|_{\mathbf{w}} > 0 \quad \text{and} \quad \frac{\partial \underline{z}_e^s(z_s, \epsilon)}{\partial w_h} > 0.$$

(b) If $w_h > w_l$, then for all $z_s > \underline{z}_h$ and $\epsilon \in \{0, 1\}$,

$$\left.\frac{\partial \underline{z}_e^h(z_s, \epsilon)}{\partial r_i}\right|_{\mathbf{w}} > \left.\frac{\partial \underline{z}_e^l(z_s, \epsilon)}{\partial r_i}\right|_{\mathbf{w}} \quad \text{and} \quad \frac{\partial \underline{z}_e^h(z_s, \epsilon)}{\partial w_h} > \frac{\partial \underline{z}_e^l(z_s, \epsilon)}{\partial w_h}.$$

(c) For all $s \in \{l, h\}$ and $z_s > 0$,

$$\left.\frac{\partial [\underline{z}_e^s(z_s, 0) - \underline{z}_e^s(z_s, 1)]}{\partial r_i}\right|_{\mathbf{w}} > 0.$$

Parts (a) and (b) of this proposition tell us about the effects of SBTC on the share of agents who are entrepreneurs. For a pure increase in w_h (no change in r_i), the entrepreneurship thresholds will increase for both skill types and the increases will be larger for high-skill types. This will decrease the share of agents of each skill type who are entrepreneurs. If the mass of agents distributed near the entrepreneurship threshold is similar for the two skill types, then the entrepreneur share for high-skill agents will decrease more.[31] This indicates how an increasing high-skill wage could generate the empirical patterns for entrepreneur shares documented in Section 2. However, the fact that this change in the high-skill wage is driven by a declining rental rate for IT capital complicates the analysis. The declining rental rate increases profits, which decreases all entrepreneurship thresholds and increases the entrepreneur shares, offsetting the effect of the change in the high-skill wage.[32]

In the static model, the analog of the entry rate is the share of entrepreneurs who were not endowed with a business, i.e. those with $\epsilon = 0$.[33] For the purposes of this section I will call this the "entry rate". A key factor affecting this is the size of the wedge between the productivity thresholds for running a business for people with and without an endowed business. As this wedge decreases, the entry rate will tend to increase.[34] For an agent with skill type s and $z_s > \underline{z}_s$, this wedge is

$$\underline{z}_e^s(z_s, 0) - \underline{z}_e^s(z_s, 1) = \left(\frac{1}{\Gamma_\pi} \right)^{1-\alpha-\eta} \left([z_s w_s + \psi + \psi_e]^{1-\alpha-\eta} - [z_s w_s + \psi]^{1-\alpha-\eta} \right). \tag{10}$$

A decrease in r_i on its own increases the profitability of entrepreneurs, which decreases the wedge because the entry cost is less relevant to entrepreneurs making higher profits. This effect is captured by the Γ_π term in the above expression and part (c) of the proposition. This works against the change in the entry rate in the data. To the extent that the falling IT capital price increases the high-skill wage, there are two additional effects. A higher wage means that in equilibrium the selected entrepreneurs are higher

[31] In general, the change in the entrepreneur share for type s agents will depend on the change in the thresholds for this type as well as the distribution of agents over z_s and z_e.

[32] The change in the share of employment at entrepreneur firms is closely connected to the change in the entrepreneur share, so discussion of this is omitted for brevity. These moments move in the same direction as long as the change in the entrepreneur share is not offset by a large enough change in average productivity of entrepreneurs in the other direction.

[33] Mathematically this is $\int_{\mathbb{Z}} \mathbb{1}_o(e)\mathbb{1}_\epsilon(0)\, dQ / \int_{\mathbb{Z}} \mathbb{1}_o(e)\, dQ$.

[34] The observed change will also depend on the direction and size of the changes in these thresholds, and the shape of the distribution over the state space. These considerations will be put aside in this section. The quantitative results will show that for estimated parameter values this does not affect the results discussed in this section.

productivity. Their higher profits strengthen the direct effect of the decrease in r_i. However, this is offset by the fact that a higher wage decreases profits because it increases costs for entrepreneurs.[35]

Overall, there are good theoretical reasons for SBTC to decrease the relative entrepreneur share of high-skill agents, but there are competing forces determining the changes in other moments of entrepreneurship that need to be determined quantitatively.

4.3. Non-entrepreneur productivity, fixed costs and entry costs

The next proposition characterizes the effects of the expansion of non-entrepreneur firms, and increases in fixed and entry costs.

Proposition 2. *Increases in non-entrepreneur productivity, fixed costs and entry costs have the following effects on the entrepreneur thresholds.*

(a) If $\partial w_s/\partial z_f > 0$, then for all $s \in \{l,h\}$, $\epsilon \in \{0,1\}$ and $z_s > 0$,

$$\frac{\partial \underline{z}_e^s(z_s,\epsilon)}{\partial z_f} > 0.$$

(b) For all $s \in \{l,h\}$, $\epsilon \in \{0,1\}$ and $z_s > 0$,

$$\left.\frac{\partial \underline{z}_e^s(z_s,\epsilon)}{\partial \psi}\right|_{\mathbf{w}} > 0,$$

and

$$\left.\frac{\partial [\underline{z}_e^s(z_s,0) - \underline{z}_e^s(z_s,1)]}{\partial \psi}\right|_{\mathbf{w}} < 0.$$

(c) For all $s \in \{l,h\}$ and $z_s > 0$,

$$\left.\frac{\partial \underline{z}_e^s(z_s,0)}{\partial \psi_e}\right|_{\mathbf{w}} > 0,$$

and, if $\partial w_s/\partial \psi_e < 0$ for all $s \in \{l,h\}$,

$$\frac{\partial \underline{z}_e^s(z_s,1)}{\partial \psi_e} < 0.$$

Start by considering the effects of increasing non-entrepreneur productivity, which is assumed to cause wages to increase.[36] The increase in wages makes entrepreneurship less profitable and increases the returns to being a worker, so entrepreneur thresholds increase and fewer agents choose to be entrepreneurs. For the entry rate of entrepreneurs, the effect of increasing non-entrepreneur productivity is ambiguous. This can be seen with Eq. (10). On one hand, the increase in wages decreases the profits of entrepreneurs (captured by the Γ_π term in the equation). This increases the wedge between the two entrepreneur thresholds. However, the increase in wages pushes up the outside option, so that the marginal entrepreneur is more profitable and the entry cost matters less to them (the wedge is smaller).

Part (b) of the proposition characterizes the effects of increasing fixed costs. The direct effect (holding wages fixed) is to increase the entrepreneur thresholds because the payoff from being an entrepreneur is lower. The magnitude of this effect for the marginal entrepreneurs who have to start a business, and those who are already endowed with one, differ. Conditional on skill type and employee productivity, the marginal entrepreneur starting a new business needs to be more productive and profitable than the marginal entrepreneur who is endowed with a business. The fixed cost is therefore a larger share of revenue for a marginal entrepreneur who is endowed with a business, so the entrepreneur threshold for this type of agent increases more. Thus, the wedge between these two thresholds decreases, as stated in part (b) of the Proposition. This will tend to increase the entry rate.

An increase in the entry cost has some qualitatively different effects (part c of the proposition). For entrepreneurs who need to start a business, the effect is the same as for an increase in fixed costs: the threshold for becoming an entrepreneur increases. Holding wages fixed, there is no effect on the occupational choice of agents endowed with a business. Under reasonable parameters, wages will decrease in equilibrium making it more profitable to be an entrepreneur.[37] This decreases the entrepreneur threshold for agents endowed with a business. These forces increase the wedge between the entrepreneur thresholds for agents who are endowed with a business and those who are not, which can decrease the entry rate. The differing effects on the occupational choices of agents endowed with businesses is the key distinction between the effects of increasing fixed and entry costs.

This discussion of the effects of increasing fixed and entry costs has mostly put aside general equilibrium effects though wages.[38] Increases in these costs decrease labor demand, push wages down, and increase entrepreneur profits. This works against the direct

[35] The selection effect of the increase in w_h is captured by the $z_s w_s$ terms in the previous expression, with $s = h$. The direct profit effect is captured by Γ_π.

[36] This restriction is weak as an increase in z_f causes demand for both types of labor to increase. So, under reasonable parameter values such as those in the quantitative exercise, the restriction will be satisfied.

[37] Wages will decrease since, with fewer people choosing to be entrepreneurs, demand for both types of labor falls.

[38] In Proposition 2, most of parts (b) and (c) are conditional on wages.

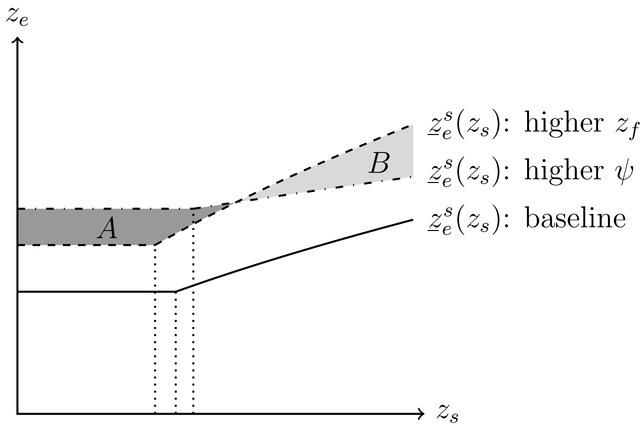


Fig. 4. Occupational choice when non-entrepreneur productivity or fixed costs increase. This is a stylized representation of the entrepreneur threshold for agents with skill s when $\psi_e = 0$. In this case the threshold does not depend on ϵ so there is only one of them. The threshold is plotted for three cases: a baseline, and after increases in fixed costs and non-entrepreneur productivity, with these increases resulting in the same entrepreneur share (areas A and B have the same mass of agents in them).

effects of increasing fixed and entry costs on entrepreneur thresholds. The quantitative analysis will show that for the estimated parameters values these general equilibrium effects are not strong enough to overturn the forces emphasized here.

Putting these results together, while increasing non-entrepreneur productivity, fixed costs and entry costs can all generate a decrease in the entrepreneur share, rising entry costs are the most likely to push the entry rate down. Increasing non-entrepreneur productivity has an ambiguous effect on this moment, while higher fixed costs push it up.

4.4. Parameter identification

The quantitative exercise will require measures of fixed costs, entry costs and non-entrepreneur productivity for 1987 and 2015. Due to difficulties measuring these directly, they will be inferred from other moments of the data. I now discuss why these parameters have independent effects on three moments — the entrepreneur share, the entry rate and the share of employment at entrepreneur firms — so that these moments can be used to identify them.[39]

While increases in all parameters in question push the entrepreneur share down, as explained above, they have quite different effects on the other moments and this is what provides the identification. For distinguishing between fixed costs and entry costs, the key moment is the entry rate. The previous analysis shows that while higher fixed costs tend to increase the entry rate, higher entry costs tends to decrease it. So with values of the entrepreneur share and the entry rate, both of these costs can be estimated.

For distinguishing changes in non-entrepreneur productivity from changes in fixed and entry costs, it is the share of employment at entrepreneur firms that is key. The Appendix provides a formal proposition to underpin this part of the identification strategy, but the intuition is as follows. Focus on distinguishing an increase in non-entrepreneur productivity from an increase in fixed costs.[40] Choose the magnitudes of these parameter changes so that they generate the same decrease in the entrepreneur share. Since an increase in fixed costs decreases wages (because there are fewer firms and lower labor demand) while an increase in non-entrepreneur productivity increases wages (because labor demand increases), these parameter changes have different effects on the selection of entrepreneurs. Fig. 4 illustrates this.[41] It shows a baseline threshold for agents to choose entrepreneurship, as well as thresholds for the cases of higher fixed costs and higher non-entrepreneur productivity. Since higher fixed costs cause wages to decrease and profits to increase, it makes the threshold for being an entrepreneur flatter. For an increase in non-entrepreneur productivity, the opposite is true. This means that for a given entrepreneur share, average entrepreneur productivity is higher after an increase in fixed costs, so the share of employment in the entrepreneur sector is higher. This is clear in the figure because there must be equal masses of entrepreneurs in areas A and B and all entrepreneurs in area B have higher productivity than those in A. Thus the combination of the change in the entrepreneur share and the change in the employment share of entrepreneurs allows for the identification of changes in fixed costs and non-entrepreneur productivity.

[39] The effects need to be independent in the linear algebra sense of this term. If the values of the three moments are plotted in $\mathbb{R}^3$, then the effects of the three parameter changes need to generate vectors that are linearly independent in this space.

[40] The intuition carries over to distinguishing entry costs from non-entrepreneur productivity.

[41] Note that there is only one threshold separating entrepreneurs from non-entrepreneurs in the figure because the entry cost is zero in this example.

5. Calibration

5.1. Details for taking model to data

Skills and education. I define high-skill work to be non-routine cognitive occupations, as defined by Acemoglu and Autor (2011), and low-skill work to be all other occupations.[42] To be able to directly compare entrepreneurship rates by education in the data and the model, I add education groups to the model. I assume that there are two education levels, college and non-college, denoted by C and N respectively.[43] In the model, each agent is endowed with an education level and these draws are made to match the education shares in the data. The share of agents with a non-college education is denoted ω. Education will matter by affecting the probability of being a high-skill type, θ_h^ξ for $\xi \in \{N, C\}$, the distribution from which initial productivities are drawn $G^\xi(\mathbf{z})$, and the law of motion for productivities $G^\xi(\mathbf{z}'|\mathbf{z})$.

Functional forms. The worker productivity of agent j with education level $\xi \in \{N, C\}$ and skill level $s \in \{l, h\}$ is assumed to be $z_{s,j,t} = \exp(\tilde{z}_{s,j,t})$, with $\tilde{z}_{s,j,t}$ following the AR(1) process

$$\tilde{z}_{s,j,t} = \mu_s^\xi + \rho_s \tilde{z}_{s,j,t-1} + \sigma_s^\xi \varepsilon_{s,j,t}$$

with $\varepsilon_{s,j,t} \sim N(0,1)$. Entrepreneur productivity for this agent is

$$z_{e,j,t} = \zeta \exp(\mu_{e,j,t} + \tilde{z}_{e,j,t}).$$

ζ is simply a scaling term that will be useful for simulating changes in the productivity level for all entrepreneurs. The second term in the parenthesis follows a standard AR(1) process

$$\tilde{z}_{e,j,t} = \rho_e \tilde{z}_{e,j,t-1} + \sigma_e^\xi \varepsilon_{e,j,t}$$

with $\varepsilon_{e,j,t} \sim N(0,1)$ being independent of $\varepsilon_{s,j,t}$.[44] The correlation between worker and entrepreneur productivity comes through the term $\mu_{e,j,t}$, which is a function of agent j's contemporaneous worker productivity:

$$\mu_{e,j,t} = \bar{\mu}_e^\xi + \chi^\xi \left(\frac{\tilde{z}_{s,j,t} - \mathbb{E}^\xi[\tilde{z}_s]}{\mathbb{V}^\xi[\tilde{z}_s]^{\frac{1}{2}}} \right),$$

where $\mathbb{E}^\xi[\tilde{z}_s]$ and $\mathbb{V}^\xi[\tilde{z}_s]$ are the unconditional expected value and variance of $\tilde{z}_s$, respectively, for agents with education level ξ. This specification allows mean entrepreneur productivity to differ across education levels through the $\bar{\mu}_e^\xi$ term, and the strength and direction of the correlation between worker and entrepreneur productivity is controlled by χ^ξ, which also depends on education. The final term standardizes worker productivity within education-skill groups.[45]

The utility function is assumed to have constant relative risk aversion form: $u(c) = c^{1-\nu}/(1-\nu)$, with $\nu > 0$ and $\nu \neq 1$.

5.2. Quantitative strategy and calibration

For the quantitative exercise I calibrate the model to the 1987 data and adjust selected parameters, calibrated to the 2015 data, to simulate changes to the economy over this period. The parameters that change from 1987 to 2015 are:

1. the share of agents who have not completed college, ω;
2. the out of labor force value, b;
3. the level of entrepreneur productivity, ζ, and the relative level of entrepreneur productivity of college and non-college agents through $\bar{\mu}_e^C$;
4. capital rental rates, r_o and r_i;
5. non-entrepreneur productivity, z_f;
6. entry and fixed costs, ψ_e and ψ.

Four of these parameters change for consistency with the data: ω to match the increase in education, b to match the increase in the out of labor force share, ξ to account for productivity growth over time, and r_o for consistency with the increase in the non-IT capital rental rate in the data. Four of the remaining parameters are adjusted to simulate the forces that this paper is focused on: r_i is the capital rental rate that drives SBTC. The change in z_f is simulating increasing productivity of non-entrepreneur firms, and fixed and

[42] I abstract from the differences within this second category of occupations since the key force under my theory is the increase in demand for high-skill employees as technology changes, rather than the differential effects among low-skill workers who are all worse off relative to the high-skilled. See Acemoglu and Autor (2011), Autor and Dorn (2013), Goos et al. (2014), Jaimovich and Siu (2020), Vom Lehn (2020), Cortes et al. (2017), and Lee and Shin (2016) for research emphasizing the distinction between these lower skill occupations. More details on the occupation classification are in the Appendix.

[43] A college education is defined as completion of a four year college degree.

[44] The innovations $\varepsilon_{s,j,t}$ and $\varepsilon_{e,j,t}$ are also independent across agents and over time.

[45] This standardization means that the effect of changes in low or high-skill productivity on entrepreneurial productivity does not depend on the scale or dispersion of these productivities.

Table 2
Parameter values. Where necessary, values are rounded to three decimal places. The 1987 value of ζ is normalized to 1.0, but this value is in the lower panel for cleaner presentation.

	1987	*2015*	*Parameters with the same values for 1987 & 2015*					
			Externally calibrated or normalized parameters					
ω	0.779	0.651	β	0.985	$\alpha+\eta$	0.85	μ_l^N	−0.008
r_o	0.082	0.121	ν	2.0	γ	−1.5	μ_h^N	−0.008
r_i	0.169	0.071	δ	0.025	$\bar{\mu}_e^N$	0.0	$\rho_l,\ \rho_h$	0.95
			Internally calibrated parameters					
b	0.303	0.423	θ_h^N	0.151	σ_l^N	0.173	α	0.615
z_f	1.134	1.338	θ_h^C	0.650	σ_l^C	0.211	η	0.235
ψ	0.122	0.290	μ_l^C	0.008	σ_h^N	0.181	ϕ	0.140
ψ_e	0.272	0.981	μ_h^C	0.009	σ_h^C	0.176	λ	0.203
$\bar{\mu}_e^C$	0.159	0.128	χ^N	−0.083	σ_e^N	0.036	τ	0.610
ζ	1.0	1.136	χ^C	0.058	σ_e^C	0.035	ρ_e	0.986

entry costs can change. I additionally allow the relative productivity of college and non-college entrepreneurs to adjust to account for changes in their relative entrepreneur rates, above and beyond what the other parameters generate. This should be thought of as capturing all forces outside of SBTC that have affected the relative profitability of college and non-college entrepreneurs.

The full details of the calibration of the model are in the Appendix. Here I summarize the approach and highlight important points. The values of 14 parameters are set externally. These are parameters that can be measured directly in the data, are measured in other papers, can be normalized, or have standard values. These parameter values are provided in the upper panel of Table 2. The returns to scale of the production function are $\alpha+\eta$. Atkeson and Kehoe (2005) provide an extensive discussion of returns to scale for single plants and settle on a value of 0.85, which is used here as well.[46] Capital rental rates are from Eden and Gaggl (2018). For IT capital it is 16.9% in 1987 and 7.1% in 2015, and for non-IT capital it is 8.2% and 12.1%, respectively.[47] γ is chosen to achieve an elasticity of substitution between high-skill labor and IT capital of 0.4, guided by the literature.[48]

The remaining parameters are calibrated internally. Their values are in Table 2 and the moments used for their calibration are in Table 3. The parameters are determined jointly by simulated method of moments and the approximate mapping between parameters and moments is as follows. Matching the changes in wages of low and high-skill workers from 1987 to 2015 is crucial since wages are fundamental for the tradeoff between being a worker and an entrepreneur. One of the elasticity of substitution parameters, τ, and the amount of productivity growth are used to match these moments.[49] The productivity levels of the non-entrepreneur sector z_f, the fixed costs ψ, and the entry costs ψ_e for 1987 and 2016 are pinned down using the identification strategy outlined in Section 4. The out of labor force values for these two years are calibrated so that the model matches the out of labor force shares in both of them. The values of $\bar{\mu}_e^C$ for 1987 and 2015 are pinned down with the relative entrepreneurship rates of college and non-college agents for these years. The remaining production function parameters are calibrated with moments related to the division of income among inputs, and for the parameters of the worker and entrepreneur productivity processes I use income moments. Finally, the probabilities of being high-skill conditional on education, θ_h^N and θ_h^C, are chosen to target the share of people in each education group in high-skill occupations.

5.3. Calibrated model

The values of internally calibrated parameters are presented in Table 2, and the calibration moments for the model and the data are in Table 3. Overall the model fits the data well given its high dimensionality. The estimated elasticity of substitution between low-skill labor and IT capital ($\frac{1}{1-\tau}$) is 2.56.[50] To put the estimates of entry and fixed costs for 1987 in perspective, they imply that it costs 25% of the median annual operating profit (sales less labor and capital costs) of entrepreneur firms to enter, and 11% to cover fixed costs. Fixed costs are estimated to have increased by a factor of 2.4 from 1987 to 2015, and entry costs by a factor of 3.6.[51] The

46 Note that despite the non-entrepreneur sector having the same value for returns to scale, the setup allows for a constant returns to scale expansion of this sector over time through the productivity term z_f. See footnote[22] for details.

47 Note that these rental rates depend on the prevailing rate of return in the economy, as well as physical depreciation rates and changes in capital prices. So they are not directly comparable to the return on equities, for example. Since the Eden and Gaggl (2018) series end in 2013, I use the 2013 values as estimates for 2015. I also deflate their nominal rental rates using the GDP Implicit Price Deflator from the BEA to get real rental rates.

48 Using similar production functions to in the present model, Krusell et al. (2000) and Vom Lehn (2020) have estimated the elasticity of substitution between high-skill workers, defined on the basis of education or occupation, and capital equipment, generating estimates of 0.67 and 0.13 respectively. γ is set to achieve an elasticity in the middle of this range.

49 Both entrepreneur and non-entrepreneur productivity, ζ and z_f, increase over time. The differences in their growth is determined by the change in the relative sizes of the two sectors.

50 There is no direct benchmark for this in the literature that I am aware of. See the Appendix for a discussion of the closest comparisons.

51 An alternative approach to fixed and entry costs would specify them (partially or fully) in units of labor, as some of these costs may require labor to overcome (e.g. fulfilling regulatory requirements or ensuring compliance). Since low and high-skill wages increase by 2.1% and 38.2% from 1987 to 2015 compared to the increases of 138% and 261% in fixed and entry costs, this approach would partially offset the estimated increases in these costs. Under this approach, the increase in these costs would also increase labor demand and therefore wages. This would result in a lower estimate for productivity growth.

Table 3
Calibration moments. Colons denote ratios. E.g. 'High-skill:low-skill averages' for income is the ratio of high-skill to low-skill average income. CV is the coefficient of variation. Entrepreneur income persistence is the share of continuing entrepreneurs in the same decile of the entrepreneur income distribution in consecutive years. Income growth rates are for real income.

Moment	Model	Data
Income moments, 1987		
Entrepreneur:high-skill averages, non-college	1.32	1.36
Entrepreneur:high-skill averages, college	1.89	1.82
High-skill:low-skill averages	1.49	1.45
College:non-college low-skill averages	1.42	1.40
College:non-college high-skill averages	1.31	1.29
CV, low-skill non-college	0.51	0.51
CV, low-skill college	0.69	0.67
CV, high-skill non-college	0.58	0.60
CV, high-skill college	0.60	0.61
CV, entrepreneurs non-college	0.91	0.96
CV, entrepreneurs college	0.91	0.94
Entrepreneur income persistence	38.6%	37.5%
Occupation distribution, 1987		
Out of labor force share	14.8%	15.1%
High-skill share, non-college	13.1%	13.1%
High-skill share, college	59.0%	60.0%
Entrepreneur share	5.3%	5.1%
Entrepreneur share, college	7.1%	7.2%
Other moments, 1987		
Employee share of income	54.6%	52.5%
IT share of capital	10.2%	10.1%
Entrepreneur share of employment	49.6%	50.0%
Entry rate of entrepreneurs	11.4%	11.7%
2015 moments		
1987–2015 growth of average low-skill income	18.1%	16.6%
1987–2015 growth of average high-skill income	43.5%	44.3%
2015:1987 out of labor force share	1.66	1.66
2015:1987 entrepreneur share	0.70	0.71
2015:1987 entrepreneur share of employment	0.78	0.79
2015:1987 entry rate of entrepreneurs	0.72	0.72
2015:1987 college to non-college entrepreneur shares	0.85	0.85

estimated growth of fixed costs is slightly smaller than De Ridder (2024)'s estimates from French and US data.[52] The productivity of college educated entrepreneurs, relative to non-college educated ones, is estimated to decrease slightly between 1987 and 2015. In 1987 the average productivity of college agents is 16.8% higher than that of non-college agents, and in 2015 this difference decreases to 13.3%.[53] In the Appendix I compare untargeted moments of the occupation and income distributions in the model and data. In particular, the income distributions for 2015 are almost entirely untargeted, and the model fits these quite closely. This indicates that the model captures the tradeoff between occupations well.

6. Quantitative results

This section evaluates the explanations for declining entrepreneurship individually and then jointly.

6.1. Individual forces

Skill-biased technical change. Fig. 5(a) analyzes the effects of SBTC in partial and general equilibrium. The starting point for these exercises is the 1987 calibration of the model. In the left panel the effects of changing r_i, holding wages fixed, are presented. In the middle panel w_h changes holding w_l fixed, and in the right panel r_i changes with wages adjusting so that the model is in equilibrium. In the panels with r_i changing, the horizontal axis is flipped so that, as you go to the right, r_i decreases, as it has in the data. In all panels the changes in four moments are presented: the entrepreneur share, the entry rate, the share of employment at entrepreneur firms, and the ratio of the entrepreneur shares of college and non-college agents. While the theory was framed to compare low and high-skill agents rather than education groups, the results carry over since a much higher share of college educated than non-college educated people are high-skill.[54] All of the moments being considered decrease in the data, so a downward sloping line means that

52 See Appendix for more details on this comparison. De Loecker et al. (2020) also provide empirical support for these types of costs increasing over time.

53 The feature of the data driving this is that the relative entrepreneur share of college-educated agents declines by more than the changes in wages and capital prices can explain. One interpretation of this is that non-college entrepreneurs compete more with non-entrepreneurial firms, and therefore are more affected by their technological improvements. Poschke (2018) argues that this kind of polarization of the firm size distribution has occurred.

54 These shares are 65% and 15%, respectively (Table 2).

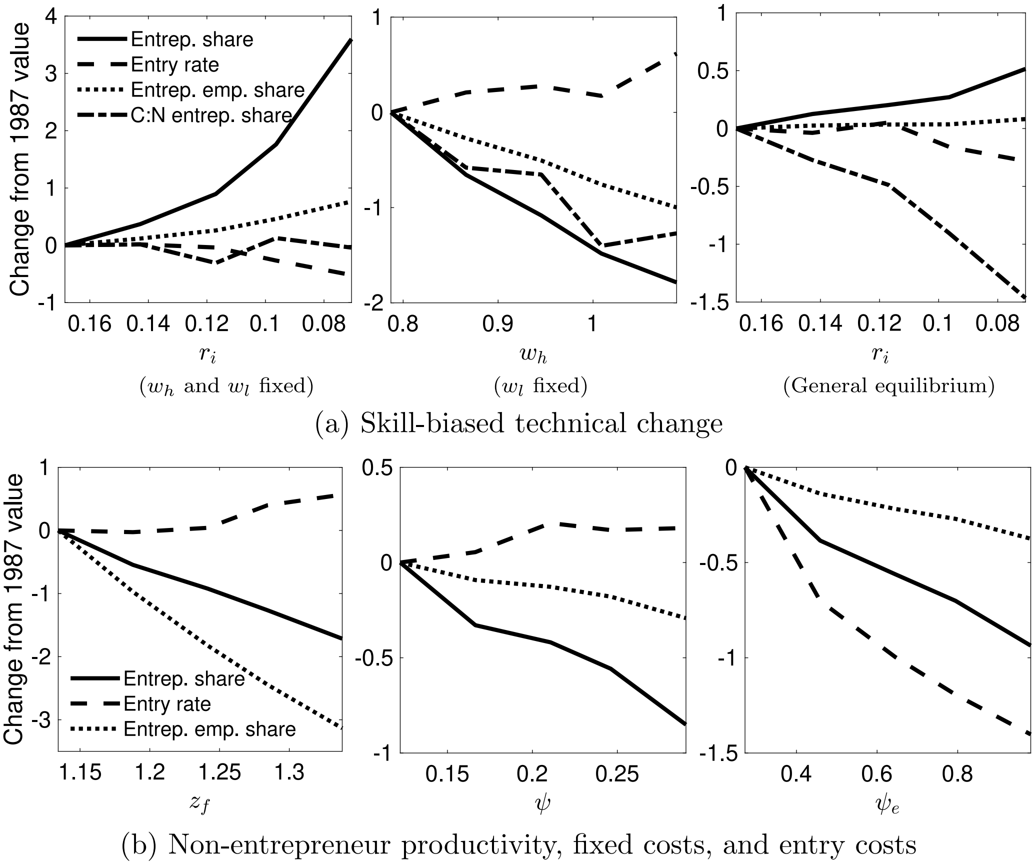


Fig. 5. Comparative statics. Parameter values are set to their 1987 values. In figure (a), in the left panel r_i is changed holding wages fixed; in the middle only w_h changes; and on the right, r_i changes and wages adjust so that the model is in the stationary equilibrium. In figure (b), it is z_f, ψ and ψ_e changing and in all cases wages adjust so that the model is in equilibrium. The vertical axis is normalized so that a magnitude of one means that the percentage change in a moment is the same as in the data from 1987 to 2015. 'Entrep. emp. share' is the share of employment at entrepreneur firms. 'C:N entrep. share' is the ratio of the college to non-college entrepreneur shares.

the relevant moment is moving in the same direction as in the data. The magnitude of the vertical axis is normalized so that a value of -1 means that the percentage change in the moment in the model is equal to the percentage change in that moment in the data from 1987 to 2015.

The results in the middle panel, for increasing w_h, confirm the predictions of the theory. The entrepreneur share decreases, and the decrease is proportionally larger for college educated agents. The decrease in the entrepreneur share also drives down the employment share of entrepreneurs. Quantitatively, this mechanism can generate much of the declines in these three moments seen in the data.[55] The issue, as identified by the theory, is that the decrease in the price of IT capital that drives the change in the high-skill wage, has offsetting effects on the entrepreneur share and the employment share of entrepreneurs. Quantitatively the opposing effects are similar in magnitude, so that neither of these moments change much as a result of SBTC. As for the entry rate, the theory showed that SBTC has competing effects on this moment. We see that quantitatively these are close to canceling each other out. The overall message is that SBTC is relevant for understanding changes in relative entrepreneur shares across the education distribution, but does not appear relevant for understanding the change in the aggregate moments of entrepreneurship.

One additional note on these results is that, because entrepreneurs and the non-entrepreneur sector have identical production functions — including returns to scale — SBTC affects them in the same way. As discussed by Jiang and Sohail (2023), if the non-entrepreneur sector has a CRS production function then SBTC will be more beneficial for that sector, and will implicitly include some skill-neutral technical change. This skill-neutral technical change would push down the entrepreneur share. That is not the case in the present setup. These two channels operate in isolation.

[55] To help with using the results from the graph for w_h to understand the magnitudes in the right panel, w_h changes from 0.79 to 1.09 as r_i changes from 0.1685 to 0.0706 in that graph.

Non-entrepreneur productivity. The left panel of Fig. 5(b) presents the effects of increasing z_f. The setup for the figure is the same as for Fig. 5(a). The theory told us that increasing non-entrepreneur productivity would decrease the entrepreneur share and that the effect on the entry rate was ambiguous because of opposing effects from increasing wages. Fig. 5(b) shows that these opposing effects on the entry rate essentially equal. For the entrepreneur share we see the predicted negative effect. For the share of employment at entrepreneur firms, the theory indicated that increasing non-entrepreneur productivity would have a larger effects on this, relative to the effect on the entrepreneur share, than increasing fixed or entry costs. The figure confirms this (compare the three panels), with increasing non-entrepreneur productivity having about twice as large an effect on the share of employment at entrepreneur firms as on the entrepreneur share, while for increasing fixed and entry costs the effect is about half as large. The figure also shows that increasing non-entrepreneur productivity cannot jointly generate the correct magnitudes for the declines in the entrepreneur share and the entrepreneur employment share compared to the data. The decline in the entrepreneur share is too small relative to the decline in the entrepreneur employment share.

Fixed and entry costs. For the effects of increasing fixed and entry costs, see the middle and right panels of Fig. 5(b). The theory indicated that in partial equilibrium rising fixed costs should decrease the entrepreneur share and increase the entry rate—the quantitative results confirm this in general equilibrium. The entrepreneur employment share decreases too.

For entry costs, the main ambiguity from the theory was how an increase would affect the share of agents who are entrepreneurs. The theory indicated that the entrepreneur threshold would increase for agents who need to start a business and decrease for those who already have a business. Quantitatively the first force is dominant, so that the entrepreneur share decreases, as it has in the data. This change also pushes down the share of employment at entrepreneur firms. The entry rate is also decreasing in the entry cost, as indicated by the theory, and this is the moment that changes the most, relative to the data. Overall rising entry costs can push all three moments down, although the magnitudes of the relative changes are different to in the data.

Finally, note that Fig. 5(b) confirms the identification strategy for fixed costs, entry costs and non-entrepreneur productivity. The changes in these parameters clearly have independent effects on the three moments of the data, in line with the theory.

6.2. Joint effects

To assess the full array of changes in the model from 1987 to 2015, the parameter changes are divided into two groups. The first group consists of changes in parameters that are necessary for consistency with the data. I will call these the *secondary parameter changes*. The college education share increases; productivity increases to allow the economy to match general wage growth[56]; the value of being out of the labor force increases; and the rental rate of non-IT capital increases. The remaining parameter changes — fixed costs, entry costs, non-entrepreneur productivity, the rental rate of IT capital, and the relative productivity of college and non-college entrepreneurs — are the main focus and I will call these the *primary parameter changes*.[57] To study the joint effects of these changes I start by performing the secondary parameter changes and then take that economy as the *baseline*, and assess the contribution of each of the primary parameter changes in moving the economy to 2015. The secondary parameter changes have modest effects on the main moments of entrepreneurship and these are discussed in the appendix.[58]

For the primary parameter changes, the focus is on how moments of entrepreneurship change from their values in the baseline scenario to 2015, and the quantitative relevance of each of the parameter changes for this. I evaluate all possible orderings of the parameter changes, generating 16 unique values for the effect of each change.[59] The results for all 16 values are included and I focus the discussion on average effects.

Fig. 6 presents the results. The scale of the vertical axis in all panels is the share of the change in the relevant moment from the baseline outlined above, to 2015, accounted for by each change. The bars represent the average effect of each change across the 16 estimates, and the circles are the individual values. Consistent with the prior analysis, the main role of SBTC is to shift entrepreneurship towards less educated agents. From Fig. 6(d), this force accounts for about half of this change after offsetting effects from fixed and entry costs are allowed for, with the other half accounted for by the decrease in the relative productivity of college-educated entrepreneurs. Its other significant effect on entrepreneurship is to increase the entrepreneur share, going against the trend in the data (Fig. 6a).

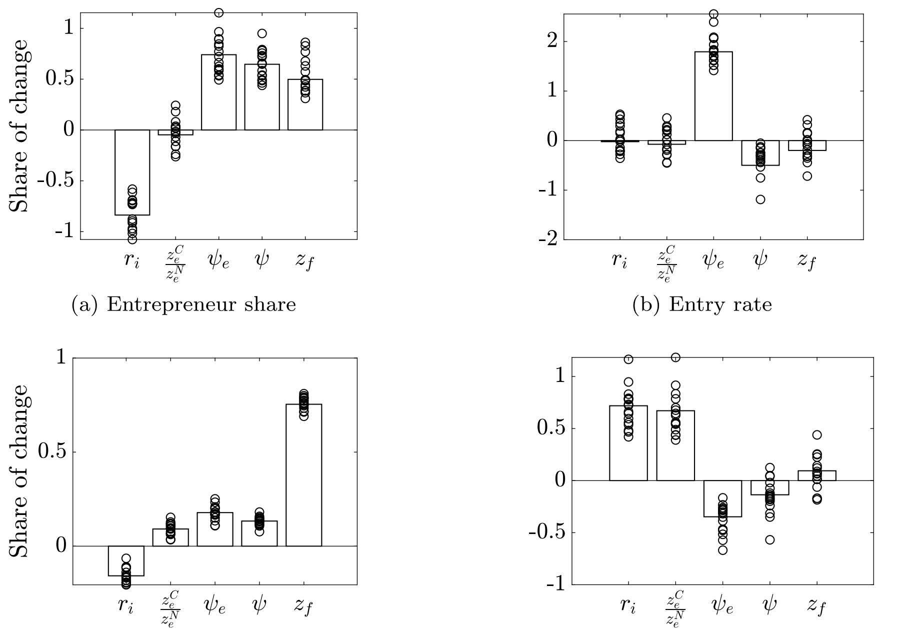
The increasing entry cost is primarily important for generating the decrease in the entry rate (Fig. 6b), as was clear from the analysis of the primary parameters in isolation. It is also the most quantitatively important factor in accounting for the decline in the entrepreneur share (Fig. 6a). For this moment though, the increases in the fixed cost and non-entrepreneur productivity are also quantitatively relevant. Their effects are 90% and 74% as large, respectively, as the effect of the entry cost. For the decline in the entrepreneur share of employment, most (76%) of this is due to increasing non-entrepreneur productivity. The earlier analysis

[56] To simulate a general increase in productivity I increase ζ so that the average level of entrepreneur productivity equals its 2015 value ($\zeta = 1.122$), and increase non-entrepreneur productivity z_f and the out of labor force value b by the same factor. I also scale fixed costs ψ and entry costs ψ_e by the same factor so that their relevance is not diminished.

[57] To change the relative entrepreneur productivity of college and non-college agents without changing average entrepreneur productivity, $\bar{\mu}_e^C$ decreases from its 1987 to 2015 value, and ζ increases from its baseline value of 1.122 to its 2015 value of 1.136.

[58] As a brief summary, the entrepreneur share decreases by seven percent and the entry rate falls by eight percent. The share of employment at entrepreneur firms increases by six percent and the ratio of the college to non-college entrepreneur shares increases by 34 percent—both of these changes are against the trends in the data, leaving larger declines to explain than the raw data suggests.

[59] There are 120 possible orderings, but some generate the same estimates for some parameters. E.g. $(r_i, z_e^C/z_e^N, \psi_e, \psi, z_f)$ and $(r_i, z_e^C/z_e^N, \psi, \psi_e, z_f)$ yield identical estimates for the effects of r_i, z_e^C/z_e^N and z_f.



(a) Entrepreneur share (b) Entry rate

(c) Entrepreneur employment share (d) College:non-college entrepreneur share

Fig. 6. Effects of changes in primary parameters. Each panel decomposes the change in a moment from its value in the baseline scenario to its 2015 value. r_i, ψ_e, ψ and z_f indicate the effects of the changes in these parameters. z_e^C/z_e^N indicates the effect of the change in the relative productivity of college and non-college entrepreneurs. The vertical scale is the share of the change in the relevant moment accounted for by each parameter change (0.5 equated to 50%). Circles are values for particular orderings of the parameter changes, and the bars are averages of these.

supports this as an increase in this productivity has a larger effect on the size of entrepreneurial firms than rising fixed or entry costs.[60]

6.3. Additional analysis

The Appendix provides additional analysis to support the results and guide their interpretation. The model is consistent with a stable entrepreneur size distribution (Fig. 1(b)) because SBTC offsets the increase in firm size due to rising fixed and entry costs. An alternative explanation for the changes in the entrepreneur share, the entry rate and the entrepreneur share of employment is changes in the labor force growth rate. If one allows this theory to account for some of the changes in entrepreneurship, using estimates based Hopenhayn et al. (2022) and Karahan et al. (2024), then the forces studied in this paper have smaller effects in levels, but the results about their relative importance hold. To aid the interpretation of the increases in fixed and entry costs, I use cross-industry variation to provide suggestive evidence that increasing regulation and IT-driven changes in technology are associated with the rise in these costs.

7. Policies for supporting entrepreneurship

The concern surrounding the decline in entrepreneurship in recent decades raises the question of whether a government should seek to boost entrepreneurship, and how. For the normative part of the question, the answer depends on the cause of the decline. If it is technological, the scope for welfare-improving policies may be limited.[61] If it is increasing regulation, then the answer would depend on whether those regulations are addressing an externality, and how. Properly addressing these questions will require additional research. The objective of this section is to outline the effects of policies for boosting entrepreneurship, under the assumption that this is desired.

60 If fixed and entry costs were specified in labor units, as discussed in footnote[51], then forces that increase wages would capture some of the effects currently attributed to fixed and entry costs. SBTC causes the high-skill wage to increase, but the low-skill wage to decrease, so its affects through this channel would depend on the type of labor used for these costs. Increasing non-entrepreneur productivity increases both wages. The magnitudes of these effects are constrained by the fact that fixed and entry costs are estimated to increase by far more than wages.

The analysis has abstracted from the transition path. Taking this into account would require many additional identification assumptions about the time and nature of the initial steady state, the time and nature of the final steady state, and the timing of all parameter changes between these points, decreasing the transparency of the analysis.

61 There could still be scope for welfare-improving policies in this case if the economy has inefficiencies to begin with.

Table 4
Effects of policies. The 2015 and 1987 columns provide moments from the model for these years. The subsidy and tax columns present results for the policies, one at a time. Total fixed and entry costs include the subsidized portion of these costs. Consumption includes the out of labor force value b for relevant agents. The consumption equivalent welfare change is with respect to 2015. It is the percentage change (−0.003 implies a decrease of 0.3%) in the consumption of all agents in 2015 that would yield the same utilitarian welfare as in each alternative scenario.

Moment	2015	Entry cost subsidy	Fixed cost subdidy	Non-entrepreneur tax	1987
Total subsidy/tax (share of GDP)	–	0.0025	0.0055	0.035	–
Entrepreneur share	0.037	0.046	0.046	0.046	0.052
Entry rate	0.082	0.125	0.077	0.078	0.113
Entrep. employment share	0.389	0.416	0.413	0.546	0.494
Low-skill share	0.419	0.418	0.417	0.414	0.569
High-skill share	0.298	0.297	0.296	0.294	0.233
OLF share	0.246	0.239	0.241	0.246	0.146
Total fixed costs	0.011	0.014	0.013	0.013	0.006
Total entry costs	0.003	0.006	0.003	0.004	0.002
Productivity	1.440	1.450	1.449	1.445	1.257
Output	1.691	1.712	1.706	1.652	1.134
Consumption	1.118	1.120	1.119	1.111	0.828
Consump. equiv. welfare change	–	−0.003	−0.009	0.003	−0.251

I focus on subsidies to entry costs and fixed costs, and a tax on non-entrepreneur revenue. Entry cost subsidies can be thought of as one-time payments that people receive when they start a business, and fixed cost subsidies would be per period subsidies that are constant across firms. While the underlying source of fixed and entry costs may not be financial, the subsidies can help if it is possible to hire labor, pay for a service or purchase capital to overcome them.[62]

To analyze the effects of these policies I start with the 2015 economy and consider the effects of spending 0.25% of pre-subsidy GDP on subsidizing entry costs.[63] To make the other policies comparable, I set the subsidy for fixed costs and the tax on the non-entrepreneur sector so that these policies achieve the same entrepreneur share as the entry cost subsidy. The subsidies are financed with lump-sum taxes, while the revenue from taxing the non-entrepreneur sector is returned to agents with lump-sum transfers.

The effects of the policies are summarized in Table 4. Start by focusing on the subsidies. The entry cost subsidy is substantially cheaper, at 0.25% of GDP compared to 0.55% for the fixed cost subsidy. The size of the entry cost subsidy is 102.7% as large as the increase in this cost from 1987 to 2015, while the fixed cost subsidy is 122.5% as large as the increase in this cost over the same period.[64] The entry cost subsidy can achieve the same increase in the entrepreneur share for lower cost because it is more targeted. The policies are effective at increasing the entrepreneur share to the extent that they cause people who would not otherwise be entrepreneurs to do so. The entry costs subsidy is relatively good at achieving this because it is only wasted on one-time payments to people that would be entrepreneurs without it. Fixed cost subsidies have more waste because they are paid every period, and people who would be entrepreneurs regardless of them have higher productivity on average, and therefore spend longer being entrepreneurs.

As well as being cheaper, the entry cost subsidy also results in larger increases in the entry rate and the entrepreneur employment share. The earlier comparative statics exercises presented in Fig. 5(b) provide the intuition for why the entry cost subsidy is the most effective at boosting the entry rate. The intuition for why the entry cost subsidy generates a larger increase in entrepreneur employment share is similar to the intuition for the greater increase in the entrepreneur share. To the extent that these subsidies go to agents who would be entrepreneurs anyway, they do not change their labor hiring decisions. Additional hires in the entrepreneur sector are due to new entrepreneurs. Since the entry cost subsidy increases the number of these more, it also increases employment in the entrepreneur sector more.[65]

Now consider the tax on the non-entrepreneur sector. For this to achieve the same increase in the entrepreneur share as the entry cost subsidy is more costly and requires a larger reallocation of labor across sectors. The required tax amounts to 3.53% of GDP,[66] and the entrepreneur share of employment increases from 38.9% to 54.6%. For the entry subsidy these numbers are 0.25% and 41.6%. The reason for the higher cost and greater labor reallocation is that the non-entrepreneur tax is a far less targeted policy for increasing the entrepreneur share. It causes the non-entrepreneur sector to demand less labor, pushing wages down. As well as encouraging more people to be entrepreneurs, it causes all existing entrepreneurs to expand their businesses. So, for a given increase in the entrepreneur share, there is much more labor reallocation. Similar to the fixed cost subsidy, it is also ineffective at increasing the entry rate.

Looking beyond entrepreneurship moments, both of the subsidies have a net negative cost. Aggregate output increases as a result of these policies, and so does aggregate productivity. The policies subsidize entrepreneurship. Due to decreasing returns to scale, aggregate productivity increases when more people are entrepreneurs. The increase in output is offset by increases in costs and less

62 For example, it could help to satisfy regulations to employ lawyers, hire accountants, or purchase equipment that meets regulatory requirements.

63 The size of the budget is illustrative. The focus is on the relative effects of the policies. The cost of the subsidy will depend on the decisions of agents in the economy and this is accounted for.

64 The values of these parameters for 2015 are $\psi = 0.290$ and $\psi_e = 0.981$. The subsidies reduces these costs to $\psi = 0.084$ and $\psi_e = 0.253$.

65 The new entrepreneurs resulting from the entry cost subsidy come from all other occupation categories. See the Appendix for details.

66 The tax rate on non-entrepreneur revenue is 7.5%.

consumption from home production, but only partially. These offsetting factors are small enough that consumption also increases. Welfare decreases by a small amount for the entry cost subsidy, and by nearly 1% for the fixed cost subsidy. The non-entrepreneur tax also increases productivity for the same reason, however output and consumption decline due to more people not working. The welfare change is slightly positive in this case. The reason for this is that households face uninsurable idiosyncratic risk, so the transfers of tax revenue provide consumption insurance.[67] The fact that aggregate consumption increases for the subsidies suggests that welfare improving versions of these policies may exist as well. The scope for welfare improvements increases if entrepreneurship has positive externalities that have not been studied here, such as new entrepreneurs being a source of productivity improvements that have spillovers to other firms, or a source of greater competition.

8. Conclusion

This paper has studied why entrepreneurship in the US has declined over the last three decades. While it is well known that the rate at which new firms are created has declined, occupational choice data shows additional facts. The entrepreneur share has decreased, and this has not been offset by the businesses of entrepreneurs growing larger, implying that an increasing share of economic activity is accounted for by non-entrepreneur firms. The decline in the entrepreneur share has also been larger for more educated people. This array of facts provides a rich set of moments for evaluating theories for the decline in entrepreneurship.

The analysis has used the structure of a dynamic, general equilibrium, occupation choice model for interpreting the data. While SBTC can account for much of the *relative* decline in the entrepreneur share for more educated people, it does not explain the decline in the aggregate entrepreneur share or the declines in the other dimensions of entrepreneurship. The paper has shown how the model and data, together, can identify and disentangle the effects of changes in fixed costs, entry costs, and the productivity of large non-entrepreneur firms. While they have all played a role in accounting for the decline in the entrepreneur share, the contributions to the decline in the other dimensions of entrepreneurship are starkly different. Rising entry costs are the main factor behind the declining entry rate, while increasing productivity of large non-entrepreneur firms account for most of the decline in the size of the entrepreneur sector.

A question that the results raise is what factors are behind the rise in fixed and entry costs. Some possibilities are increasing regulation, changes in production technologies, ideas getting harder to find, or that customers are becoming harder to attract.[68] I have provided suggestive evidence that increasing regulation and changes in production technologies driven by IT technology adoption may have played a role. An important challenge for future research is to provide causal evidence for the drivers of these cost increases, and quantify the contribution of the various hypotheses.

In terms of policy, subsidies to entry costs and fixed costs, and a tax on the non-entrepreneur sector can all boost entrepreneurship. However, the entry cost subsidy is the most effective because it is more targeted at people who would not otherwise choose to be entrepreneurs. There is scope for further research on these policies. With more evidence on the underlying cause of the increase in fixed and entry costs, we will be in a better position to evaluate whether and how to support entrepreneurship going forward.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.jmoneco.2025.103812.

Data availability

Data will be made available on request.

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[67] For more on entrepreneurship and uninsurable idiosyncratic risk see entrepreneurs facing an entry cost and uninsurable idiosyncratic risk Robinson (2023).
[68] For research that considers these trends see Kleiner (2015), Aghion et al. (2023), Hsieh and Rossi-Hansberg (2023), De Ridder (2024), Weiss (2020), Bloom et al. (2020), Bornstein (2021).

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