Reluctant Entrepreneurs: Evidence from China's SOE Reform*

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Abstract

We study the impact of state-owned enterprises (SOEs) on the quality of entrepreneurship in China. Using a long series of firm registration and performance data, we document that the massive SOE downsizing in the late 1990s significantly improved both the quantity and the quality of entrepreneurship. Compared to entrepreneurs in other time periods, firms founded by reluctant entrepreneurs induced by SOE layoffs perform better. To explain these results, we present a simple model of occupational choices in which high-skilled individuals obtain a higher value than low-skilled individuals from the benefits offered by SOE jobs, leading them to select into the SOE sector in the pre SOE reform era. When the SOE sector was downsized, some high-skilled SOE employees were reluctantly unleashed into entrepreneurship. We also provide corroborating evidence for other implications of the model.

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JEL Codes: J08, J28, J68, L26.

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1 Introduction

Entrepreneurship is one of the main engines of economic growth, promoting innovation and generating employment opportunities (Haltiwanger et al., 2013; Decker et al., 2014). Firms founded by highly skilled entrepreneurs tend to exhibit greater growth throughout their lifecycle and are the key drivers of economic dynamism (Queiró, 2022; Kaplan et al., 2009; Becker and Hvide, 2022; Choi et al., 2023). Thus, it is crucial to understand who becomes entrepreneurs.

There is a large literature on the factors that encourage or discourage individuals from undertaking entrepreneurial activities.[1] The conventional wisdom is that individuals with the greatest ability naturally gravitate towards entrepreneurship. However, an alternative view, known as "reluctant" or "forced" entrepreneurs, argues that individuals start their own businesses not out of a strong desire or passion for entrepreneurship, but rather out of necessity or other circumstances.[2] This view is most forcefully argued in an important paper by Hacamo and Kleiner (2022), which analyzes the employment histories of 640,000 U.S. workers from LinkedIn, and documents that college students who graduate during a period of high unemployment are more likely to become entrepreneurs; moreover, compared to voluntary entrepreneurs, firms founded by what they refer to as "forced entrepreneurs" who graduated in years with relatively high unemployment rate are more likely to survive, innovate, and receive venture-backing. Hacamo and Kleiner (2022) explained their findings by showing that labor market shocks tend to disproportionately impact high-earners; as a result, a recession can unleash the untapped entrepreneurial potential across the top of the skill distribution that would otherwise have chosen to be wage earners in a stronger labor market.

Our paper contributes to this literature. We study, in the context of China's historical and massivedownsizing of state-owned enterprises (SOEs) in the late 1990s, how the reduced availability of SOE employment as a career option impacted career decisions of high-skilled individuals, particularly their choices between waged employment and entrepreneurship, and how *reluctant* entrepreneurs unleashed by the SOE downsizing positively contributed to the overall quantity and quality of entrepreneurship in both short and long terms. Our paper complements Hacamo and Kleiner (2022) in that we are able to study not only how the sorting of individuals who just enter the labor market differed before and after the SOE downsizing, but also the reshuffling of high-ability individuals who initially sorted into the state sector before the SOE downsizing, in the literal sense of the word "reluctantly," into entrepreneurship.

China's momentous SOE downsizing starting from 1998 is likely the most extensive privatization initiative ever witnessed in modern history in terms of employment. Official data suggests that China laid off a staggering number of more than 35 million SOE workers between 1995 and 2001 (Ministry of Human Resources and Social Security, 2006), approximately 30% of the total SOE sector workforce, particularly during the SOE downsizing of 1998 when China was preparing for its accession to the World Trade Organization (WTO). Our study period starts from 1993, when

[1] See the related literature below for details.

[2] It appears that the first mentions of "reluctant entrepreneurs" as a concept appeared in non-economics articles, e.g., *The Reluctant Entrepreneur* (Ken Veit, Harvard Business Review, 1992), and *Reluctant Entrepreneurs: Why They Do It and How They Do It* (Eyal Yaniv and David Brock, 2012).

the Chinese government decided to gradually expose the SOEs to market competition, and focuses on the period from 1998 to 2001 during which the SOE downsizing was largely complete. We document that massive SOE downsizing unequivocally led to a larger number of new firm creations. In particular, we provide empirical evidence that, after carefully controlling for market conditions and business environment, firms founded by entrepreneurs induced by the massive SOE downsizing exhibit superior performance, as measured by metrics such as return on equity (ROE), annual net income, profit, survival rate, and growth, relative to their comparable peers.

There are at least three reasons why China provides an ideal setting to study the impact of SOEs on entrepreneurship. First, the share of SOEs in the Chinese economy has experienced dramatic changes since the 1990s. The number of state-owned and state-controlled enterprises fell from 118,000 in 1995 to 24,961 in 2004, and Gan (2008) estimated that close to two thirds of China's SOEs were either privatized or subjected to nonstate ownership between 1995 and 2005. This provides the labor market shock that we exploit in our paper.[3] Second, despite the fact that SOEs have lower productivity than private-owned enterprises (POEs),[4] extensive literature documents that SOEs have better access to economic resources,[5] and SOE employees enjoy superior job-related benefits than those of POEs or the self-employed.[6] To the extent that individuals value these benefits, the availability of SOE employment is likely to affect who selects into entrepreneurship. Third, China is unique in the sense that the State Administration for Industry and Commerce (SAIC) maintains the firm registration database which covers the universe of *all* registered firms established in China since 1949. The database contains information on the year of the firm's establishment, exit date (if applicable), 4-digit industry classification code, registered capital, equity investment history, as well as the basic demographic information of the legal representative and main initial shareholders, such as age, birthplace, and their shares in the company. The availability of such detailed firm registration data allows us to study the impact of SOEs on entrepreneurship. We also have unique annual report data for all registered firms and administrative tax data for a representative sample that contain annual financial performance metrics, which allows us to examine the ability of the reluctant entrepreneurs induced by the SOE downsizing relative to their voluntary counterparts both in the short and long terms.

The mechanism we propose to explain our findings is based on the simple idea that changes in the opportunities of SOE employment affect the allocation of skills between waged employment, both in SOEs and POEs, and entrepreneurship. We show that the large SOE sector, through its provision of additional benefits, leads to a reluctance towards entrepreneurial endeavors among high-skilled individuals. The mechanism yields important implications for the impact of the state

[3]However, from 2013 there has been a resurgence of SOEs in the Chinese economy (Fang et al., 2022; Brandt et al., 2023), and thus understanding the impact of SOEs on China's entrepreneurship is again crucial to predict the future dynamism of the Chinese economy.

[4]Song et al. (2011) documented that compared to the POE sector, the productivity in the SOE sector is about 9% lower.

[5]For example, SOEs have better access to finance (Song et al., 2011; Cull and Xu, 2003), more subsidies (Min, 2011), favorable tax treatment and land use rights (Harrison et al., 2019), and greater market power (Yu, 2014).

[6]For example, SOEs have access to cheaper housing (Wang et al., 2005), a better pension system (West, 1999), and more social welfare (Cheng et al., 2021).

sector on the market economy. The allure of state-sector employment for high-skilled labor not only discourages the growth of the private sector through labor allocation but also, more importantly, impedes the establishment of new productive private firms on a broader scale, thus reducing the dynamism of the economy. However, once these previously reluctant, high-skilled individuals are compelled to exit the SOEs—for example, due to the large-scale SOE downsizing that occurred in China in the late 1990s—they transform into successful entrepreneurs who catalyze the economic growth in subsequent decades.

We first develop a simple three-sector occupational choice model to illustrate how individuals with different entrepreneurial abilities select into three sectors: working for an SOE; working for a POE; and becoming an entrepreneur. If the individual becomes an SOE worker, he receives a constant wage as well as additional benefits—e.g., job security, fringe benefits, and social status; if he works for a POE, he receives a constant wage plus a bonus payment that depends on his ability; if he becomes an entrepreneur, he is endowed with a project and exerts effort to search for an alternative riskier project with a higher payoff, where the cost of effort decreases with his entrepreneurial ability. We show that if individuals with a higher entrepreneurial ability tend to value more the benefits/amenities associated with the SOE jobs, then the most able individuals can be selected into the SOE sector, the moderately able individuals into the entrepreneurial sector, and the least able individuals into the POE sector (Proposition 1). As a result, the average entrepreneurial ability of SOE workers is higher than that of entrepreneurs. A downsizing of the SOE sector, modeled as a layoff of SOE workers, leads not only to *more* entrepreneurs but also to *better* entrepreneurs on average (Proposition 2). Recognizing the differences in career choice problems faced by individuals who entered the labor market before the SOE reform started (before 1992), during the SOE reform (1993-1997), or after the SOE downsizing (after 1998), our model also predicts potential performance heterogeneity among entrepreneurs of different generations (Proposition 3).

We use firm registration and performance data sets to test model predictions. Our identification strategy relies on the heterogeneity across the entrepreneurs' *home* (i.e, *birth*) provinces in the realized intensity of SOE layoffs. We define the intensity of treatment in an entrepreneur's home province as the percentage change in the number of SOE employees in 2001 relative to that in 1995. To identify the causal effect of SOE layoff on entrepreneurship, we rely on a difference-in-differences (DID) analysis that compares the entry and the performance of entrepreneurs *born in* high-layoff-intensity provinces to those *born in* low-layoff-intensity provinces, before and after the massive SOE downsizing in 1998. It is worth emphasizing, as we explain in more detail in Section 5.1, that our identification is based on variations in the intensity of SOE layoffs in the entrepreneurs' home provinces, rather than in the firms' registration provinces. In other words, our identification comes from comparing the performance of firms in the same registration province established by entrepreneurs from provinces differentially affected by SOE layoffs. While the province in which to register one's businesses may be an endogenous choice, the individual's birthplace, and thus the intensity of the SOE layoff shock, is exogenous. It is important to emphasize that the two do not always coincide with each other, allowing our identification to be immune from endogenous firm

location choice. To address the concern that the *realized* layoff intensity in a province, our measure of treatment intensity, may be correlated with some unobserved provincial-level changes that affect the entrepreneurial market, we further exploit the fact that provinces differ in the initial industry composition before the SOE downsizing in 1998 to construct a Bartik shift share instrument (Bartik, 1991).

We show that the 1998 SOE downsizing boosted new firm creation as well as the entry of new entrepreneurs. We find that a 10 percent increase in the layoff intensity – exactly one standard deviation of the layoff intensities across provinces – leads to a 7.5 percent increase in the number of newly created firms (accounting for about 2,050 new firms) per province per year after the downsizing event. The estimate is robust to the aforementioned Bartik instruments based on the pre-layoff province-level industry composition.

More importantly, we find that the layoff-induced entrepreneurs outperformed other comparable entrepreneurs. Specifically, the average quality of entrepreneurs, as measured by their firms' performance metrics, such as return on equity (ROE), annual net income, and profit, exhibited a larger increase after the 1998 SOE downsizing for entrepreneurs from the high-layoff intensity provinces compared to those from the low-layoff intensity provinces. This outperformance persists even after more than 10 years among the surviving firms. Our finding is robust to a number of specifications and the use of the instrumental variable approach. We also find that layoff-induced entrepreneurs who initially entered the labor market before 1992 (the older, pre-SOE reform cohort) perform worse than those who entered the labor market between 1993 and 1997 (the middle cohort), who in turn perform worse than those who entered the labor market after 1998 (the younger, post-SOE downsizing cohort), which suggests that the SOE layoffs were directional in the sense that the less able SOE workers were subject to higher probability of being laid off than their more able counterparts (Proposition 3).

Apart from the mechanism laid out above, there exist several potential alternative explanations that may rationalize our findings. We present four alternative explanations and provide evidence that none of them could fully drive our findings. One alternative mechanism is that a more intensive SOE layoff may lead to a more abundant local labor supply, which will decrease local labor costs and improve firm performance; a second potential mechanism is that a more intensive layoff releases more skilled labor into the labor market, and it is the more able employees rather than the more able entrepreneurs that cause the new firms' better performance; a third potential mechanism is that provinces where more SOE workers were laid off, may be more pro-market during the SOE reform, which can encourage entrepreneurship and improve performance; and a fourth channel is that former SOE workers may have accumulated social capital such as networks that can contribute to their entrepreneurial performance after they leave the SOE sector. In Section 6, we carefully examine these channels and demonstrate that our results are not driven by these alternative mechanisms.

Related Literature. Our paper primarily contributes to the growing literature on reluctant entrepreneurs, but it is also related to several additional strands of literature.

First, we contribute to an extensive literature on the factors that can encourage individuals

to engage in entrepreneurial activities. The early literature finds little return premium associated with entrepreneurship compared with waged job (Hamilton, 2000; Moskowitz and Vissing-Jørgensen, 2002). The existing literature finds that psychic benefits (Jones and Pratap, 2020), the value of experimentation (Manso, 2016), and the option of returning to the paid job (Catherine, 2022) facilitate entrepreneurial activities. Meanwhile, the literature identifies factors that can hinder individuals from undertaking entrepreneurial endeavors, ranging from regulations related to business entry (Klapper et al., 2006; Bruhn, 2011; Branstetter et al., 2014) and tax policy (Gentry and Hubbard, 2000) to financial constraints (Evans and Jovanovic, 1989; Holtz-Eakin et al., 1994; Blanchflower and Oswald, 1998),[7] financial environment (Guiso et al., 2004; Lee et al., 2011), career risk (Baptista et al., 2012; Gottlieb et al., 2022), and the correlation between individual productivity in the waged workforce and entrepreneurship (Murphy et al., 1991; Bai et al., 2021).

Second, our paper also contributes to the literature on the relationship between labor market shocks and entrepreneurial activities. A handful of studies find that (i) displaced workers experience permanent income loss after job displacement (Jacobson et al., 1993; Yagan, 2019), (ii) entering the labor market during recessions may cause permanent human capital loss (Kahn, 2010), and (iii) labor shocks may push the labor force towards entrepreneurship (Evans and Leighton, 1990; Babina, 2020; Hacamo and Kleiner, 2022). Contrary to the conventional wisdom that individuals with a higher ability enter into entrepreneurship and thus workers who start firms after unemployment may be less likely to achieve success (see, e.g., Moreira, 2016; Sedláček and Sterk, 2017), we show that labor market shocks—SOE layoffs in our context—translate into *better* entrepreneurial performance. Specifically, the firms of the newly entered layoff-induced entrepreneurs on average generate more profits, survive longer, and are more likely to become serial entrepreneurs than those of the "incumbent" entrepreneurs who started their businesses before the massive layoff.

Third, our paper is also related to the literature on state sector reform and corporate privatization. Previous literature on China's SOE reform focuses on its impact on the reallocation of capital and labor from less productive SOEs to more productive POEs, thus improving the average total factor productivity of the Chinese economy (Song et al., 2011; Lin and Tan, 1999; Bai et al., 2009; Hsieh and Song, 2015), as well as shaping the labor market dynamics (Cai et al., 2008; Meng, 2012). Several papers study the impact of the SOE reform on households and identify a negative effect on labor income and living standards (Zuo, 2016; Tian et al., 2022). To the best of our knowledge, we are the first to document the positive effect of the SOE reform in spurring entrepreneurship. We show that the SOE downsizing released a large number of high-skill workers, who were previously attracted by the additional benefits provided by the SOEs and were reluctant to become entrepreneurs. These reluctant entrepreneurs thrive after the downsizing of the SOE sector and contribute to the dynamism of the Chinese economy in the subsequent decades.

The remainder of the paper is organized as follows. Section 2 describes the institutional background of SOE reform and the massive SOE downsizing in 1998. Section 3 lays out the model and derives testable hypotheses. Section 4 describes the data and the main variables. Section 5

[7] See also Hurst and Lusardi (2004); Bianchi and Bobba (2013); Adelino et al. (2015); Schmalz et al. (2017); and Hombert et al. (2020).

presents our empirical strategy and the main empirical results. Section 6 discusses and tests several potential alternative mechanisms. Section 7 concludes.

2 Institutional Background

In this section, we first provide the institutional and historical background of the SOE sector and the SOE reform in China, then we provide the descriptive statistics about the evolution of entrepreneurship over time.

2.1 SOE Reform

Pre-SOE Reform Era and SOE Job Characteristics (1985-1992). In the Chinese labor market until the early 1990s, more than 60% of the urban working population was employed in the SOE sector. Jobs in the SOE sector were expected to be lifetime employment with a rigid wage system, and they were well respected with substantial non-monetary benefits. Although wages under the planning system differed across individuals, the wage distribution was compressed and did not directly reward differences in productivity (Meng, 2012). Lifetime employment and centrally determined wages reduced mobility and incentives, which, in turn, led to overstaffing, shirking, low productivity, and SOEs tended to suffer big losses and relied on government support.

SOE Reform in the Early 1990s (1993-1997). Following Deng Xiaoping's South Tour in 1992, a spectrum of liberalization policies was adopted to reform the SOE sector and establish a modern enterprise system. Crucially, the reform introduced market competition against SOEs and harbingered a vibrant private sector (Garnaut et al., 2018; Naughton, 1994). The reform from late 1992 significantly worsened the prospect of SOE jobs by lessening the government support for the SOEs, though they continued to operate at loss. At the same time, the "guaranteed job assignment" system for college graduates was revoked from 1992,[8] and college graduates were highly encouraged to seek job opportunities on their own, including in the private sector.

Massive SOE Layoff in the Late 1990s (1998-2001). From 1998, China initiated a major SOE reform, known as the "*Grasp the Large, Let Go of the Small*" policy, which was announced at the 15th CCP Congress (Hsieh and Song, 2015; Frazier, 2006; Bai et al., 2006). The key component of the policy was to keep only a few large SOEs in the strategic sectors and to merge, privatize, and close most other medium-to-small SOE firms. This led to a substantial downsizing of the SOE labor force.

Data from the Chinese National Bureau of Statistics shows that the SOE employment peaked at about 109.5 million in 1995, but it fell to 74.1 million by 2001, representing a 32.3% decline. There was also significant heterogeneity across sectors in the SOE layoff intensity: The most affected sectors were manufacturing, mining, and sales & trade, which laid off 62% of their employees; and

[8] See http://www.moe.gov.cn/jyb_sjzl/moe_164/201002/t20100220_3430.html.

the total number of employees in these sectors dropped from 52 million in 1995 to 20 million in 2001. The least affected sectors were education & entertainment, social welfare, and government agency & social organization— the total number of employees in these sectors even saw a slight increase from 27 million in 1995 to 29 million in 2001 (National Bureau of Statistics, 1998, 2002).[9] We will exploit the pre-reform cross-province variations in the SOE sectoral compositions to construct Bartik instruments in Section 5.1.

Figure 1 plots the number of individuals employed in the SOE sector and non-SOE sector (including self-employment), as well as the share of SOE employment in the urban workforce, from 1985 to 2005. It shows a massive drop in the number of SOE workers around 1998. Figure 2 plots the geographical variations of the SOE layoff intensity, as measured by the percentage change in the number of SOE employees from 1995 to 2001 by province. It shows significant regional variation in the layoff intensity, where provinces such as Inner Mongolia, Heilongjiang, Jilin, Zhejiang, and Jiangxi laid off more than 30% of the SOE employees, while provinces such as Hunan and Tibet were much less affected.

[Figures 1 and 2 about here]

2.2 Evolution of Entrepreneurship

The private sector was virtually non-existent in China until the late 1980s, when small informal businesses became permitted. Chinese entrepreneurs gradually emerged. The SOE reform initiated in late 1992 led to diminishing prospects for the state sector and a proliferation of entrepreneurship. Nevertheless, voluntary entrepreneurship was slow and gradual until the 1998 downsizing of the SOE sector. The massive layoff *forcibly* pushed thousands of former SOE employees into entrepreneurship.

In the post-layoff era, there was a remarkable increase in the number of private firms and new entrepreneurs, with a focus on small businesses in the light-industry and service sectors. As shown in Figure 3, the number of new entrepreneurs remained stable at around 4,000 per year in the early 1990s but experienced rapid growth afterward; by 2005 it more than doubled.

[Figure 3 about here]

We focus on the era *after* the 1992 SOE reform, during which the prospect for the state sector started to decline. A watershed moment was 1998, which marked the start of the massive downsizing of the SOE sector.

3 An Illustrative Model of Ability Selection

In this section, we develop a simple Roy (1951)-style three-sector occupational choice model and derive three testable hypotheses: (i) if there is a sufficiently positive correlation between an

[9] Table A1 reports the summary statistics for the industry level SOE employment and layoff.

individual's entrepreneurial ability and his valuation of the SOE job, then most entrepreneurially able individuals will select into the SOE sector (Proposition 1); (ii) the downsizing of the SOE sector can spur an increase in the quantity and quality of entrepreneurs (Proposition 2); and (iii) the performance of SOE layoff-induced entrepreneurs may vary across different age groups (Proposition 3).

3.1 Pre-SOE Reform: Occupational Choice and Ability Selection

There is a continuum of risk-neutral individuals. Each individual faces the decision of (i) joining the workforce to be an SOE worker, (ii) entering entrepreneurship, or (iii) becoming a POE employee. If the individual decides to become an SOE worker, he receives a constant wage $w_S > 0$ and an additional benefit $b_S > 0$ (e.g., job security, fringe benefits, and social status). His utility is

$$U_S := w_S + kb_S,$$

where $k > 0$ is the weight or marginal valuation of the additional benefit and can vary across individuals.[10]

If the individual decides to become an entrepreneur, he is endowed with a project (safer project).[11] The project succeeds and generates a payoff of V_S with probability $p_S \in (0,1)$ and fails with complementary probability. The individual chooses effort $e \geq 0$ to search for an alternative project. Individual's effort is costly, and the effort cost is specified as $C(e) = \frac{e^2}{2\theta}$, where $\theta \in [\underline{\theta}, \bar{\theta}] \subset \mathbb{R}_+$ measures the individual's *entrepreneurial ability*. With probability e, the individual finds the alternative project; with remaining probability $1-e$, the individual can only select the initial project. The alternative project succeeds and generates a payoff of V_R with probability $p_R \in (0,1)$ and fails with complementary probability. Failure generates a disutility $-\Delta$ to the individual, where $\Delta > 0$ can be either the amount of loss that failure of a project yields or the individual's fear of failure.[12] The individual faces the risk-return tradeoff: The alternative project is riskier but yields a higher expected return—i.e., $p_R < p_S$ and $p_R V_R - (1-p_R)\Delta > p_S V_S - (1-p_S)\Delta > 0$. The latter condition implies that the individual would choose the riskier project whenever it is available.

The individual chooses search effort $e \in [0,1]$ to maximize

$$\max_{e \geq 0} \left\{ e\left[p_R V_R - (1-p_R)\Delta\right] + (1-e)\left[p_S V_S - (1-p_S)\Delta\right] - \frac{e^2}{2\theta} \right\}. \tag{1}$$

[10] Alternatively, k can be interpreted as an individual's probability of obtaining the benefit b_S, which may differ across individuals.

[11] See Edmans and Liu (2011) for a similar modeling specification.

[12] For expositional convenience, we assume that both projects generate the same amount of loss to the individual in the case of failure. All of our results remain intact if failure generates different losses to the individual for the two projects.

It is straightforward to verify that the individual would choose

$$e^* = [(p_R V_R - p_S V_S) - (p_S - p_R)\Delta]\,\theta.$$

For notational convenience, let $b_E := [(p_R V_R - p_S V_S) - (p_S - p_R)\Delta]^2/2$, which can intuitively be interpreted as the marginal return of an individual's ability. The individual's expected utility under the optimal search intensity, after plugging $e = e^*$ into the objective function (1), is

$$U_E := [p_S V_S - (1 - p_S)\Delta] + b_E\theta.$$

If the individual decides to become a POE employee, he receives a constant wage $w_P > 0$. An individual's entrepreneurial ability—namely, the ability to create and identify promising products, motivate and coordinate workers, and solve complex analytical problems—may also boost productivity in salaried employment (Levine and Rubinstein, 2020). To this end, we assume that a POE employee receives a bonus payment $b_P\theta$, which increases with his entrepreneurial ability θ. Therefore, his expected utility as a POE worker is

$$U_P := w_P + b_P\theta.$$

We assume that the marginal return of entrepreneurial ability θ in the POE sector is smaller than that in the entrepreneurial sector. More formally, we make the following assumption:

$$0 < b_P < b_E. \tag{2}$$

Individuals differ in their entrepreneurial ability θ and marginal valuation of the SOE job k.[13] For simplicity, we assume that there is a one-to-one mapping between θ and k—i.e., $k = h(\theta)$—and entrepreneurial ability θ are drawn independently from an interval $[\underline{\theta}, \bar{\theta}]$ according to a common distribution function $F(\cdot)$, which admits a positive and continuous density $f(\cdot) \equiv F'(\cdot)$.

We assume that $h'(\cdot) > 0$, which represents a positive correlation between individuals' entrepreneurial ability and their valuation of the SOE job.[14,15]

A type-θ individual optimally decides on his occupational choice $j \in \{S, E, P\}$ to solve the follow maximization problem:

$$\max_{j \in \{S,E,P\}} \{U_j(\theta)\}.$$

Given individual's optimal occupational choice, we can calculate the expected entrepreneurial ability in each sector $j \in \{S, E, P\}$ as $\Theta_j := \mathbb{E}\big[\theta \,|\, U_j(\theta) \geq U_i(\theta), i \in \{S, E, P\}\big]$. The following

[13] Alternatively, we can assume that individuals differ in their entrepreneurial ability θ and their additional benefit b_S from working for SOEs. Our results are robust to this model specification.

[14] Assuming $h'(\theta) > 0$ is analogous to the assumption $\zeta \geq 1$ in Hacamo and Kleiner (2022), which ensures that there is a positive correlation between workers' productivity and entrepreneurial ability.

[15] Recall in Footnote 10 that k can be alternatively interpreted as the probability of an individual receiving the additional benefit b_S. An increasing $h(\cdot)$ thus indicates that an individual with a higher ability has a higher probability of unlocking the benefit b_S.

result ensues.

Proposition 1 ***(Occupational Choice and Ability Selection)*** *Suppose that the measure of individuals in the SOE sector, that in the entrepreneurial sector, and that in the private sector are all strictly positive before the SOE reform. If $h'(\theta) > b_E/b_S$ for all $\theta \in [\underline{\theta}, \bar{\theta}]$—i.e., if θ and k are strongly positively correlated—then there exist two cutoffs $\underline{\theta}^\dagger < \bar{\theta}^\dagger$ such that the individual chooses to become an SOE worker if $\theta > \bar{\theta}^\dagger$, be an entrepreneur if $\theta \in (\underline{\theta}^\dagger, \bar{\theta}^\dagger)$, and be a POE employee if $\theta < \underline{\theta}^\dagger$, which in turn implies that $\Theta_S > \Theta_E > \Theta_P$ (see Figure 4).*[16]

[Figure 4 about here]

PropositionA.1 in Appendix A generalizes the analysis to the situation where the condition $h'(\theta) > b_E/b_S$ is not satisfied and provides suggestive evidence for the comparative statics under Proposition 1, which lends further support for the strongly positive correlation between θ and k.

In Appendix A.1, we provide supportive evidence, using the China Health and Nutrition Survey (CHNS) survey data, for the ability ranking among the three sectors—i.e., $\Theta_S > \Theta_E > \Theta_P$—as stated in Proposition 1, prior to the 1998 SOE downsizing. Proposition 1 can be used to generate comparative statics with respect to the change of SOE sector wage w_S—i.e., the sign of $d\Theta_j/dw_S$ for $j \in \{S, E, P\}$. This comparative statics prediction is supported by the evidence reported in Table A4, where it shows that both the education level of SOE workers and that of entrepreneurs decrease with the regional average SOE wages.

3.2 SOE Reform: Worsening Job Prospects, Massive Layoffs, and Three Generations

Next, we introduce SOE reform into the model, which consists of worsening job prospects and the massive layoff, and investigate the impact of the downsizing of the SOE sector.

According to the institutional and historical background described in Section 2, we divide the time span into three eras indexed by $t \in \{1, 2, 3\}$ and individuals into three generations indexed by $j \in \{1, 2, 3\}$. Generation-j individuals enter the labor market and make their first-time occupational choice in era $t = j$. Era 1 refers to the pre-SOE reform era (1985-1992); era 2 refers to the early 1990s (1993-1997), when SOE job prospects worsened over time; and era 3 refers to the late 1990s during which the massive SOE layoffs are triggered (1998-2005). The baseline setting laid out in Section 3.1 delineates generation-1 individuals' occupational choice prior to the SOE reform.

The job prospects of the SOE sector worsen from $U_S(\theta) = w_S + kb_S$ in era 1 to $\widetilde{U}_S(\theta) := \widetilde{w}_S + k\widetilde{b}_S$ in era 2, with $\widetilde{w}_S \leq w_S$, $\widetilde{b}_S \leq b_S$, and strict inequality holding for at least one. Further, we assume $h'(\theta) > b_E/\widetilde{b}_S$ for all $\theta \in [\underline{\theta}, \bar{\theta}]$.[17,18]

[16] To be more specific, $\underline{\theta}^\dagger$ is the unique solution to $U_P(\theta) = U_E(\theta)$ and $\bar{\theta}^\dagger$ is the unique solution to $U_E(\theta) = U_S(\theta)$.

[17] It can be verified that no individuals choose to enter the SOE sector in era 2 if otherwise $h'(\theta) \leq b_E/\widetilde{b}_S$ for all $\theta \in [\underline{\theta}, \bar{\theta}]$.

[18] The worsening SOE job prospects can be interpreted more broadly as the improving prospects of the entrepreneurial and the private sectors.

The massive SOE downsizing takes place in era 3 and we denote the number of job positions in the SOE sector for each generation after the SOE downsizing by ℓ, which is smaller than the equilibrium amount of SOE jobs for generation $j \in \{1, 2\}$. Layoff can either (i) be *random* and independent of individuals' entrepreneurial ability, or (ii) be *directional* and start from the least able SOE workers.

The timeline of the events is summarized in Figure 5 and more details regarding each generation are provided below:

Generation 1. Generation-1 individuals optimally make their occupational choice in era 1 by comparing $U_S(\theta)$, $U_E(\theta)$, and $U_P(\theta)$. In era 2, the utility of staying in the SOE sector decreases from $U_S(\theta)$ to $\widetilde{U}_S(\theta)$. As a result, an SOE worker of generation 1 may decide to work in a different sector, in which case a small switching cost $\mathfrak{c} > 0$ must be incurred.[19] More formally, a generation-1 individual who works in the SOE sector would choose to move to a different sector if $\widetilde{U}_S(\theta) < \max\{U_E(\theta), U_P(\theta)\} - \mathfrak{c}$. In era 3, some of the SOE workers who choose to remain in the SOE sector in era 2 are laid off and only ℓ of them are retained.

Figure 6a illustrates the impact of the SOE reform on generation-1 individuals. In era 1 prior to the reform, individual works in the SOE sector if $\theta > \bar{\theta}^\dagger$, in the entrepreneurial sector if $\theta \in (\underline{\theta}^\dagger, \bar{\theta}^\dagger)$, and in the POE sector if $\theta < \underline{\theta}^\dagger$. As the SOE job prospects worsen in era 2, the individual with ability $\theta \in (\bar{\theta}^\dagger, \bar{\theta}_1^\dagger)$—where $\bar{\theta}_1^\dagger$ is the unique solution to $\widetilde{U}_S(\theta) = U_E(\theta) - \mathfrak{c}$—switches from the SOE sector to the entrepreneurial sector. A mass $1 - F(\bar{\theta}_1^\dagger) - \ell$ of the individuals who remain in the SOE sector are laid off and become entrepreneurs in era 3.

Generation 2. The analysis for generation-2 individuals is similar to that for generation-1 individuals. Generation-2 individuals make their first-time occupational choice in era 2 by comparing $\widetilde{U}_S(\theta)$, $U_E(\theta)$, and $U_P(\theta)$, and some of the generation-2 SOE workers are laid off in era 3.

Figure 6b illustrates the impact of the SOE reform on generation-2 individuals. Let $\bar{\theta}_2^\dagger$ be the unique solution to $\widetilde{U}_S(\theta) = U_E(\theta)$. It can be verified that $\bar{\theta}_1^\dagger < \bar{\theta}_2^\dagger$ due to individuals' reluctance in switching jobs. In era 2, individual works in the SOE sector if $\theta > \bar{\theta}_2^\dagger$, in the entrepreneurial sector if $\theta \in (\underline{\theta}^\dagger, \bar{\theta}_2^\dagger)$, and in the POE sector if $\theta < \underline{\theta}^\dagger$. A mass $1 - F(\bar{\theta}_2^\dagger) - \ell$ of the individuals working in the SOE sector are laid off and become entrepreneurs in era 3.

Generation 3. Individuals of generation 3 make their occupational choice in era 3. They realize that the measure of SOE job positions has been reduced to ℓ before they decide on their occupations. If more than ℓ individuals apply for SOE jobs, they will be selected with equal probabilities. Those who are not hired incur a cost $c > 0$—e.g., time cost, search cost—and choose between the POE and the entrepreneurial sector.

Unlike generations 1 and 2 who make their first occupational choice before the massive layoff, generation-3 individuals make their choice after the layoff and thus need to form rational expectation

[19] Switching cost is of especial interest and relevant in labor market settings. See, e.g., Mortensen (1986); Dix-Carneiro (2014).

about the probability of entering the SOE sector, which we denote by $q \in [0,1]$, when making their occupational choice. Fixing q, a generation-3 individual solves the following optimization problem:

$$\max\left\{q\widetilde{U}_S(\theta) + (1-q)\left(\max\{U_E(\theta), U_P(\theta)\} - c\right), U_E(\theta), U_P(\theta)\right\}.$$

The probability of an individual successfully entering the SOE sector q in the equilibrium satisfies the following condition:

$$q = \frac{\ell}{\mathbb{E}\left[\mathbb{1}(q\widetilde{U}_S(\theta) + (1-q)(\max\{U_E(\theta), U_P(\theta)\} - c) \geq \max\{U_E(\theta), U_P(\theta)\})\right]}. \tag{3}$$

The following result can be obtained.

Lemma 1 ***(Equilibrium for Generation 3)*** *Suppose that $h'(\theta) > b_E/\widetilde{b}_S$ for all $\theta \in [\underline{\theta}, \bar{\theta}]$ and the measures of individuals in all three sectors (the SOE sector, the entrepreneurial sector, and the private sector) are all strictly positive for generation 2 in era 2. Fixing ℓ, there exists a unique solution $q \in (0,1)$ to (3). In the equilibrium, an individual chooses to apply for SOE jobs if $\theta > \bar{\theta}_3^\dagger$, be an entrepreneur if $\theta \in (\underline{\theta}^\dagger, \bar{\theta}_3^\dagger)$, and be a POE employee if $\theta < \underline{\theta}_3^\dagger$ (see Figure 6c), where $\underline{\theta}_3^\dagger$ is the unique solution to $q\widetilde{U}_S(\theta) + (1-q)\left(\max\{U_E(\theta), U_P(\theta)\} - c\right) = U_E(\theta)$. Moreover, $\bar{\theta}_3^\dagger > \bar{\theta}_2^\dagger > \bar{\theta}_1^\dagger$.*

Lemma 1 established equilibrium existence and uniqueness for generation-3 individuals when the measure of SOE positions is capped due to the SOE reform. It can be verified that $1 - F(\bar{\theta}_3^\dagger) > \ell$. That is, in the unique equilibrium, the measure of applicants actively searching for the SOE jobs exceeds the job quota.

Note that the downsizing of the SOE sector changes individuals' occupational decision as well as the ability allocation across sectors. To see this, all individuals with $\theta \in (\bar{\theta}_2^\dagger, \bar{\theta})$ would be employed in the SOE sector in the absence of the downsizing of the SOE sector, as is the case with the generation-2 individuals (see Figure 6c). In anticipation of the downsizing of the SOE sector, on the one hand, individuals with $\theta \in (\bar{\theta}_2^\dagger, \bar{\theta}_3^\dagger)$ change their occupational choice and choose to enter entrepreneurship instead in order to avoid incurring the time/search cost c. On the other hand, although the decision of those with $\theta \in (\bar{\theta}_3^\dagger, \bar{\theta})$ remains unchanged, some of them end up in the entrepreneurial sector due to the rationed job opportunities in the SOE sector. The performance of these entrepreneurs—i.e., those with $\theta \in (\bar{\theta}_2^\dagger, \bar{\theta})$—can be identified and measured by our subsequent empirical analysis.

Impact of the massive SOE downsizing. Our subsequent empirical analysis in Section 5.3 focuses on entrepreneurs' expected performance conditional on success, which corresponds to $y^* := \frac{e^* p_R V_R + (1-e^*) p_S V_S}{e^* p_R + (1-e^*) p_S}$ in our model.[20] The following result ensues.

[20] It is noteworthy that the performance comparison established in the following Propositions 2 and 3 are not specific to entrepreneurs' expected performance conditional on success and remain for other performance measures that increase with e^*—e.g., entrepreneurs' unconditional expected performance measured by $e^*\left[p_R V_R - (1-p_R)\Delta\right] + (1-e^*)\left[p_S V_S - (1-p_S)\Delta\right]$ or $e^* p_R V_R + (1-e^*) p_S V_S$.

Proposition 2 ***(Impact of the SOE Layoff on Entrepreneurs' Performance)*** *Suppose that* $h'(\theta) > b_E/\widetilde{b}_S$ *for all* $\theta \in [\underline{\theta}, \bar{\theta}]$. *The average performance of entrepreneurs for generation* $j \in \{1, 2\}$ *in era* 3 *is higher than that in era* 2.

Recall by Proposition 1 the most able generation-1 individuals choose to become SOE workers prior to the SOE reform (see Figure 4); among them, those with lower ability enter entrepreneurship prior to the massive layoff and those with higher ability remains in the SOE sector (see Figure 6a). Similarly, the most able generation-2 individuals choose to work in the SOE sector in era 2 (see Figure 6b). Therefore, compared to generation-3 entrepreneurs who enter in era 3, firms founded by SOE layoff-induced entrepreneurs have a higher entrepreneurial ability. As a result, massive layoffs would boost the average performance of entrepreneurs, which is consistent with our empirical findings in Section 5.3.

With slight abuse of notation, denote the expected value of y^* of generation-1 and generation-2 individuals who become an entrepreneur in era 3 by $\mathcal{Y}_1^*$ and $\mathcal{Y}_2^*$, respectively. Similarly, denote the expected performance y^* of generation-3 entrepreneurs whose ability exceeds $\bar{\theta}_2^\dagger$ by $\mathcal{Y}_3^*$. The following result can be obtained.

Proposition 3 ***(Heterogeneous Effect of the SOE Layoffs on Entrepreneurs' Performance)*** *Suppose that* $h'(\theta) > b_E/\widetilde{b}_S$ *for all* $\theta \in [\underline{\theta}, \bar{\theta}]$. *The following statements hold:*

(i) If the massive SOE layoff is random and is independent of individuals' entrepreneurial ability, then $\mathcal{Y}_2^* > \mathcal{Y}_1^*$ *and* $\mathcal{Y}_2^* > \mathcal{Y}_3^*$.

(ii) If the massive SOE layoff is directional and starts with the least capable SOE workers, then $\mathcal{Y}_2^* > \mathcal{Y}_1^*$ *and* $\mathcal{Y}_3^* > \mathcal{Y}_2^*$.

Two remarks are in order. First, the divergence between $\mathcal{Y}_1^*$ and $\mathcal{Y}_2^*$ is due to the existence of labor market friction—i.e., the switching cost $\mathfrak{c} > 0$ individuals need to incur when moving to other sectors—which results in individuals' reluctance in changing a career.[21] As a result, the average ability of the older cohort in the SOE sector—some of whom will be unleashed to become entrepreneurs by the massive SOE layoff—is lower than that of the younger cohort. This leads to $\mathcal{Y}_2^* > \mathcal{Y}_1^*$, as predicted in Proposition 3, irrespective of how the SOE sector lays off workers.

Second, the divergence between $\mathcal{Y}_2^*$ and $\mathcal{Y}_3^*$ is due to the fact that the massive layoff changes generation-3 individuals' rational expectation in successfully finding an SOE job.[22] By Proposition 3, the comparison between $\mathcal{Y}_2^*$ and $\mathcal{Y}_3^*$ sensitively depends on how layoff is conducted, which will be tested and confirmed in our subsequent empirical investigation.

3.3 Testable Hypotheses

From Propositions 1 to 3, we can derive the following testable hypotheses:

[21] It is straightforward to verify that $\mathcal{Y}_2^* = \mathcal{Y}_1^*$ if the switching cost $\mathfrak{c} = 0$.

[22] It can be verified that $\mathcal{Y}_2^* = \mathcal{Y}_3^*$ if job quota is adequate such that an individual expects that he can always find a job in the SOE sector (i.e., $q = 1$).

Hypothesis 1 ***(Entrepreneurial Ability Ranking)*** *The average entrepreneurial ability in the SOE sector is the highest pre-layoff, followed by the entrepreneurial sector and the POE sector.*[23,24]

Hypothesis 2a ***(Impact of SOE Downsizing on Number of Entrepreneurs)*** *The downsizing of the SOE sector increases the number of entrepreneurs.*

Hypothesis 2b ***(Impact of SOE Downsizing on Entrepreneurs' Performance)*** *The downsizing of the SOE sector increases the average performance of new entrepreneurs for all age cohorts.*

Hypothesis 3 ***(Heterogeneous Effect of SOE Downsizing across Different Age Cohorts)*** *The average performance of entrepreneurs caused by the SOE downsizing is better for generation 2 than for generation 1, while the comparison between those for generations 2 and 3 is depends on whether the SOE layoffs are random or directional.*

4 Data and Descriptive Statistics

We combine several data sets to investigate the effect of the massive SOE downsizing in China in the late 1990s on the evolution of entrepreneurship and to examine the performance of the firms created by these "reluctant" entrepreneurs.

4.1 Firm Registration and Annual Report Database

Firm Registration. The Chinese State Administration for Industry and Commerce (SAIC) releases the firm registration database which covers the universe of *all* registered firms—over 200 million in total—established in China since 1949. We focus on the over 5 million firms that were established during the period between 1993 and 2005, and track their performance until 2020. The firm registration data contains information on the firm's year of establishment, exit date (if applicable), 4-digit industry classification code, amount of registered capital, and the history of ownership changes (if any). Apart from firm registration information, it also provides basic demographic information of the legal representative and initial main shareholders, such as age, birthplace, and their shares in the company. As each person has a unique identifier, serial entrepreneurs or shareholders in multiple firms can be identified. We define an *entrepreneur* as the legal representative of a firm.[25] A burgeoning literature suggests that self-employed individuals may have human capital characteristics distinct from other entrepreneurs (see, e.g., Schoar, 2010; Hurst and Pugsley, 2011; La Porta and Shleifer, 2014; Levine and Rubinstein, 2017).[26] As such, we follow the recent

[23] We relegate the supporting evidence for this hypothesis to Appendix A.1.

[24] It should be noted that although the ability ranking established in Proposition 1 presumes that individuals are of generation 1 prior to the SOE reform, it remains intact for generation-2 individuals who make their first-time occupational choice before the massive layoff.

[25] Our results are robust to the alternative definition of entrepreneur if it is defined as the largest shareholder of a company.

[26] See Levine and Rubinstein (2020) for a detailed discussion on the differences between self-employment and entrepreneurs.

literature (e.g., Azoulay et al., 2020; Barwick et al., 2022; Brandt et al., 2022) and exclude the self-employed individuals from the sample of entrepreneurs in our baseline analysis.[27]

Firm Annual Report. According to the Chinese government regulations, local SAIC offices require all firms to report their financial information annually for the purposes of an inspection procedure to ensure that firms are operating normally and running businesses legally. Failure to report the information to SAIC for two consecutive years results in the cancellation of the firm's license to operate. SAIC collected this information manually in the early years of the system, and the government began to collect the data digitally after 2010. The information contained in the firm's annual report includes the firm's assets, liabilities, total sales, total profit, net profit, and total taxes.

Our SAIC data set has two unique features. First, it tracks the firm registration and performance for a very long period; second, our firm registration data contains unique identifiers for the main shareholders and legal representatives of each firm, which allows us to trace the entrepreneurial history and extract basic demographic information.

4.2 Administrative Tax Records

To enrich our measure of firm performance, we also use the administrative enterprise income tax records from the Chinese State Administration of Tax (SAT) for the years 2008-2015, covering a representative sample of more than 1 million firms from stratified sampling.[28] For tax collection and audit purposes, SAT collects firm-level records of tax payments, as well as other financial statement information used in tax-related calculations. The advantages of tax data are twofold. First, it is representative with wide coverage. As administrative data, it is not subject to the potential measurement error problem of self-reported annual report data. As such, we also use this data set to cross-validate our findings from the annual report data. Second, it contains detailed historical information on a wide array of tax-related information about the firms, including their total production, sales, inputs, employment, etc. This allows us to examine the firms' performance in a longer time horizon and in more dimensions.

4.3 Chinese Statistical Yearbooks

We use the Chinese Statistical Yearbooks from 1995 to 2001 to obtain information on the industrial and employment structure of the provinces. We construct the *layoff intensity* measure at the province level from the changes in the employment structure before and after the SOE layoffs, as well as our Bartik-style instrumental variables from the national level change in employment structure and the provincial level pre-layoff industrial structure. Specifically, we construct the province-level layoff intensity measure, denoted by $Layoff_h$, as the percentage change in the number

[27] In Section 6.2, we supplement the analysis with the self-employed sample. Our findings are robust to this alternative sample.

[28] China's SAT is the equivalent of the Internal Revenue Service (IRS) in the US.

of SOE employees from 1995 to 2001 in province h:[29]

$$Layoff_h = -\frac{\#SOE_{h,2001} - \#SOE_{h,1995}}{\#SOE_{h,1995}}, \tag{4}$$

where $\#SOE_{h,1995}$ and $\#SOE_{h,2001}$ are, respectively, the SOE employment levels in years 1995 and 2001 in province h.

4.4 Summary Statistics

Table 1 presents the summary statistics for our main sample based on the firm registration and annual report data. Panel A shows the summary statistics of our treatment intensity measure—the layoff intensity—at the province level as defined by Equation (4). The average layoff intensity in China was 27%, with a minimum of 5% in Tibet province and a maximum of 43% in Heilongjiang province. The standard deviation of layoff intensity in the sample of 31 provinces was 0.1. Panel B reports the summary statistics from the firm-registration data aggregated to the province-year level. We focus on the over 5 million firms that were established during the period between 1993 and 2005. In our sample period, there were, on average, about 12,000 new firms and 10,000 new entrepreneurs in each province-year cell. Panel C reports the summary statistics of our key variables at the firm level. It shows that the firms, on average, had a registered capital of 3.3 million RMB; about 80% of the firms and entrepreneurs entered the market after 1997; 91% of the firms survived the first year, and 45% of them remained in the market after 5 years; entrepreneurs were on average 38 years old when establishing their firms, and over 84% of the firms were established by new entrepreneurs. Last, Panel D reports the summary statistics of our key outcome variables—which we use to measure the performance of firms—at the firm-year level from the annual report data, which we have more than 20 million observations on firm performance up till 2020 for the firms established between 1993 and 2005.

[Table 1 about here]

Table 2 presents the summary statistics for the administrative tax records data. We have over 1.5 million observations for 0.5 million unique firms established in the period between 1993 and 2005. These firms, on average, had registered capital of 56 million RMB, annual revenue of 141 million RMB, assets of 259 million RMB, annual net profit of 6.4 million RMB, and employed about 146 employees. It is noteworthy that, on average, the firms in the tax records data are significantly larger than the firms in the registration data. This is because the tax records data is surveyed by stratifying firms from all sizes and over-represent the medium to large size firms, while the registration data covers the universe of firms, the majority of which are small firms.

[Table 2 about here]

[29] We use subscript h to indicate the *home* province of the entpreneur.

5 Empirical Strategy and Results

In this section, we introduce our empirical strategy and present the main findings. Section 5.1 describes the empirical strategy. Section 5.2 confirms Hypothesis 2a that layoffs unambiguously increase the number of entrepreneurs. Section 5.3 takes a close look at the performance of the SOE layoff-induced entrepreneurs and confirms Hypothesis 2b. Section 5.4 tests the prediction on the heterogeneity in entrepreneurial performance during the post-layoff era among entrepreneurs of different generations and supports Hypothesis 3.

5.1 Empirical Strategy

Our baseline specification employs a simple difference-in-differences (DID) method to analyze the impact of the massive SOE downsizing on the number of entrepreneurs and the performance of their firms. As discussed in Section 2, the massive SOE layoff poses an exogenous shock to the labor market in which about 32% of the SOE employees were laid off within a relatively short period of time. This labor market displacement shock occurred at the same time across China, but with different intensities. Our identification strategy relies on the heterogeneity across provinces in the realized SOE layoff intensity. The DID specification compares entrepreneurs *from* high-layoff-intensity provinces with those *from* low-layoff-intensity provinces, but operating in the *same destination* province, before versus after the SOE downsizing. It is worth noting that we rely on the regional variations in layoff intensity in the entrepreneurs' birth province rather than the firms' establishment province. During the pre-reform period, the SOE labor market had almost no mobility, which makes the home province layoff intensity a more accurate measure for the exogenous SOE layoff shock experienced by a potential entrepreneur. While firms' registration (i.e., destination) province could be an endogenous choice for the entrepreneurs in seeking better business opportunities, one's home province is pre-determined and thus subject to little endogeneity concerns.

Entrepreneurial Migration in China. Because our identification strategy relies on the presence of entrepreneurs from different home provinces who registered their firms in the same destination province, we first present evidence that such "migrant entrepreneurs" are quite common in the data. Figure 7 plots the direction and volume of entrepreneurial migration for the top 30 province pairs with the greatest number of entrepreneurial flows during the post-layoff era 1998-2005. It shows that the major inflow provinces (Guangdong, Shanghai, and Beijing) attracted entrepreneurs from across the country. In our data set, over 20% of entrepreneurs established their first firms outside their home provinces.

[Figure 7 about here]

In our empirical analysis, we look at two sets of outcome variables: (i) the number of new firms/entrepreneurs measured at the province level; and (ii) the performance of their firms measured at the firm level.

New Firms/Entrepreneurs at the Province Level. We first examine how the number of new entrepreneurs or new firms, at the province level, are impacted by the SOE layoff intensity as measured by Equation (4). Our baseline province-level regression equation is specified as follows:

$$Y_{ht} = \beta_0 + \beta_1 After_t \times Layoff_h + \gamma_h + \eta_t + \epsilon_{ht}, \tag{5}$$

where h and t respectively index the entrepreneur's home province and the year, and Y_{ht} represents either the number of new firm registered by entrepreneurs *from* home province h in year t or the number of new entrepreneurs *from* home province h in year t;[30] $After_t$ is a dummy variable that takes value 1 for years from 1998 onward, and 0 otherwise; $Layoff_h$ measures the treatment intensity for province h, which we constructed according to Equation (4); γ_h and η_t are province and year fixed effects respectively; and ϵ_{ht} is the error term. β_1 is the main coefficient of interest. It captures the additional effect of greater exposure to the 1998 SOE downsizing on the number of new firms or new entrepreneurs from the province.

Firm Performance. At the firm level, we compare the performance of the firms founded by entrepreneurs who entered the market after 1993 but before the 1998 SOE downsizing with those founded by entrepreneurs who entered between 1998 and 2005, interacting with the layoff intensity of the entrepreneur's *home* province, while simultaneously controlling for the firm's *registration* (i.e., *destination*) province. That is, our identification comes from comparing the performance of firms in the same registration province established by entrepreneurs from provinces differentially impacted by SOE layoffs. To ensure that we are comparing entrepreneurs with the same experience, we only consider the *first* firm established by each entrepreneur in our main specification of firm-level regressions.[31]

While we cannot perfectly observe entrepreneurs who were previously employed at an SOE firm and were subsequently laid off during the downsizing, it is reasonable to argue that those who established new firms right after the massive SOE layoff from the high-layoff-intensity provinces are *more likely* to be laid-off former SOE employees. Thus, the regression specification is as follows.

$$Y_{ijhptd} = \beta_0 + \beta_1 After_d \times Layoff_h + \beta_2 X_i + \gamma_h + \gamma_p + \eta_t + \delta_j + \theta_d + \epsilon_{ijhptd}, \tag{6}$$

where the index i denotes firm, j the industry, h the entrepreneur's *home* province, and p the province where the firm i was registered in (i.e, the firm's *registration* province), t the calendar year in which the firm reports its performance, and d the year in which the entrepreneur first enters the market.[32] The outcome variable Y_{ijhptd} is one of the following metrics of firm performance: ROE, log of gross profit, log of net income, survival rate,[33] and whether the entrepreneur became

[30] Because some entrepreneurs established multiple firms— i.e., serial entrepreneurs— we examine both the number of new firms and new entrepreneurs spurred by the SOE downsizing.

[31] The majority of the entrepreneurs only established one firm in our sample period, and the first firm established by the entrepreneurs accounts for more than 86% of the universe of firms.

[32] Because we are looking at the entrepreneur's first firm in this regression, d is also the firm's establishment year.

[33] To address the misreporting concerns regarding firm closure—i.e., firms may not officially de-register when they

a serial entrepreneur after the first firm. $After_d$ and $Layoff_h$ are defined in the same way as in Equation (5). X_i is firm i's registered capital (in log). γ_h, γ_p, η_t, δ_j, and θ_d correspond to the fixed effects of the entrepreneur's home province, firm's registration province, report year, industry, and establishment year, respectively; and ϵ_{ijhptd} refers to the error term. The standard errors are clustered at the home province-by-industry-by-year level.

Remark 1 *Since we do not perfectly observe entrepreneurs who were previously employed at an SOE firm and were subsequently laid off during the downsizing, the "reluctant entrepreneurs" in our analysis are thus proxied with measurement error. Thus our findings should be interpreted as lower bounds of the true effects because of the downward attenuation bias caused by the measurement error.*

Although the first firm established by the entrepreneurs account for the majority of the firms, one may still be concerned that our main specification is subject to selection bias. As such, we supplement our test by examining the *subsequent* firms established by entrepreneurs who established two or more firms in the sample period (which are often referred to as "*serial entrepreneurs*"). The regression specification is as follows:

$$Y_{ijhpt\mathbf{d}} = \beta_0 + \beta_1 After_{d(e)} \times Layoff_h + \beta_2 X_i + \gamma_h + \gamma_p + \eta_t + \delta_j + \theta_{d(e)} + \theta_{d(i)} + \epsilon_{ijhpt\mathbf{d}}, \quad (7)$$

where $\mathbf{d} \equiv (d(i), d(e))$ is a vector of two indices: $d(i)$ denotes the firm i's establishment year, and $d(e)$ the year in which the entrepreneur e first became an entrepreneur;[34] and $\theta_{d(e)}$ and $\theta_{d(i)}$ correspond to the entrepreneur's entering year, and firm's establishment year fixed effects, respectively. All the other indices and variables are defined similarly to those in Equation (6). The standard errors are clustered at the home province-by-industry-by-year level.

Remark 2 *By simultaneously controlling for the fixed effects of the entrepreneur's entering year and the firm's establishment year, we compare the performance of firms established in the same year by the layoff-induced entrepreneurs with those established by the voluntary entrepreneurs (who became an entrepreneur before the SOE downsizing). This enables us to tease out the effect of unobserved national-level market environment changes —e.g., market conditions and the business environment —that may affect the firms' performance. This was not possible in our main specification (Equation (6)), which focuses on the first firm, because the first firm established by a reluctant entrepreneur cannot be in the same year as the ones established by a voluntary entrepreneur.*

Instrumental Variable (IV) Approach. One concern about the DID strategy is that the layoff intensity in a province h, as constructed in Equation (4), may be correlated with unobserved

exit the market—we code survival to be zero when a firm stops submitting annual reports which we interpret as a *de facto* exit of the firm.

[34] Since we are looking at the subsequent firms established by the entrepreneurs who established two or more firms, $d(i)$ and $d(e)$ are different.

time-varying provincial-level changes that also affect the entrepreneurial activities. For instance, entrepreneurs may be more likely to establish firms in places where the local politicians become more friendly to private businesses after the SOE layoffs, which may simultaneously affect the measurement of layoff intensity (to the extent that entrepreneurs establish the firms in their home province) and the entrepreneurship outcomes of interest.

To address the concern about endogeneity, we construct a Bartik-style IV that takes advantage of the fact that provinces differed in their initial industrial composition and, as mentioned in Section 2, the layoff intensities varied significantly between industries. Specifically, we use changes in the national-level *industry-specific* layoff intensity as exogenous determinants of the displacement shock, and then interact it with the provincial-level industrial composition of SOE employment in 1995 (before the SOE downsizing):

$$Bartik_h = \sum\nolimits_j \frac{\#SOE_{j,h}^{95}}{\#SOE_h^{95}} \times \frac{\#SOE_j^{95} - \#SOE_j^{01}}{\#SOE_j^{95}}, \tag{8}$$

where h, j, and t indicate the home province, industry, and year, respectively. $\#SOE_{j,h}^{95}$ is the number of SOE workers in industry j in province h in 1995; $\#SOE_h^{95}$ is the total SOE employment level in province h in 1995; and $\#SOE_j^{95}$ is the total SOE employment level in industry j in 1995. Other variables are defined similarly.

The Bartik-style layoff intensity measure serves as a positive labor supply shifter, which is arguably exogenous to the local demand for entrepreneurs. We instrument $Layoff_h$ in the estimation of Equations (5) and (6) by $Bartik_h$.

5.2 1998 SOE Downsizing and Surge of Entrepreneurs

Baseline Results. We first provide evidence that SOE downsizing leads to more new entrepreneurship. In Panel A of Table 3, we report the results from estimating Equation (5). It shows that the coefficients for the interaction term $After \times Layoff_h$ are positive and statistically significant at 1% in all specifications. The estimated coefficients suggest that a 10 percentage point increase in the layoff intensity in a province (one standard deviation of the layoff intensities across provinces, see Table 1) results in about 7.5 percent yearly increase in the number of new firms (Column (1)), and in values, an increase of about 2,050 new firms (Column (2)) by entrepreneurs from this province, in the 7 years after the 1998 SOE downsizing. The effect of the SOE downsizing on the entry of new entrepreneurs is of similar magnitude: A 10 percentage point increase in the layoff intensity in a province on average leads to a yearly increase of 6.4 percent (Column (3)), or in values, about 1,570 new entrepreneurs from this province (Column (4)), during the 7 years after the 1998 SOE downsizing.

[Table 3 about here]

IV Results. In Panel B of Table 3, we report the results of the estimation of Equation (5) using Bartik IV constructed in Equation (8). It shows that the coefficients for the interaction term *After*

$\times$ $Layoff_h$ remain positive and statistically significant at 1%, and the magnitudes of the estimates are higher than those estimated from the baseline OLS regression. The estimates suggest that a 10 percentage point increase in the layoff intensity in a province (i) results in a 14.5 percent increase in the number of new firms (Column (1)), or in values, an increase of about 5,540 new firms created by entrepreneurs from this province (Column (2)) per year; and (ii) leads to an increase of 12 percent (Column (3)), or in values, 4,480 new entrepreneurs (Column (4)) per year from the province.[35]

In summary, both the DID and IV estimations yield consistent and robust findings that the 1998 SOE downsizing resulted in a surge of new entrepreneurs and new firms from high-layoff-intensity areas relative to low-layoff-intensity areas, supporting Hypothesis 2a.

Dynamics. The "parallel trend" assumption for the validity of our DID strategy is that, in the absence of the 1998 SOE downsizing, provinces more affected by the SOE downsizing would have the same trend of the evolution of entrepreneurship as the less affected provinces. We now provide supporting evidence for this assumption by examining the dynamic effect of SOE downsizing on the evolution of entrepreneurship. Specifically, we employ the event-study approach and estimate the following augmented regression equation:

$$Y_{ht} = \beta_0 + \sum_{t'=1993}^{2005} \beta_{1t'} Year_{t,t'} \times Layoff_h + \gamma_h + \eta_t + \epsilon_{ht}, \tag{9}$$

where $Year_{t,t'}$ is the dummy variable for year t that takes value 1 if and only if $t = t'$, and year 1997 is omitted as the reference year. Our coefficients of interest are the $\beta_{1t'}$, which capture the difference in the number of new entrepreneurs from provinces with different layoff intensities.

Figure 8 plots the estimated $\hat{\beta}_{1t'}$s with their 95% confidence intervals. It shows that, prior to the 1998 SOE downsizing, provinces with different layoff intensities do not have statistically significant differences in the number of new entrepreneurs each year. The difference starts to get larger overtime and turns statistically significant after 1997.

[Figure 8 about here]

5.3 Performance of Layoff-induced Entrepreneurs

Hypothesis 2b states that the downsizing of the SOE sector results in on average higher quality entrepreneurs, as reflected by their better average performance, regardless of the entrepreneurs' age cohorts; in addition, Hypothesis 3 further predicts that the magnitude of the improvement of the entrepreneurial quality may vary across different generations of entrepreneurs. In this subsection, we examine the effect of the SOE downsizing on the entrepreneurs' performance at the firm level. Furthermore, we compare the performance of the firms founded by entrepreneurs who entered the

[35] Note that there are 13 fewer observations in the IV specification than in the OLS specification. This is because Chongqing was separated from Sichuan province and became the fourth centrally administered municipality only in 1997; its industry distribution information was not available before 1997, making it impossible to construct the instrumental variable for Chongqing.

market before the 1998 SOE downsizing with those founded by entrepreneurs who entered after 1998, interacting with the layoff intensity of the entrepreneurs' home province.

First Firm Established by Each Entrepreneur. We consider the performance of the first firm established by each entrepreneur as specified in Equation (6). In Panel A of Table 4, we find that, following the 1998 SOE downsizing, the average performance of new firms established by the entrepreneurs from high-layoff intensity provinces exhibited a larger increase compared to those from low-layoff intensity provinces. Specifically, a 10 percentage point increase in the entrepreneur's home province's layoff intensity is associated with a 0.36 percentage point increase in the entrepreneur's firm ROE, a 3.23 percent increase in gross profit, a 4.04 percent increase in annual net income, and a 0.29 percentage point increase in the probability of the firm surviving at least 5 years. The results are statistically significant at least at the 5% level.

In Panel B of Table 4, we report the IV regression results using the Bartik instruments constructed in Equation (8). It shows that the coefficients for the interaction term $After \times Layoff_h$ are positive and statistically significant, and the magnitude of the effect is larger than those estimated from the baseline OLS regression. The results suggest that a 10 percentage point increase in the entrepreneur's home province's layoff intensity is associated with a 1.02 percentage point increase in the entrepreneur's firm ROE, a 58.05 percent increase in gross profit, a 26.21 percent increase in annual net income, and a 4.9 percentage point increase in the probability of the firm surviving at least 5 years.

[Table 4 about here]

Subsequent Firms Established by Each Serial Entrepreneur. We supplement our test by examining the performance of *subsequent* firms established by the *serial* entrepreneurs, i.e., those who registered two or more firms in the sample period. In Panel A of Table 5, we report the results from estimating Equation (7). Our findings that layoff-induced entrepreneurs perform better are robust in both magnitude and statistical significance: The average performance of the subsequent firms established by the entrepreneurs who are from high-layoff intensity provinces exhibits a larger improvement following the 1998 SOE downsizing compared to their counterparts from low-layoff intensity provinces. Column (1) examines the selection of the sample used in this analysis by estimating the probability that an entrepreneur will become a serial entrepreneur. It suggests that a 10 percentage point increase in the entrepreneur's home province's layoff intensity is associated with a 0.18 percentage point increase in the probability that the entrepreneur becomes serial, an indicator of being more successful. In terms of the performance measures, a 10 percentage point increase in the entrepreneur's home province's layoff intensity is associated with a 0.08 percentage point increase in the firms' ROE, a 5.08 percent increase in gross profit, a 3.88 percent increase in annual net income, and a 0.15 percentage point increase in the probability of the firm surviving at least five years. The results are statistically significant, and the magnitude of the effect is similar to that in our main specification focusing on the first firms established by the entrepreneurs.

In Panel B of Table 5, we report the IV regression results. The results are robust and the magnitude of the effect is greater than that estimated from the baseline OLS regression. It suggests that a 10 percentage point increase in the entrepreneur's home province's layoff intensity is associated with a 2.28 percentage point increase in the probability of becoming serial, 1.31 percentage point increase in the firms' ROE, a 51.68 percent increase in gross profit, a 35.72 percent increase in annual net income, and a 1.37 percentage point increase in the probability of the firm surviving at least five years.

[Table 5 about here]

Addressing Survival Bias. Another concern regarding our empirical analysis is the survival bias, which may bias our estimation for the outperformance of the layoff-induced entrepreneurs upwards (or downwards) if the firms established by the layoff-induced entrepreneurs have a lower (or a higher) survival rate and the low-performance firms quit the market early. To account for survival bias, we construct a balanced panel of firm performance by setting the values of ROE, gross profit, and net income at the bottom 10 percentile values of the surviving samples for the firms that disappeared from the sample. In Panel A of Table 6, we report the regression results estimating Equation (6) using the constructed balanced panel data. It shows that the positive effect of layoff on the new entrepreneurs' average performance remains robust both statistically and economically. The results suggest that a 10 percentage point increase in the entrepreneur's home province's layoff intensity is associated with a 1.7 percentage point increase in the firms' ROE, a 11.68 percent increase in gross profit, and a 13.66 percent increase in annual net income. In Panel B of Table 6 we report the IV regression results. The results are robust and the magnitude of the effect is larger than that estimated from the baseline OLS regression. In summary, by correcting the survival bias, we find a larger effect on the performance of layoff-induced entrepreneurs, which is consistent with the higher survival rate associated with layoff-induced entrepreneurs.

[Table 6 about here]

Long-Term Performance. The firm inspection data, despite its wide coverage, only contains a limited set of variables. In order to investigate firms' performance in greater detail, we leverage the Administrative Tax Records (2008-2015) from the Chinese SAT, as described in Section 4.1. These panel data allow us to examine the firms' performance in terms of production, employment, tax payment, etc. We also use this data set to cross-validate our findings from the SAIC annual report data. Since the Administrative Tax Records started in 2008, our results in this section should be interpreted as the effect of 1998 SOE downsizing on the entrepreneurs' long-run performance conditional on surviving until 2008.

Table 7 reports the regression results estimating Equation (6) using the Administrative Tax Records. It shows that the coefficient estimates for the interaction term $After \times Layoff_h$ are positive and statistically significant. The results suggest that a 10 percentage point increase in the entrepreneur's home province's layoff intensity is associated with a 1.46 percentage point increase

in the firms' ROA, and a 0.78 percent increase in the value-added. In addition, we find that a 10 percentage point increase (one standard deviation) in the entrepreneur's home province's layoff intensity also leads to an increase of employment by 0.56 percent and tax payment by 2.7 percent, suggesting that these layoff-induced entrepreneurs created more employment and paid more taxes than voluntary entrepreneurs. Furthermore, the magnitude of the long-term effect we estimated with the administrative tax record data is similar to that of the effect estimated using the inspection data.

[Table 7 about here]

5.4 Heterogeneity in Performance Improvement Across Generations of Entrepreneurs

Recall that the three generations of entrepreneurs entered the labor market in different eras of the SOE reform and thus faced different trade-offs in their career choices. Hypothesis 3 derives a testable hypothesis with respect to the heterogeneity in firm performance in the post-layoff era, which we test in this section. Before we proceed, it is useful to recall the definition of "generation:" Generation-j individuals entered the labor market and made their first-time occupational choice in era $t = j$, where era 1 is the pre-SOE reform era, 1985-1992); era 2, 1993-1997; and era 3, 1998-2005. Taking age 22 as the year when one makes his/her first-time choice, we thus define generation 1 entrepreneurs as those born before 1970; generation 2, those born between 1971 and 1975; and generation 3, those born after 1975. We test the hypothesis with a cohort-DID design:

$$Y_{ijhptd} = \beta_0 + \beta_1 Generation\_g(i) \times Layoff_h + \beta_3 X_i + \gamma_h + \gamma_p + \alpha_{g(i)} + \eta_t + \delta_j + \theta_d + \epsilon_{ijhptd}, \quad (10)$$

where $Generation\_g(i)$ is a dummy variable for the generation of the entrepreneur who established firm i based on i's founder's birth year. $\alpha_{g(i)}$ is the entrepreneur's birth year fixed effect, and all other variables are as defined in Equation (6). Consistent with the theoretical prediction, we focus on the post-layoff era and restrict our sample to the entrepreneurs who first entered the market between 1998 and 2005.

We first test the differential impact of the 1998 SOE downsizing on the entrepreneurial quality of the first and second generations by restricting the estimation sample to firms established by individuals born before or in 1975. The results are reported in Panel A of Table 8 where $Generation\_2$ equals one if the entrepreneur was born in years between 1971 and 1975. The results show that the coefficient estimates for the interaction term $Generation\_2 \times Layoff_h$ are all positive and statistically significant. This suggests that generation-2 entrepreneurs induced by layoffs have higher entrepreneurial quality than generation-1 entrepreneurs induced by layoffs, consistent with Hypothesis 3.

We then test the differential impact of the 1998 SOE downsizing on the entrepreneurial quality of the second and third generations by restricting the estimation sample to first firms established by entrepreneurs born in or after 1971. The results are reported in Panel B of Table 8 where

Generation_3 equals one if the entrepreneur was born in or after 1976. The results show that the coefficient estimates for the interaction term $Generation\_3 \times Layoff_h$ are positive for all performance variables, though statistically insignificant for ROE and the 5-year survival probability. This suggests that layoff-induced generation 3 entrepreneurs have (weakly) higher entrepreneurial quality than the layoff-induced generation 2 entrepreneurs, a result that is more consistent with a selective layoff pattern, i.e. the state sector laid off individuals from the left tail of the ability distribution.

[Table 8 about here]

6 Alternative Explanations

We now discuss several potential alternative explanations for our main findings. Although our main identification relies on the variations in the SOE layoff intensity in entrepreneurs' home province instead of firms' registration province, the home province's local market could still have an impact on firms' performance because a sizeable number of entrepreneurs start businesses in their own province.

6.1 Lower Labor Cost in Provinces with Higher Layoff Intensity

It is possible that provinces with a higher layoff intensity would subsequently have a more abundant local supply of workers. This may lead to lower labor costs and higher profit margins for firms, which can then attract more entrepreneurs. This labor cost channel may potentially explain our main empirical findings if the lower labor cost were to benefit the new firms more. Below, we address the concern and rule out this alternative explanation from three perspectives.

Exploiting Subsequent Firm Specification. The empirical results, reported in Table 5, for *subsequent* firm performance as specified in Equation (7) controlled for both the firms' establishment year fixed effect and the calendar year fixed effects, in addition to the province fixed effect. This ensures that we are controlling for all market conditions, including the local labor costs. Put differently, we are essentially comparing the improvement in the average performance of subsequent firms established in the *same* year by entrepreneurs from the *same* province across provinces with different layoff intensities; as such local labor costs should similarly impact such newly established firms in the same province, whether their founders first became entrepreneurs before or after the 1998 SOE downsizing. The results in Table 5 show that all our results remain robust, suggesting that the labor cost channel does not drive our findings.

Controlling for Labor Costs. The specification in Equation (7) allows comparison under the same market conditions including labor cost, but only in a subsample of all subsequent firms. To address the concern of potential selection bias, we return to the sample of first firms established by all the entrepreneurs, and reestimate Equation (6) with direct control for the labor cost channel by including the average wage in the firms' registration city in our regression. The city-level average

annual wages are taken from the Chinese city yearbooks (1994-2020). Table 9 presents the results and shows that after controlling for the local labor costs, the coefficient estimates for the interaction term $After \times Layoff_h$ remain positive and statistically significant, and the magnitude is similar to that reported in Table 4.

[Table 9 about here]

Labor Cost as the Outcome Variable. Finally, we would like to point out that the data do not seem to support the premise of the labor cost channel that provinces with a higher SOE layoff intensity would have a lower labor cost. We estimate Equation (5) at the city level, with the log of the city-level average annual wage being the dependent variable. As SOE layoff intensity is measured at the province level, we cluster the standard errors at the province-year level. The results are presented in Table A5. It shows that cities in a province with a higher layoff intensity experienced a larger increase in the average wage level, even after controlling for population, GDP, and total employment. Specifically, a 10 percentage point increase in the SOE layoff intensity leads to a 3 percent increase in the average labor cost. Hence, entrepreneurs in provinces with a higher layoff intensity in fact do not benefit from a lower labor cost. Intuitively, the entry of new entrepreneurs due to SOE layoffs also increases the demand for labor. When the increase in labor demand outweighs that in labor supply, we can observe an increase in the labor cost after the massive SOE layoffs.

6.2 More Able Employees in Provinces with Higher Layoff Intensity

Another possibility is that it is the more able *employees* rather than the more able entrepreneurs that explain the better performance of the firms established after the SOE downsizing. The underlying premise is that the SOE downsizing releases more skilled labor into the labor market *and* they are more likely to enter the firms established by the new entrepreneurs. Next, we exploit two settings to affirm the contribution of entrepreneurs' ability to the performance of their firms.

Low Skill-Intensive Industries. We first examine the performance of firms separately by the skill intensity of the firms' industry. The measure of skill intensity is borrowed from Belo et al. (2017) and is calculated at the 3-digit industry level for US firms. The skill intensity of an industry is defined as the percentage of high-skill workers—i.e., those who work in occupations requiring a high level of training and preparation—in that industry. We then use the industry correspondence to map the industry-level skill intensity to Chinese firm data.[36] We define an industry as skill intensive if the skill intensity is above 0.3.[37]

If the ability of employees is key to explaining the better performance of the firms established by the layoff-induced entrepreneurs, then it is reasonable to expect that the outperformance would

[36]The industry correspondence is available at https://www.census.gov/naics/reference_files_tools/2022_NAICS_Manual.pdf.

[37]Our results are robust to different thresholds of skill intensity such as 0.1 and 0.2.

primarily come from firms in the skill-intensive industries. We repeat the estimation of Equation (6) but include a triple interaction term $After \times Layoff_h \times Skill\ Intensive$ where the dummy variable *Skill Intensive* takes value 1 for firms in the skill-intensive industries. Table 10 reports the regression results. First, the coefficient estimates for the double-interaction terms $After \times Layoff_h$, with the exception of the log profit outcome, remain positive and statistically significant, suggesting that the out-performance of the layoff-induced entrepreneurs remains robust for firms in industries with low skill intensity (below 0.3). Second, the coefficient estimates for the triple-interaction terms $After \times Layoff_h \times Skill\ Intensive$ are insignificant. That is, there is no difference in the magnitude of outperformance between firms in the skill intensive industries and those in low-skill-intensity industries. These results suggest that the prominence of highly skilled labor, freed by the SOE downsizing, is unlikely to be the driving force for our main findings reported in Table 4.

[Table 10 about here]

Self-Employed Individuals. We also examine the sample of self-employed individuals. According to the registration requirement, self-employed businesses have an average of 1 to 3 employees. Therefore, the self-employed individual's performance is unlikely to be affected by the supply of talent in the labor force.

We measure the performance of the self-employed individuals mainly by whether they are able to transform from self-employment to entrepreneurship,[38] and their firms' performance (conditional on successful transition to entrepreneurship) as reflected in the firm inspection data.[39] To examine the transition from self-employment to entrepreneurship, we leverage on our unique data set on business registration and entrepreneurs, which also contains the universe of the self-employed business. The unique individual identifier enables us to track the entire business of each individual and to identify the self-employed individuals who later became legal representatives of registered firms during our sample period, which we define as a successful transition. To the extent that skilled labor released by the SOE layoffs are more likely to join and benefit the *new* firms, the mechanism is unlikely to affect the transition from self-employment to entrepreneurship. Regardless of whether the self-employed entered the market before or after the SOE layoffs, the local labor supply should not affect their transitions differently.

First, we re-estimate Equation (6) using the sample of business owners whose first establishment is coded as self-employment and entered the market between 1993 and 2005. The dependent variable in the regression is a dummy variable that takes value 1 if the self-employed becomes an entrepreneur before 2005 and 0 otherwise. The result in column (1) of Table 11 shows that, following the 1998 SOE downsizing, the self-employed individuals from high-layoff intensity provinces, on average, have a larger increase in the probability of transitioning into an entrepreneur: a 10 percentage

[38] With data from various countries, the literature has documented consistent evidence for the lack of transition between the self-employed and entrepreneurship (Mondragón-Vélez and Peña, 2010; Gompers et al., 2005; Nanda, 2011; Schoar, 2010).

[39] Due to data constraint, we do not observe the performance of the self-employed business as we do for the formally registered firms.

point increase in the province's layoff intensity is associated with a 0.8 percentage point increase in the probability of becoming an entrepreneur.

We further examine the performance of the firms established by the entrepreneurs who grew from self-employment. In columns (2)-(4) of Table 11, we report the results from estimating Equation (6) using this subsample of firms. Consistent with our main finding from the entire sample of registered firms reported in Table 4, we find that, among entrepreneurs who started as self-employed, the performance of those from high-layoff-intensity provinces, on average, increased more than those from provinces with low-layoff-intensity. The magnitudes are similar: a 10 percentage point increase in the home province's layoff intensity is associated with a 0.41 percentage point increase in the firm's ROE, a 4.13 percent increase in annual net income, a 3.25 percent increase in gross profit. The result on the probability of the firm surviving 5 years or more is not significant.

[Table 11 about here]

6.3 Social Capital Accumulation from SOE Jobs

A third possibility is that the layoff-induced entrepreneurs may have superior social networks, particularly with local government officials, possibly acquired while they worked at the SOEs, which could potentially support their businesses and explain the outperformance of firms established by these ex-SOE employees. To rule out this alternative argument, we re-estimate Equation (6) using only the subsample of firms that were established by the *migrant* entrepreneurs who started their business outside their home provinces.[40] Social capital, if it were accumulated through the working experience in the SOEs and were to play a role in boosting firm performance, mainly works locally. For instance, it is unlikely that an entrepreneur from Beijing will have strong social connections in Shanghai.[41] Furthermore, in order to control for the possible network effect in the destination provinces among the migrant entrepreneurs, we also include home-province-by-firm-province fixed effect.

Table 12 shows that the outperformance of layoff-induced entrepreneurs remains robust in magnitude and statistical significance for the subsample of migrant entrepreneurs: a 10 percentage point increase in the entrepreneur's home province's layoff intensity is associated with a 0.35 percentage point increase in the firms' ROE, a 5.31 percent increase in gross profit, a 4.42 percent increase in annual net income, and a 0.4 percentage point increase in the probability of the firm surviving 5 years or more. The results suggest that social capital is not the main factor that drives the results in Table 4.

[Table 12 about here]

[40] Because we are using only the migrant entrepreneurs in this analysis, we include in Table 12 the more stringent Home Province × Firm Registration Province fixed effects instead of the home province and the firm registration province fixed effects. The Home Province × Firm Registration Province is more suited to capture the potential network effects of entrepreneurs from the same home province operating in the same destination province. The results are similar if we only include the the Home Province and the Firm Registration Province fixed effects.

[41] One may still be concerned that migration decisions are endogenous. However, an entrepreneur is more likely to migrate to another province for favorable business conditions, instead of social networks, because social connections tend to be local. In the next subsection, we address the impact of business environment.

6.4 Better Business Environment in High-layoff-intensity Provinces

Another possibility is that provinces with stronger pro-market orientations may be more aggressive during the SOE reform, leading to a greater reduction in SOE workforce. If the change in business environment were to favor new entrants significantly more than existing firms, the better business environment in the high-layoff intensity provinces might explain the better performance of the layoff-induced entrepreneurs.

We address the concern as follows. First, we modify our main test of entrepreneurial performance based on Equation (6) by estimating the following equation:

$$\begin{aligned} Y_{ijhptd} =& \beta_0 + \beta_1 After_d \times Layoff_h + \beta_2 After_d \times Layoff_p + \beta_3 X_i \\ &+ \gamma_h + \gamma_p + \eta_t + \delta_j + \theta_d + \epsilon_{ijhptd}, \end{aligned} \tag{11}$$

where indices i, j, h, p, t, and d denote firm, industry, entrepreneur's *home province*, firm's registration province, calendar year, and establishment year, respectively; $Layoff_h$ is the layoff intensity in the entrepreneur's home province, and $Layoff_p$ is the layoff intensity of firm i's registration province, γ_h and γ_p are respectively the fixed effects for the entrepreneur's home province and firm i's registration province. All other variables are defined as in Equation (6). By controlling for the firm's registration province fixed effects γ_p, we are comparing firms established in the *same* province but by entrepreneurs from provinces of different layoff intensities, before and after the reform. This guarantees that we compare firms facing the same business environment such as capital market conditions, government policies, entry barrier, etc.[42] In Equation (11), we control for both the layoff intensities of the entrepreneurs' home province and the firms' registration province, through the respective fixed effects γ_h and γ_p, and focus on the interaction terms $After \times Layoff_h$ and $After \times Layoff_p$. Note that the SOE layoff intensity in the entrepreneurs' home province is our proxy for the likelihood that the entrepreneur was a former SOE worker being laid off during the SOE downsizing, and the layoff intensity in the firms' registration province, on the other hand, proxies for the firms' business environment if it were correlated with the province's SOE layoff intensity.

In Table 13, we report the regression results from estimating Equation (11). The results suggest that the outperformance of the firms established by the layoff-induced entrepreneurs is mainly driven by the layoff intensity in the entrepreneurs' home province, not by that in the firms' registration province. The coefficient estimates of the interaction term with the intensity of the home province layoffs, $After \times Layoff_h$, are consistently positive and statistically significant with similar magnitudes to those of the baseline results; in contrast, the coefficient estimates of the interaction term with the layoff intensity of the firms' registration province, $After \times Layoff_p$, do not have a consistent sign and are not statistically significant. These findings altogether indicate that the business environment of the firms' province is not a key driver for our results.

[42] Because a significant fraction of entrepreneurs in our sample are migrant entrepreneurs who established the firm outside their home province, the layoff intensities in the home province and the destination province are not subject to a collinearity problem.

[Table 13 about here]

We also perform a placebo test by estimating Equation (6) on firms established *prior to* the 1998 SOE downsizing. The entrepreneurs who founded these firms were not subject to the 1998 SOE downsizing shock; therefore, they are the nontreated firms in our main tests reported in Table 4. However, if the business environment improved in provinces with a high level of layoff, *and* if the better business environment positively affects firm performance, then after the 1998 SOE downsizing the performance of firms established prior to the downsizing event should also improve more in provinces with a high level of layoff than those in provinces with a low level of layoff. Table A6 reports the regression results; if anything, the results point to the opposite direction. Those firms established before the 1998 SOE reform did not perform better after the SOE reform, thus it does not corroborate the business environment channel. The results in Table A6 can be attributed to increased competition from newly entered high-quality entrepreneurs in provinces with higher SOE layoff intensities.

7 Concluding Remarks

Firms founded by high-skilled entrepreneurs exhibit better performance and sustained growth, and they are the key drivers for economic dynamism. However, individuals with the greatest ability do not always gravitate towards entrepreneurship when alternative employment options offer more valuable benefits; often high-skilled individuals become entrepreneurs reluctantly. In this paper, we leverage the momentous downsizing of the SOE sector in 1998 during China's era of SOE reform to study the impact of SOEs on the quality of entrepreneurship. This unprecedented event enables us to study not only changes in the sorting of individuals who just entered the labor market, but also the reshuffling of high-ability individuals—who initially sorted into the state sector before the SOE reform—reluctantly into entrepreneurship.

Our empirical findings demonstrate that the massive SOE downsizing in the late 1990s significantly enhanced the quality of entrepreneurship by releasing high-quality workers. Firms founded by the reluctant entrepreneurs induced by the SOE layoffs outperform those in other time periods. To explain these results, we present a simple occupational choice model where high-skilled individuals obtain a higher value than low-skilled individuals from the benefits offered by SOE jobs, leading them to select into the SOE sector in the pre-SOE reform era. When the SOE sector was downsized, some high-skilled SOE employees were reluctantly unleashed into entrepreneurship. Consistent with our theoretical prediction, we find that the younger cohort who entered the labor market after the 1998 downsizing of the SOE sector has the best performance, followed by the layoff-induced entrepreneurs who entered the labor market between 1993 and 1997 and those who initially entered the labor market before 1992. We carefully examine the alternative channels, such as lower labor cost, abundant skilled labor, social capital accumulated from SOE experience, and better business environment, and confirm that our results are not driven by these factors. Our findings contribute to the growing literature on reluctant entrepreneurs and to our understanding

of the implications of SOEs on the quality of entrepreneurship.

The mechanism has significant implications for the influence of the state sector on the broader market economy. The allure of state-sector employment for high-skilled labor not only discourages private sector growth through labor allocation but, more importantly, impedes the establishment of new productive private firms on a broader scale, thereby stifling economic dynamism. However, once these previously reluctant, highly skilled individuals are compelled to leave SOEs, they become successful entrepreneurs, catalyzing subsequent economic growth.

While we study the problem in the context of China in the era of SOE reform, we believe that the mechanism elucidated herein extends to broader contexts that feature a strong state sector. The resurgence of SOEs in the Chinese economy from 2013 onward underscores the continued relevance of understanding the impact of SOEs on entrepreneurship to predict future economic dynamism. Our findings may also shed light on cross-country comparisons of entrepreneurial quality. For example, countries and regions with a strong state sector, e.g., Turkey, which offers additional benefits and job protections, especially when social security is insufficient, may expect lower entrepreneurial qualities as a result.

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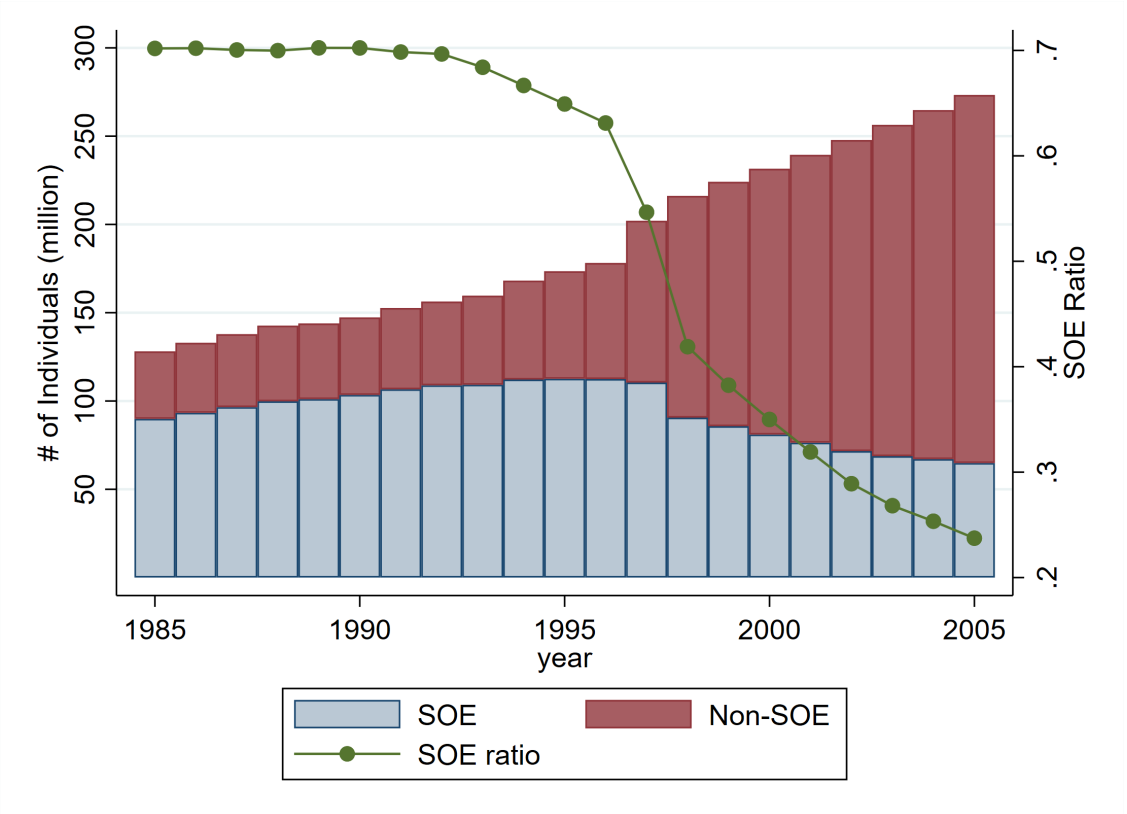
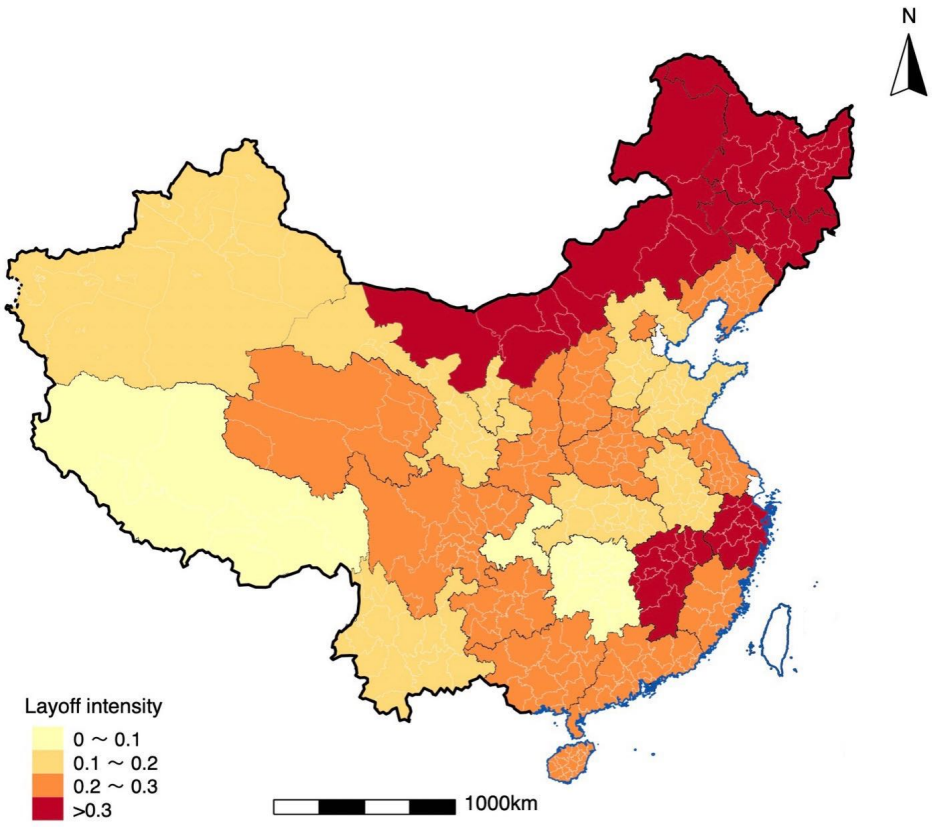
Figure 1: Evolution of SOE Employment



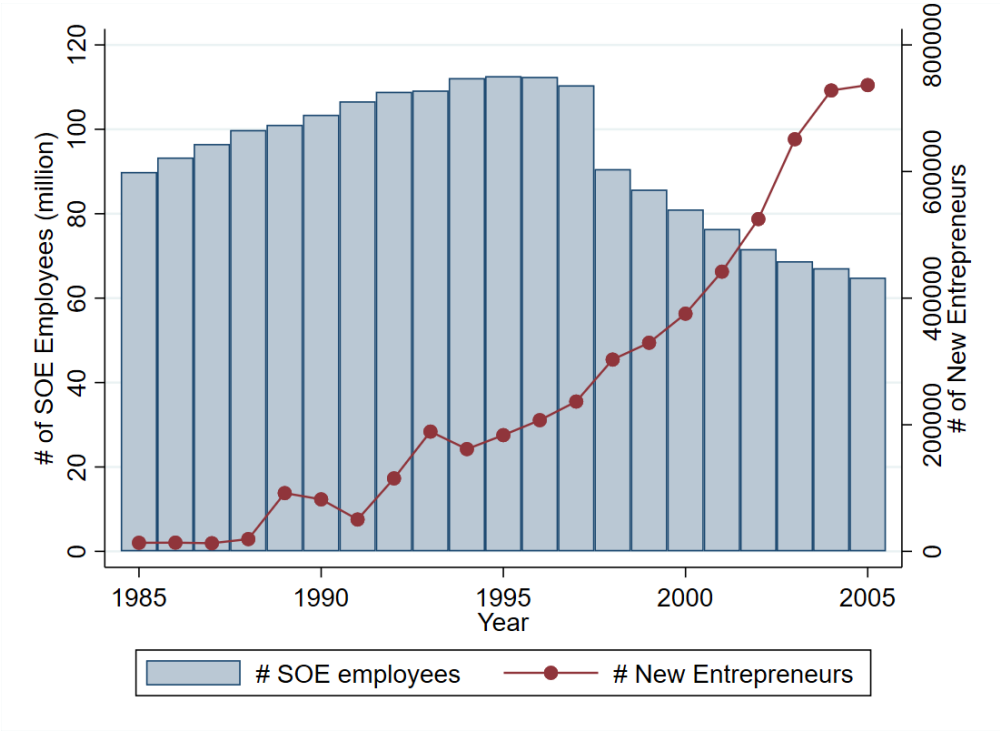
Notes: This figure plots the the ratio and number of SOE employment from 1985 to 2005 at the national level in China. The left axis corresponds to the number of individuals, and the right axis corresponds to the ratio of SOE employment to the total urban working population. The blue bar corresponds to the number of SOE employees, the red bar corresponds to the number of non-SOE urban working population— including non-SOE employees and entrepreneurs, and the green line corresponds to the ratio of SOE employment to the total urban working population.

Figure 2: Geographical Distribution of SOE Layoff Intensity



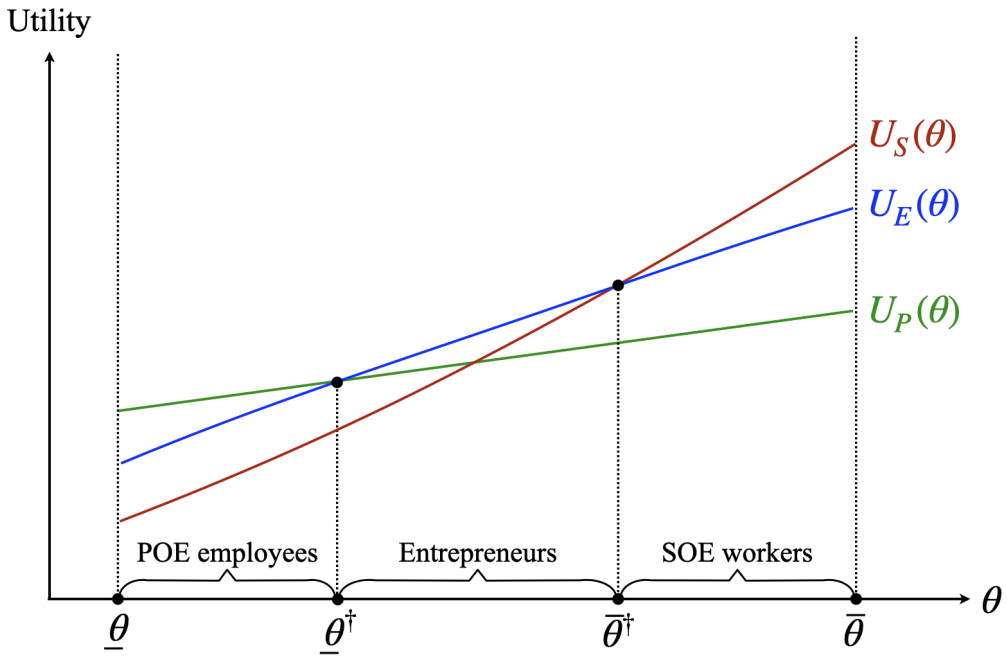
Notes: This figure plots the geographical distribution of the SOEs' layoff intensity across the reform period (1995-2001), and it shows significant regional variation in the layoff intensity.

Figure 3: SOE Layoff and the Evolution of Entrepreneurship



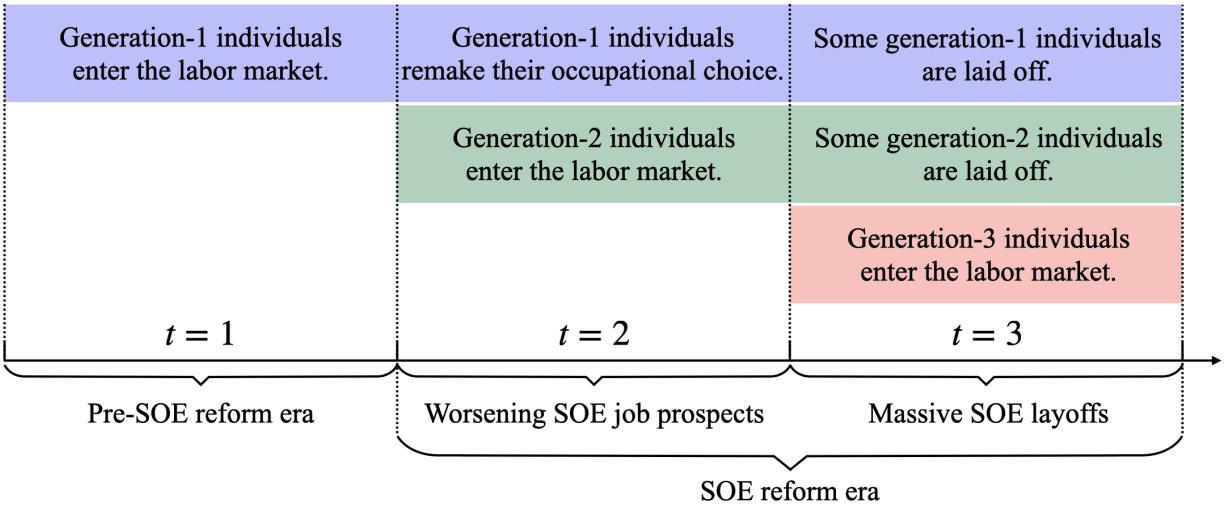
Notes: This figure plots the evolution of entrepreneurship in corresponds to the evolution of SOE layoff. The left axis corresponds to the number of SOE employees, and the right axis corresponds to the number of new entrepreneurs in each year. It shows that the number of new entrepreneurs that enters the market each year were stable (around 4,000 per year) in the early 1990s, and has been growing rapidly and more than doubled till 2005.

Figure 4: Individual's Occupational Choice and Ability Selection



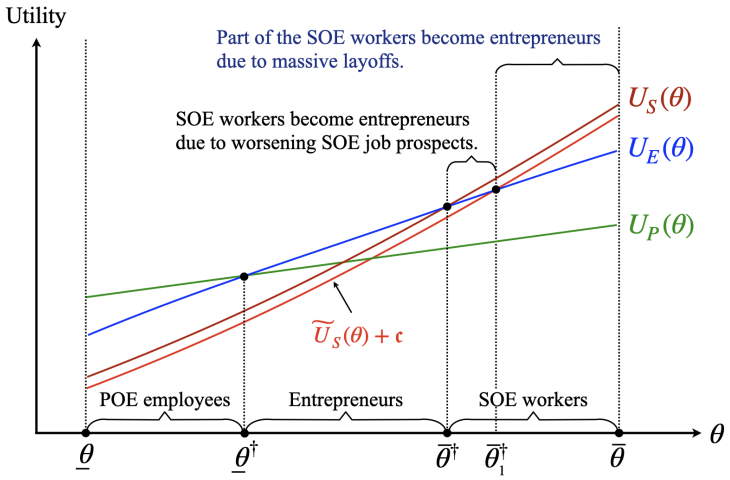
Notes: See text.

Figure 5: Timeline

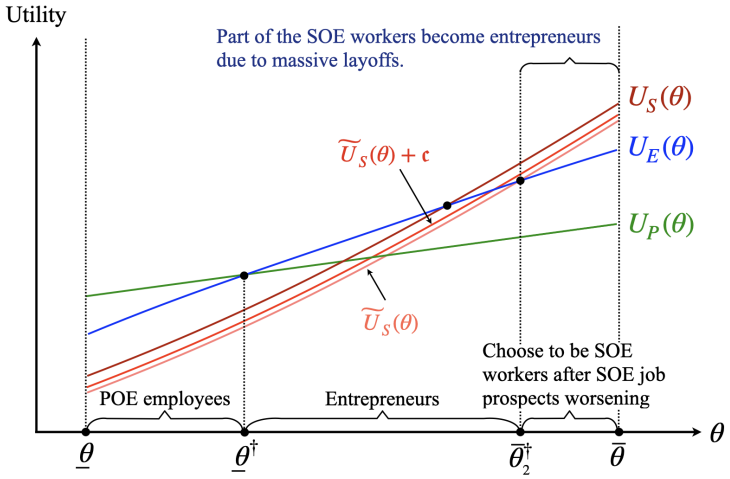


Notes: See text.

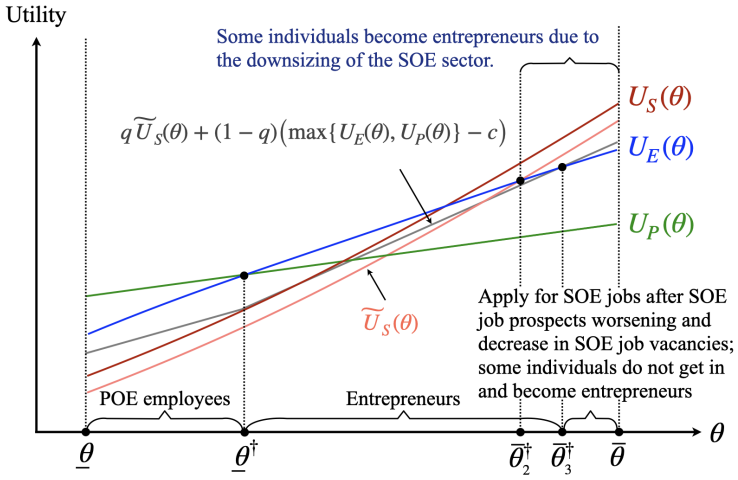
Figure 6: Worsening Job Prospects, Massive SOE Layoffs, and Individual's Occupational Choice



(a) Generation-1 Individuals

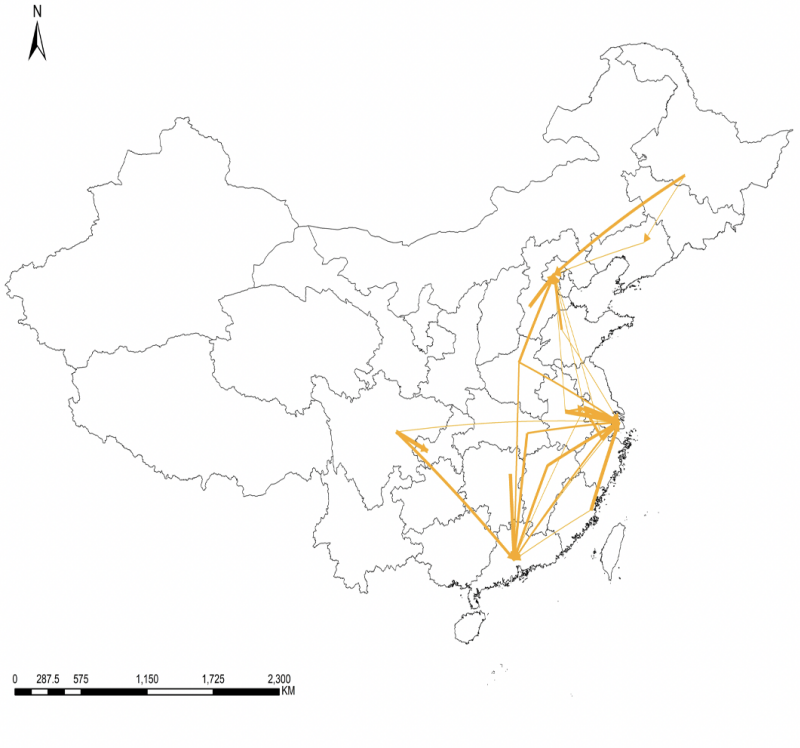


(b) Generation-2 Individuals



(c) Generation-3 Individuals

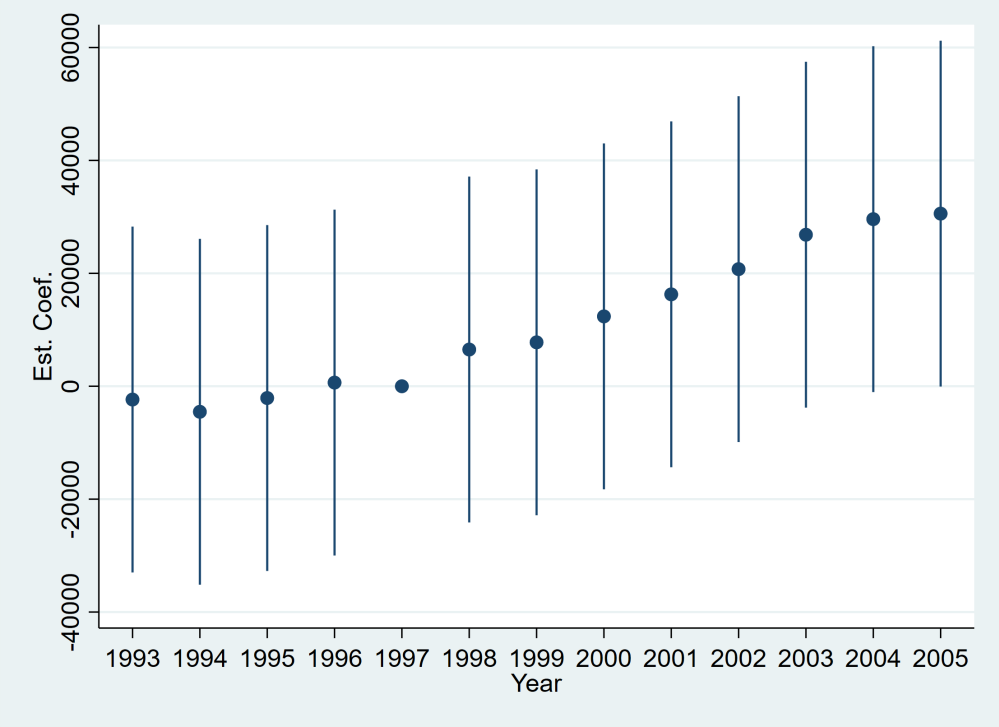
Figure 7: Entrepreneurial Migration



Entrepreneur's Home Province	Firm's Registration Province	Flow
Jiangsu	Shanghai	44375
Zhejiang	Shanghai	41656
Sichuan	Chongqing	30160
Anhui	Shanghai	22960
Fujian	Shanghai	19584
Hunan	Guangdong	19372
Hebei	Beijing	17092
Hubei	Guangdong	14580
Jiangxi	Guangdong	11291
Jiangxi	Shanghai	10046
Zhejiang	Jiangsu	9555
Heilongjiang	Beijing	9442
Henan	Beijing	8996
Sichuan	Guangdong	8914
Shandong	Beijing	8580
Anhui	Jiangsu	7189
Henan	Guangdong	7001
Hubei	Shanghai	6703
Henan	Shanghai	6473
Zhejiang	Guangdong	6214
Liaoning	Beijing	6007
Fujian	Guangdong	5857
Jiangsu	Guangdong	5757
Heilongjiang	Liaoning	5717
Anhui	Beijing	5666
Guangdong	Shanghai	5348
Zhejiang	Beijing	5337
Sichuan	Shanghai	5330
Shandong	Shanghai	5230
Jiangsu	Beijing	5210

Notes: This figure plots the direction of the entrepreneurial migration for the top 30 province pairs with the largest number of entrepreneur flow during the post-layoff era 1998-2005. Thicker arrow represents larger flow. The table on the right lists the size of the flows for the top 30 province pairs.

Figure 8: The Dynamic Effect of SOE Layoff on Entrepreneurship



Notes: This figure plots the estimated $\hat{\beta}_{1t}$ with 95% confidence intervals for regression Equation (9) . It plots the dynamics of the impact of SOE layoff on the entry of new entrepreneurs. It shows that provinces with different layoff intensity do not have statistically significant differences in the number of new entrepreneurs each year before the SOE reform, and the difference starts to get larger and statistically significant over time. The effect of SOE layoff on the number of new entrepreneurs is persistent across the period of interest.

Table 1: Descriptive Statistics for Firm Registration and Firm Annual Report Data

Variable	Obs	Mean	Std. Dev.	Min	Med	Max
Panel A: Province Level Observations						
Layoff intensity	31	0.27	0.10	0.05	0.28	0.43
Panel B: (Home) Province-Year Level Observations						
# of New firms	416	12,184	12,948	32	7,504	79,248
# of New entrepreneurs	416	10,490	10,880	30	6,552	66,187
Panel C: Firm Level Observations						
Registered capital (million RMB)	4,996,879	3.31	11.94	0	0.50	132.27
Established after 1997	5,068,548	0.81	0.39	0	1	1
Entrepreneur after 1997	5,068,548	0.76	0.43	0	1	1
Survive 1 year	5,068,548	0.91	0.28	0	1	1
Survive 3 years	5,068,548	0.65	0.48	0	1	1
Survive 5 years	5,068,548	0.45	0.50	0	0	1
Entrepreneur age	5,068,548	38.51	9.57	20	38	75
Entrepreneur age (first)	4,363,850	38.19	9.68	20	38	75
Panel D: Firm-Year Level Observations						
Asset (million RMB)	19,711,305	5,455.9	57,602.0	0.0	2.4	1,180,000
Liability (million RMB)	20,756,843	3,004.5	35,055.2	0	0.7	733,000
Revenue (million RMB)	21,200,864	3,138.0	35,192.9	0	0.6	748,000
Profit (million RMB)	20,335,727	41.9	871.7	-7,581.2	0	20,729.2
Net income (million RMB)	21,430,051	30.2	686.8	-6,959.2	0	17,949.3
Equity (million RMB)	17,621,441	2,112.8	22,018.3	0.0	1.0	480,000
ROE	17,343,095	-0.0	0.4	-5.3	0.0	4.4

Note: This table presents the summary statistics for our main sample based on the firm registration and annual report data. Panel A reports the summary statistics of our treatment intensity measure, the SOE layoff intensity, at province level. Panel B corresponds to the (home) province-year level variables aggregated from the firm-registration data. Panel C corresponds to the firm-level variables from the registration data. Panel D corresponds to the firm-year level variables from the firm annual report data. We focus on the firms that are established between 1993 and 2005.

Table 2: Descriptive Statistics for Administrative Tax Records

Variable	Obs	Mean	Std. Dev.	Min	Med	Max
Registration Capital (million RMB)	1,576,223	56.0	337.5	0.0	5.1	6956.0
Revenue (million RMB)	1,564,917	141.6	757.9	0.0	16.9	16078.2
Assets (million RMB)	1,568,937	259.8	1795.3	0.0	17.6	39589.8
Tax (million RMB)	1,531,966	2.3	12.6	0.0	0.1	244.1
Net profit (million RMB)	1,568,157	6.4	61.2	-303.6	0.1	1171.1
Value added (million RMB)	1,131,187	18.1	112.6	-67.0	0.4	2396.9
Employment	1,575,402	146.2	467.7	1	36	8600
Return on assets	1,553,167	0.1	4.1	-54.2	0.0	157.0

Note: This table presents the summary statistics for the administrative tax records data. The sample are the tax records in the years between 2008 and 2015 of firms registered in the period between 1993 and 2005.

Table 3: Effect of SOE Layoff on Entrepreneurship

	(1) log(# of Firm)	(2) # of Firm	(3) log(# of Entrepreneur)	(4) # of Entrepreneur
		Panel A: OLS		
After×Layoff$_h$	0.746***	20,503.402***	0.640***	15,730.834***
	(0.237)	(6,229.767)	(0.241)	(5,196.328)
Constant	8.706***	9,034.240***	8.593***	8,086.836***
	(0.041)	(1,075.311)	(0.042)	(896.930)
Obs.	403	403	403	403
R^2	0.974	0.818	0.973	0.821
		Panel B: IV		
After×Layoff$_h$	1.450***	55,407.397***	1.215***	44,804.035***
	(0.439)	(11,928.887)	(0.445)	(9,951.056)
Constant	15.734***	105,038.365***	14.968***	78,519.002***
	(0.413)	(11,231.533)	(0.419)	(9,369.324)
Obs.	390	390	390	390
R^2	0.974	0.802	0.973	0.805
Home Province FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Note: This table reports the results of estimating Equation (5). Panel A for the OLS regression results and Panel B for the IV regression results. The unit of observation is home province-year, and the data sample covers the period between 1993 to 2005. Column (1) and (2) report the regression results for the number of new firms, and Column (3) and (4) report the regression results for the number of new entrepreneurs. Standard errors are clustered at the home province level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 4: Effect of SOE Layoffs on Entrepreneurial Performance

	ROE	log(Profit)	log(Net income)	Survive 5 years
Panel A: OLS				
After× Layoff$_h$	0.0359***	0.323**	0.404***	0.0290***
	(0.00833)	(0.161)	(0.151)	(0.00727)
log(Registered Capital)	-0.00267***	0.407***	0.387***	0.0155***
	(0.000249)	(0.00501)	(0.00452)	(0.000116)
Obs.	14,554,751	12,971,077	13,409,238	1,388,645
R^2	0.009	0.209	0.196	0.141
Panel B: IV				
After×Layoff$_h$	0.102**	5.805***	2.621***	0.490***
	(0.0435)	(1.572)	(0.593)	(0.0517)
log(Registered Capital)	-0.00267***	0.408***	0.388***	0.0154***
	(0.000241)	(0.00514)	(0.00467)	(0.000115)
Obs.	14,554,751	12,971,077	13,409,238	1,388,645
R^2	0.000	0.091	0.095	0.009
Home Province FE	Yes	Yes	Yes	Yes
Firm Registration Province FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	No
Establishment Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Note: This table reports the results of estimating Equation (6). Panel A for the OLS regression results and Panel B for the IV regression results. The data sample includes the first firms established by each entrepreneur who entered the market between 1993 and 2005. Standard errors are clustered at the home province-by-year-by-industry level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 5: Effect of SOE Layoffs on Entrepreneurial Performance: Subsequent Firms

	Serial	ROE	log(Profit)	log(Net income)	Survive 5 years
		Panel A: OLS			
After×Layoff$_h$	0.0180*	0.00752	0.508***	0.388***	0.0146*
	(0.00932)	(0.0107)	(0.103)	(0.0970)	(0.00766)
log(Registered capital)	0.0182***	-0.00733***	0.261***	0.253***	0.0103***
	(0.000146)	(0.000342)	(0.00397)	(0.00385)	(0.000136)
Obs.	1,388,645	5,291,497	4,777,527	4,889,632	1,126,897
R^2	0.026	0.009	0.154	0.137	0.731
		Panel B: IV			
After×Layoff$_h$	0.228***	0.131**	5.168***	3.572***	0.137***
	(0.0661)	(0.0532)	(0.725)	(0.554)	(0.0468)
log(Registered Capital)	0.0181***	-0.00732***	0.262***	0.253***	0.0103***
	(0.000147)	(0.000341)	(0.00398)	(0.00386)	(0.000136)
Obs.	1,388,645	5,291,497	4,777,527	4,889,632	1,126,897
R^2	0.011	0.000	0.039	0.041	0.005
Home Province FE	Yes	Yes	Yes	Yes	Yes
Firm Registration Province FE	Yes	Yes	Yes	Yes	
Year FE	Yes	Yes	Yes	Yes	No
Establishment Year FE	No	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
First Entry Year FE	Yes	Yes	Yes	Yes	Yes

Note: This table reports the results of estimating Equation (7). Panel A for the OLS regression results and Panel B for the IV regression results. The data sample includes the subsequent firms established by each entrepreneur who entered the market between 1993 and 2005. Standard errors are clustered at the home province-by-year-by-industry level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 6: Effect of SOE Layoffs on Entrepreneurial Performance: Robustness

	ROE	log(Net income)	log(Profit)
	Panel A: OLS		
After× Layoff$_h$	0.170***	1.168***	1.366***
	(0.0277)	(0.321)	(0.422)
log(Registered Capital)	-0.000822***	0.318***	0.319***
	(0.000231)	(0.00707)	(0.00747)
Obs.	6,894,271	6,626,924	6,356,573
R^2	0.033	0.242	0.265
	Panel B: IV		
After× Layoff$_h$	1.031***	16.74***	44.40***
	(0.290)	(3.964)	(13.37)
log(Registered capital)	-0.000801***	0.318***	0.318***
	(0.000232)	(0.00716)	(0.00783)
Obs.	6,894,271	6,626,924	6,356,573
R^2	-0.004	0.038	-0.092
Home Province FE	Yes	Yes	Yes
Firm Registration Province FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Establishment year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes

Note: This table reports the results of estimating Equation (6). The data sample includes the first firms established by each entrepreneur who entered the market between 1993 and 2005, and it is a constructed balanced panel of firm performance by setting the values of ROE, gross profit, and net income variables at the bottom percentile for the firms that disappeared from that sample. Standard errors are clustered at the home province-by-year-by-industry level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 7: Effect of SOE Layoffs on Long-Run Entrepreneurial Performance

	ROA	log(Employment)	log(Value-added)	log(Tax)
After$\times$ Layoff$_h$	0.146*	0.0566**	0.0784***	0.273***
	(0.0784)	(0.0251)	(0.0225)	(0.0437)
log(Registered Capital)	-0.000532	0.344***	0.539***	0.468***
	(0.00175)	(0.000557)	(0.00151)	(0.000958)
Home Province FE	Yes	Yes	Yes	Yes
Firm Registration Province FE	Yes	Yes	Yes	Yes
Establishment Year FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Obs.	1,224,503	1,241,503	894,318	962,272
R^2	0.072	0.483	0.125	0.431

Note: This table reports the results of estimating Equation (6). The data is the administrative enterprise income tax records from the Chinese State Administration of Tax (SAT 2008–2015). Standard errors are clustered at the home province-by-year-by-industry level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 8: Heterogeneity in Performance Improvement

	ROE	log(Net income)	log(Profit)	Survive 5 years
Panel A: First (Old) versus Second (Middle) Generation				
Generation_2× Layoff$_h$	0.0172***	0.368***	0.289***	0.0151*
	(0.00575)	(0.0593)	(0.0557)	(0.00795)
log(Registered Capital)	-0.00281***	0.397***	0.378***	0.0167***
	(0.000281)	(0.00562)	(0.00514)	(0.000139)
Constant	0.0122***	-0.145***	-0.281***	0.849***
	(0.00209)	(0.0309)	(0.0278)	(0.00206)
Obs.	11,376,409	10,138,270	10,449,309	1,054,425
R^2	0.008	0.205	0.191	0.151
Panel B: Second (Middle) versus Third (Young) Generation				
Generation_3× Layoff$_h$	0.000609	0.179**	0.194***	0.00572
	(0.00705)	(0.0780)	(0.0739)	(0.0108)
log(Registered Capital)	-0.00329***	0.356***	0.341***	0.0207***
	(0.000341)	(0.00535)	(0.00537)	(0.00104)
Constant	0.00732***	-0.0979***	-0.238***	0.834***
	(0.00223)	(0.0277)	(0.0287)	(0.00595)
Obs.	3,792,975	3,289,933	3,385,334	363,791
R^2	0.007	0.183	0.171	0.155
Home Province FE	Yes	Yes	Yes	Yes
Firm Registration Province FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	No
Establishment year FE	Yes	Yes	Yes	Yes
Birth year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes

Note: This table reports the results of estimating Equation (10). Panel A compares the first generation to the second generation. The sample includes the first firms established by entrepreneurs born in or before 1975 and entered the market between 1998 and 2005. Generation_2 equals 1 for entrepreneurs born between 1970 and 1975. Panel B compares the second generation to the third generation. The sample includes the first firms established by entrepreneurs born in or after 1970 and entered the market between 1998 and 2005. Generation_3 equals 1 for entrepreneurs born in or after 1976. Standard errors are clustered at the home province-by-year-by-industry level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 9: Alternative Channel: Labor Cost

	ROE	log(Profit)	log(Net income)	Survive 5 years
After× Layoff$_h$	0.0559***	0.640***	0.595***	0.0303***
	(0.00968)	(0.205)	(0.184)	(0.00918)
log(Registered Capital)	-0.00298***	0.402***	0.382***	0.0169***
	(0.000273)	(0.00560)	(0.00502)	(0.000131)
log(City Average Wage)	-0.0245***	-0.475***	-0.431***	-0.0182***
	(0.00159)	(0.0674)	(0.0593)	(0.000919)
Home Province FE	Yes	Yes	Yes	Yes
Firm Registration Province FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	No
Establishment Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Obs.	12,035,559	10,867,279	11,309,924	1,139,194
R^2	0.009	0.217	0.201	0.147

Note: This table reports the results of estimating Equation (6) and directly controls for the local average wage in the firms' registration city. The data sample includes the first firms established by each entrepreneur who entered the market between 1993 and 2005. Standard errors are clustered at the home province-by-year-by-industry level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 10: Effect of SOE Layoff on the Firm Performance, by Skill Intensity of the Industry

	ROE	log(Profit)	log(Net income)	Survive 5 years
After× Layoff$_h$	0.0389***	0.194	0.249**	0.0253***
	(0.00784)	(0.119)	(0.111)	(0.00800)
After× Layoff$_h$ ×Skill Intensive	0.00573	0.0658	0.0666	-0.0329
	(0.0162)	(0.211)	(0.200)	(0.0201)
log(Registered Capital)	-0.00203***	0.403***	0.383***	0.0152***
	(0.000227)	(0.00521)	(0.00474)	(0.000114)
Constant	-0.00560***	-0.302***	-0.432***	0.862***
	(0.00211)	(0.0366)	(0.0345)	(0.00195)
Home Province FE	Yes	Yes	Yes	Yes
Firm Registration Province FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	No
Establishment year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Obs.	14,546,705	12,962,080	13,400,258	1,388,417
R^2	0.011	0.221	0.206	0.160

Note: This table reports the results of estimating Equation (6). The data sample includes the first firms established by each entrepreneur who entered the market between 1993 and 2005. High-skill is a dummy variable taking value 1 for firms in industries with skill intensity above 0.3. Standard errors are clustered at the home province-by-year-by-industry level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 11: Effect of SOE Layoff on the Growth of the Self-employed

	1(Entrepreneur)	ROE	log(Net Income)	Log(Profit)	Survive 5 years
After×Layoff$_h$	0.0808***	0.0407***	0.325**	0.413**	0.00130
	(0.0229)	(0.0152)	(0.161)	(0.205)	(0.0194)
log(Registered Capital)	0.00470***	-0.00288***	0.389***	0.371***	0.0168***
	(0.00114)	(0.000318)	(0.00558)	(0.00542)	(0.000259)
Home Province FE	Yes	Yes	Yes	Yes	Yes
Firm Registration Province FE	. Yes	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	No
Establishment year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Obs.	2,975,584	3,030,291	2,691,794	2,776,540	290,443
R^2	0.017	0.008	0.206	0.191	0.149

Note: This table reports the results of estimating Equation (6). In column (1), the data sample includes the first business of all self-employed that entered the market between 1993 and 2005 and the dependent variable is a dummy variable that takes value 1 if the self-employed became an entrepreneur before 2005. Columns (2)-(4) report regression results for the firms that were established by entrepreneurs who started as self-employed individuals and entered the market between 1993 and 2005. The data sample includes the first firms established by this subsample of entrepreneurs. Standard errors are clustered at the home province-by-year-by-industry level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 12: Alternative Channel: Social Capital (Migrant Entrepreneurs)

	ROE	log(Profit)	log(Net income)	Survive 5 years
After× Layoff$_h$	0.0345**	0.531***	0.442**	0.0403**
	(0.0136)	(0.179)	(0.174)	(0.0189)
log(Registered Capital)	0.00200***	0.424***	0.411***	0.0182***
	(0.000239)	(0.00596)	(0.00592)	(0.000249)
Home Province×Firm Reg. Province FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	No
Establishment Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Obs.	3,398,487	2,807,060	2,876,225	315,836
R^2	0.008	0.193	0.177	0.138

Note: This table reports the results of estimating Equation (6), with the exception that the more stringent Home Province × Firm Registration Province fixed effects are included instead of the Home Province and the Firm Registration Province fixed effects. The data sample includes the first firms established by each entrepreneur who entered the market between 1993 and 2005, and who established their firms outside their home province. Standard errors are clustered at the home province-by-year-by-industry level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table 13: Alternative Channel: Business Environment

	ROE	log(Profit)	log(Net income)	Survive 5 years
After× Layoff_h	0.0218**	0.739***	0.449***	0.0429***
	(0.0102)	(0.152)	(0.139)	(0.0124)
After× Layoff_p	0.0175*	-0.506***	-0.0543	-0.0144
	(0.0103)	(0.146)	(0.138)	(0.0124)
log(Registered Capital)	-0.00267***	0.407***	0.387***	0.0155***
	(0.000241)	(0.00512)	(0.00468)	(0.000114)
Home Province FE	Yes	Yes	Yes	Yes
Firm Registration Province FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	No
Establishment Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Obs.	14,554,258	12,970,534	13,408,611	1,384,546
R^2	0.009	0.209	0.196	0.141

Note: This table reports the results of estimating Equation (11) and directly controls for the fixed effects of both the entrepreneurs' home province and the firms' registration province, as well as the fixed effects for report year, industry, and firm establishment year. The data sample includes the first firms established by entrepreneurs who entered the market between 1993 and 2005. Standard errors are clustered at the home province-by-year-by-industry level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Online Appendix (Not For Publication)

Appendix A Comparative Statics and Suggestive Evidence of Ability Selection

In this section, we consider a fully-fledged setting of the baseline model where the condition $h'(\theta) > b_E/b_S$ imposed in the main text is relaxed. The following result can be obtained in parallel to Proposition 1.

Proposition A.1 ***(Selection on Entrepreneurial Ability)*** *Suppose that the measures of individuals in the SOE sector, in the entrepreneurial sector, and in the private sector are all strictly positive before the SOE reform. The following statements hold:*

(a) If $h'(\theta) > b_E/b_S$ for all $\theta \in [\underline{\theta}, \bar{\theta}]$—i.e., if θ and k are strongly positively correlated—then there exist two cutoffs $\underline{\theta}^\dagger < \bar{\theta}^\dagger$ such that the individual chooses to become an SOE worker if $\theta > \bar{\theta}^\dagger$, be an entrepreneur if $\theta \in (\underline{\theta}^\dagger, \bar{\theta}^\dagger)$, and be a POE employee if $\theta < \underline{\theta}^\dagger$, which in turn implies that $\Theta_S > \Theta_E > \Theta_P$ (see Figure A1a).

(b) If $b_E/b_S > h'(\theta) > b_P/b_S$ for all $\theta \in [\underline{\theta}, \bar{\theta}]$—i.e., if θ and k are moderately positively correlated—then there exist two cutoffs $\underline{\theta}^\dagger < \bar{\theta}^\dagger$ such that the individual chooses to become an entrepreneur if $\theta > \bar{\theta}^\dagger$, be an SOE worker if $\theta \in (\underline{\theta}^\dagger, \bar{\theta}^\dagger)$, and be a POE employee if $\theta < \underline{\theta}^\dagger$, which in turn implies that $\Theta_E > \Theta_S > \Theta_P$ (see Figure A1b).

(c) If $h'(\theta) < b_P/b_S$ for all $\theta \in [\underline{\theta}, \bar{\theta}]$—i.e., if θ and k are weakly positively or negatively correlated—then there exist two cutoffs $\underline{\theta}^\dagger < \bar{\theta}^\dagger$ such that the individual chooses to become an entrepreneur if $\theta > \bar{\theta}^\dagger$, be a POE employee if $\theta \in (\underline{\theta}^\dagger, \bar{\theta}^\dagger)$, and be an SOE worker if $\theta < \underline{\theta}^\dagger$, which in turn implies that $\Theta_E > \Theta_P > \Theta_S$ (see Figure A1c).

As mentioned in Section 3, how individuals' entrepreneurial ability is selected in the three sectors generates different predictions that can be empirically tested. Figures A1a to A1c illustrate the pattern of ability selection predicted in Proposition A.1 when the correlation between θ and k is strongly positive, moderately positive and weakly positive or negative, respectively. A closer look at Proposition 1 and Figure A1 yields the following testable hypotheses:

Hypothesis 1a ***(Ability Selection Pattern under Proposition A.1(a))*** *Prior to the SOE reform, if the most able individuals choose SOE jobs as predicted in Proposition A.1(a), then $\Theta_S > \Theta_E > \Theta_P$. Moreover, $\underline{\theta}^\dagger$ remains unchanged and $\bar{\theta}^\dagger$ decreases with w_S, which in turn implies that $d\Theta_S/dw_S < 0$, $d\Theta_E/dw_S < 0$, and $d\Theta_P/dw_S = 0$ (see Figure A2a).*

Hypothesis 1b ***(Ability Selection Pattern under Proposition A.1(b))*** *Prior to the SOE reform, if moderately able individuals choose SOE jobs as predicted in Proposition A.1(b), then*

$\Theta_E > \Theta_S > \Theta_P$. *Moreover,* $\underline{\theta}^\dagger$ *decreases with* w_S *and* $\bar{\theta}^\dagger$ *increases with* w_S*, which in turn implies that the sign of* $d\Theta_S/dw_S$ *is indeterminate,* $d\Theta_E/dw_S > 0$*, and* $d\Theta_P/dw_S < 0$ *(see Figure A2b).*

Hypothesis 1c ***(Ability Selection Pattern under Proposition A.1(c))*** *Before the SOE reform, if the least able individuals choose SOE jobs as predicted in Proposition A.1(c), then* $\Theta_E > \Theta_P > \Theta_S$*. Moreover,* $\underline{\theta}^\dagger$ *increases with* w_S *and* $\bar{\theta}^\dagger$ *remains unchanged, which in turn implies that* $d\Theta_S/dw_S > 0$*,* $d\Theta_E/dw_S = 0$*, and* $d\Theta_P/dw_S > 0$ *(see Figure A2c).*

A.1 Ability Ranking across Sectors

We first use four panels of data from the Chinese Health and Nutritional Survey (CHNS) collected before the 1998 massive SOE downsizing, namely, the 1989, 1991, 1993, and 1997 panels, to test the ability distribution across the three sectors.[43] CHNS is an ongoing longitudinal survey of individuals, households, and communities in nine provinces in China and follows a multi-stage, random cluster sampling design.[44] CHNS provides a nationally representative sample of rural and urban clusters that contain much of the economic, institutional, and social variations in contemporary China. We restrict our analysis to those within the working ages between 22 and 50, and focus on the working urban population employed in the SOE and the POE sectors, in addition to the entrepreneurs. Observations with missing information were excluded. We have a final sample of 7,267 individuals.

Table A2 in Appendix A presents the descriptive statistics for the CHNS sample (Panel A), and for the subsample of SOE employees (Panel B), entrepreneurs (Panel C), and POE employees (Panel D), respectively. Panel A shows that the average annual income (in the current price) was 2,897 RMB, 33% completed at least high school, and the average "education index" was 21.[45] In addition, the average age of the sample is about 35 years, 51% are female, the average household size is 4.2, and 87% are married. Panels B to D show that entrepreneurs, on average, earn twice as much as SOE employees and POE employees. On the other hand, the entrepreneurs have a lower average education index (21) compared to SOE employees (23), and are 14% less likely to have finished high school; but the entrepreneurs have a higher average education index than POE employees (16.7), and are 18% more likely to have finished high school.

Following Queiró (2022), which shows that schooling is a strong predictor for entrepreneurs' human capital and firm performance, we use individuals' education level as a proxy for their entrepreneurial ability. We use both the "education index" and the indicator for whether an individual

[43] The results in this section is consistent with findings in Bai et al. (2021), though we use different samples and different measures of "ability."

[44] See https://www.cpc.unc.edu/projects/china. The nine provinces are Heilongjiang, Liaoning, Shandong, Jiangsu, Henan, Hubei, Hunan, Guangxi, and Guizhou.

[45] The "education index" summarizes the years and quality of education the respondent received, and it is defined in the official CHNS document as follows: (i) 0 stands for no education, (ii) 11-16 stands for 1-6 years of primary school education, (iii) 21-26 stands for 1-6 years of middle school education, (iv) 27-29 stands for 1-3 years of technical school education, and (v) 31-36 stands for 1-6 years of college and above education. We follow the official definition and use the index instead of the simple years of education to capture both the years of education and the quality of different types of education.

completed high school as the outcome variable of interest. Table A3 reports the regression results. In all regressions, we control for a set of personal characteristics, including age, gender, household size, marital status, and the province-by-year fixed effects. The omitted group is the POE employees. It shows that on average, both SOE workers and entrepreneurs, compared to POE employees, have more years of education and are more likely to have finished high school. SOE workers have the highest level of education, followed by entrepreneurs and POE employees. Although education is clearly a noisy proxy for one's entrepreneurial ability, the results of Table A3 provide evidence of ability sorting consistent with Hypothesis 1.

[Table A3 about here]

Recall that empirical results in Appendix A.1 provide evidence of ability ranking across the three sectors consistent with Hypothesis 1a. Next, we use the same CHNS survey data set to provide additional evidence of the comparative statics stated in Hypothesis 1a—namely, *ceteris paribus*, both the entrepreneurial ability of SOE workers and that of entrepreneurs decrease with respect to w_S, while that of POE employees remains constant.

Test for comparative statics with respect to w_S. We measure w_S as the county-level average SOE wage premium relative to that of the regional average wage to tease out the regional variation in average income level. We regress individuals' education level on the regional SOE wage premium to capture the effect of wage premium on average education level, separately for the SOE worker subsample, the POE worker subsample, and the entrepreneur subsample. Table A4 reports the regression results. It shows that the level of education of both SOE workers and entrepreneurs decreases with the average SOE wages. Specifically, a 10% increase in the region's SOE wage is associated with a 0.7% decrease in the average education level of the SOE workers and a 4.6% decrease in the average education of entrepreneurs, and the effect is statistically significant. Moreover, there is no statistically significant correlation between the SOE wage and the average education level of the POE workers as shown in Column (3). Columns (4)-(6) repeat the exercise with a dummy variable taking the value 1 for individuals who have finished high school education, and the results remain robust.

[Table A4 about here]

In summary, our findings are consistent with the predictions of Hypothesis 1a and suggest that in the pre-reform era, the SOE sector positively selects individuals with higher ability.

Appendix B Proofs

Proof of Proposition 1

Proof. By Equation (2), $U_E(\theta) - U_P(\theta)$ is strictly increasing in θ, implying that there exists a unique $\underline{\theta}^\dagger$ solving

$$U_E(\underline{\theta}^\dagger) - U_P(\underline{\theta}^\dagger) = 0. \tag{12}$$

It follows immediately that an individual prefers entering entrepreneurship to becoming a POE employee if and only if $\theta > \underline{\theta}^\dagger$.

The condition $h'(\theta) > b_E/b_S$ implies that $U_S(\theta) - U_E(\theta)$ is strictly increasing in θ. When $\theta > \underline{\theta}^\dagger$, there exists a unique $\bar{\theta}^\dagger > \underline{\theta}^\dagger$ such that

$$U_S(\bar{\theta}^\dagger) - U_E(\bar{\theta}^\dagger) = 0. \tag{13}$$

Similarly, it can be verified that an individual prefers becoming an SOE worker to entering entrepreneurship if and only if $\theta > \bar{\theta}^\dagger$.

The above analysis implies that the individual chooses to become an SOE worker if $\theta > \bar{\theta}^\dagger$, be an entrepreneur if $\theta \in (\underline{\theta}^\dagger, \bar{\theta}^\dagger)$, and be a POE employee if $\theta < \underline{\theta}^\dagger$. Therefore, we can express Θ_j for $j \in \{S, E, P\}$ as follows.

$$\Theta_P = \mathbb{E}[\theta \,|\, \theta < \underline{\theta}^\dagger], \Theta_E = \mathbb{E}[\theta \,|\, \underline{\theta}^\dagger < \theta < \bar{\theta}^\dagger], \text{ and } \Theta_S = \mathbb{E}[\theta \,|\, \theta > \bar{\theta}^\dagger].$$

It follows immediately that $\Theta_P < \Theta_E < \Theta_S$. This concludes the proof.

□

Proof of Lemma 1

Proof. Fixing q, an individual chooses to enter entrepreneurship if and only if

$$q\widetilde{U}_S(\theta) + (1-q)\left[\max\{U_E(\theta), U_P(\theta)\} - c\right] \geq \max\{U_E(\theta), U_P(\theta)\}$$

which is equivalent to

$$q\big[\widetilde{U}_S(\theta) - \max\{U_E(\theta), U_P(\theta)\}\big] - (1-q)c \geq 0.$$

It is evident that the above inequality holds if and only if $\widetilde{U}_S(\theta) > \max\{U_E(\theta), U_P(\theta)\}$ and $q > c/\big[\widetilde{U}_S(\theta) - \max\{U_E(\theta), U_P(\theta)\} + c\big]$. Therefore,

$$\mathcal{N}(q) := \mathbb{E}\Big[\mathbb{1}\big(q\widetilde{U}_S(\theta) + (1-q)\left(\max\{U_E(\theta), U_P(\theta)\} - c\right) \geq \max\{U_E(\theta), U_P(\theta)\}\big)\Big]$$

is weakly increasing in q and thus $q\mathcal{N}(q)$ is strictly increasing in q.

Next, note that

$$\big[q\mathcal{N}(q)\big]\big|_{q=1} = 1 - F(\bar{\theta}_2^\dagger) > \ell, \text{ and } \big[q\mathcal{N}(q)\big]\big|_{q=0} = 0 < \ell.$$

Therefore, there exists a unique solution $q \in (0,1)$ to $q\mathcal{N}(q) = \ell$, or equivalently, there exists a unique solution $q \in (0,1)$ to (3).

Recall by assumption that $h'(\theta) > b_E/\widetilde{b}_S$ for all $\theta \in [\underline{\theta}, \bar{\theta}]$. Further, individual's utility of entering entrepreneurship and that of becoming a POE employee are not influenced by the massive layoff. Therefore, the cutoff between POE and entrepreneur is again $\underline{\theta}^\dagger$ and it remains to show that $\bar{\theta}_3^\dagger > \bar{\theta}_2^\dagger > \bar{\theta}_1^\dagger$. By Proposition 1, for $\theta > \underline{\theta}^\dagger$, we have that $U_E(\theta) > U_P(\theta)$ and thus

$$\begin{aligned}
&q\widetilde{U}_S(\theta) + (1-q)(\max\{U_E(\theta), U_P(\theta)\} - c) - \max\{U_E(\theta), U_P(\theta)\} \\
=&q\big[\widetilde{U}_S(\theta) - U_E(\theta)\big] - (1-q)c,
\end{aligned}$$

which is strictly increasing in θ. Therefore, there exists a unique threshold $\bar{\theta}_3^\dagger$ such that

$$q\left[\widetilde{U}_S\big(\bar{\theta}_3^\dagger\big) - U_E\big(\bar{\theta}_3^\dagger\big)\right] = (1-q)c. \tag{14}$$

Similar to (13), the thresholds $\bar{\theta}_2^\dagger$ and $\bar{\theta}_1^\dagger$ are pinned down by

$$\widetilde{U}_S(\bar{\theta}_2^\dagger) = U_E(\bar{\theta}_2^\dagger), \text{ and } \widetilde{U}_S(\bar{\theta}_1^\dagger) = U_E(\bar{\theta}_1^\dagger) - \mathfrak{c}. \tag{15}$$

Combining (14) and (15) yields that

$$\begin{aligned}
\widetilde{U}_S\big(\bar{\theta}_3^\dagger\big) - U_E\big(\bar{\theta}_3^\dagger\big) =& \frac{(1-q)c}{q} > 0 = \widetilde{U}_S\big(\bar{\theta}_2^\dagger\big) - U_E\big(\bar{\theta}_2^\dagger\big) \text{ and} \\
\widetilde{U}_S\big(\bar{\theta}_2^\dagger\big) - U_E\big(\bar{\theta}_2^\dagger\big) =& 0 > -\mathfrak{c} = \widetilde{U}_S\big(\bar{\theta}_1^\dagger\big) - U_E\big(\bar{\theta}_1^\dagger\big),
\end{aligned}$$

which in turn implies that $\bar{\theta}_3^\dagger > \bar{\theta}_2^\dagger > \bar{\theta}_1^\dagger$ and concludes the proof. □

Proof of Proposition 2

Proof. It is straightforward to verify that $e^* \equiv [(p_R V_R - p_S V_S) - (p_S - p_R)\Delta]\,\theta$ is strictly increasing in θ and $y^* \equiv \frac{e^* p_R V_R + (1-e^*) p_S V_S}{e^* p_R + (1-e^*) p_S}$ is strictly increasing in e^*. Therefore, y^* is strictly increasing in θ.

For generation $j \in \{1,2\}$, recall that the ability of entrepreneurs in era 2 are below $\bar{\theta}_j^\dagger$, whereas that enters entrepreneurship (due to the massive layoff) in era 3 are above $\bar{\theta}_j^\dagger$. Therefore, the average ability, as well as the expected performance, of entrepreneurs in era 3 is higher than that in era 2. This concludes the proof. □

Proof of Proposition 3

Proof. With slight abuse of notation, we add θ into $y^* \equiv \frac{e^* p_R V_R + (1-e^*) p_S V_S}{e^* p_R + (1-e^*) p_S}$ to emphasize the fact that an entrepreneur's expected performance conditional on success depends on his ability θ. Recall from the proof of Proposition 2 that $y^*(\theta)$ is strictly increasing in θ.

First consider the case of random layoff. The expected performance of entrepreneurs for generation $j \in \{1,2\}$ in era 3 can be expressed as follows:

$$\mathcal{Y}_j^* = \mathbb{E}\big[y^*(\theta) \,\big|\, \theta > \bar{\theta}_j^\dagger\big],\ j \in \{1,2\}. \tag{16}$$

For generation 3, it follows from (3) and Lemma 1 that

$$q\big(1 - F(\bar{\theta}_3^\dagger)\big) = \ell. \tag{17}$$

Note that an generation-3 individual with $\theta > \bar{\theta}_2^\dagger$ would end up being an entrepreneur with probability 1 if $\theta \in (\bar{\theta}_2^\dagger, \bar{\theta}_3^\dagger)$—in which case he chooses to become an entrepreneur in the first place—and with probability $1-q$ if $\theta \in (\bar{\theta}_3^\dagger, \bar{\theta})$—in which case he applies for an SOE job but is not hired. Therefore, $\mathcal{Y}_3^*$ can be expressed as

$$\begin{aligned}
\mathcal{Y}_3^* =& \frac{\Big[F(\bar{\theta}_3^\dagger) - F(\bar{\theta}_2^\dagger)\Big]\,\mathbb{E}\Big[y^*(\theta) \,\Big|\, \bar{\theta}_2^\dagger < \theta < \bar{\theta}_3^\dagger\Big] + (1-q)\Big[1 - F(\bar{\theta}_3^\dagger)\Big]\,\mathbb{E}\Big[y^*(\theta) \,\Big|\, \theta > \bar{\theta}_3^\dagger\Big]}{\Big[F(\bar{\theta}_3^\dagger) - F(\bar{\theta}_2^\dagger)\Big] + (1-q)\Big[1 - F(\bar{\theta}_3^\dagger)\Big]} \\
=& \frac{\Big[F(\bar{\theta}_3^\dagger) - F(\bar{\theta}_2^\dagger)\Big]\,\mathbb{E}\Big[y^*(\theta) \,\Big|\, \bar{\theta}_2^\dagger < \theta < \bar{\theta}_3^\dagger\Big] + \Big[1 - F(\bar{\theta}_3^\dagger) - \ell\Big]\,\mathbb{E}\Big[y^*(\theta) \,\Big|\, \theta > \bar{\theta}_3^\dagger\Big]}{1 - F(\bar{\theta}_2^\dagger) - \ell},
\end{aligned} \tag{18}$$

where the second equality follows from (17).

By Lemma 1, we have that $\bar{\theta}_2^\dagger > \bar{\theta}_1^\dagger$ and thus $\mathbb{E}[y^*(\theta) \,|\, \theta > \bar{\theta}_2^\dagger] > \mathbb{E}[y^*(\theta) | \theta > \bar{\theta}_1^\dagger]$, from which we can conclude that $\mathcal{Y}_2^* > \mathcal{Y}_1^*$. Next we show that $\mathcal{Y}_2^* > \mathcal{Y}_3^*$. Carrying out the algebra, we can obtain that

$$\begin{aligned}
&\Big[F(\bar{\theta}_3^\dagger) - F(\bar{\theta}_2^\dagger)\Big]\,\mathbb{E}\Big[y^*(\theta) \,\Big|\, \bar{\theta}_2^\dagger < \theta < \bar{\theta}_3^\dagger\Big] + \Big[1 - F(\bar{\theta}_3^\dagger) - \ell\Big]\,\mathbb{E}\Big[y^*(\theta) \,\Big|\, \theta > \bar{\theta}_3^\dagger\Big] \\
=& \Big[1 - F(\bar{\theta}_2^\dagger)\Big]\,\mathbb{E}\Big[y^*(\theta) \,\Big|\, \theta > \bar{\theta}_2^\dagger\Big] - \ell\mathbb{E}\Big[y^*(\theta) \,\Big|\, \theta > \bar{\theta}_3^\dagger\Big] \\
<& \Big[1 - F(\bar{\theta}_2^\dagger) - \ell\Big]\,\mathbb{E}\Big[y^*(\theta) \,\Big|\, \theta > \bar{\theta}_2^\dagger\Big],
\end{aligned} \tag{19}$$

where the strict inequality follows from the fact that $y^*(\theta)$ is strictly increasing in θ and $\bar{\theta}_3^\dagger > \bar{\theta}_2^\dagger$. Combining (16), (18), and (19) yields $\mathcal{Y}_2^* > \mathcal{Y}_3^*$.

Next, consider the case of directional layoff. The expected performance of generation-3 entrepreneurs in era 3 with $\theta > \bar{\theta}_2^\dagger$ is again (18), and the expected performance of entrepreneurs for generation $j \in \{1,2\}$ in era 3 can be expressed as

$$\mathcal{Y}_j^* = \mathbb{E}\big[y^*(\theta) \,\big|\, \bar{\theta}_j^\dagger < \theta < F^{-1}(1-\ell)\big],\ j \in \{1,2\}.$$

Recall $\bar{\theta}_2^\dagger > \bar{\theta}_1^\dagger$ from Lemma 1. Therefore, we have that

$$\mathcal{Y}_1^* = \mathbb{E}\big[y^*(\theta) \,\big|\, \bar{\theta}_1^\dagger < \theta < F^{-1}(1-\ell)\big] < \mathbb{E}\big[y^*(\theta) \,\big|\, \bar{\theta}_2^\dagger < \theta < F^{-1}(1-\ell)\big] = \mathcal{Y}_2^*,$$

and it remains to show $\mathcal{Y}_2^* < \mathcal{Y}_3^*$. Recall $q \in (0,1)$ from Lemma 1; together with (17), we can obtain that

$$F^{-1}(1-\ell) > F^{-1}\Big(1-\frac{\ell}{q}\Big) = \bar{\theta}_3^\dagger. \tag{20}$$

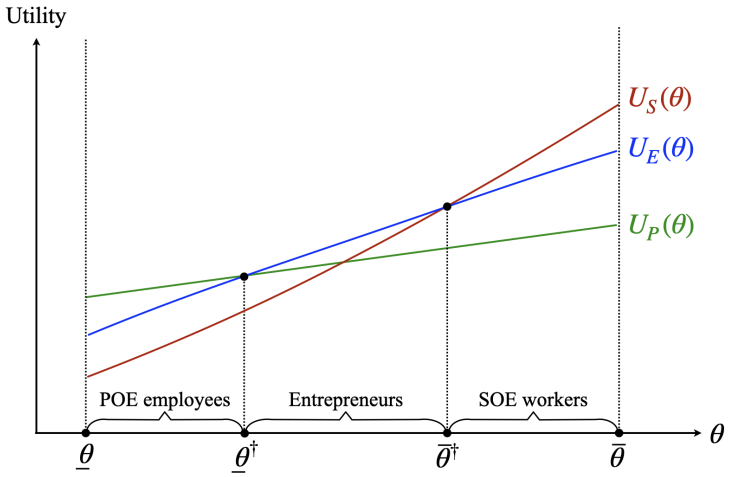
Therefore, we have that

$$\begin{aligned}
&\Big[F(\bar{\theta}_3^\dagger) - F(\bar{\theta}_2^\dagger)\Big]\,\mathbb{E}\left[y^*(\theta)\,\middle|\,\bar{\theta}_2^\dagger < \theta < \bar{\theta}_3^\dagger\right] + \Big[1 - F(\bar{\theta}_3^\dagger) - \ell\Big]\,\mathbb{E}\left[y^*(\theta)\,\middle|\,\theta > \bar{\theta}_3^\dagger\right] \\
&= \Big[1 - F(\bar{\theta}_2^\dagger)\Big]\,\mathbb{E}\left[y^*(\theta)\,\middle|\,\theta > \bar{\theta}_2^\dagger\right] - \ell\mathbb{E}\left[y^*(\theta)\,\middle|\,\theta > \bar{\theta}_3^\dagger\right] \\
&> \Big[1 - F(\bar{\theta}_2^\dagger)\Big]\,\mathbb{E}\left[y^*(\theta)\,\middle|\,\theta > \bar{\theta}_2^\dagger\right] - \ell\mathbb{E}\left[y^*(\theta)\,\middle|\,\theta > F^{-1}(1-\ell)\right] \\
&= \Big[1 - F(\bar{\theta}_2^\dagger) - \ell\Big]\,\mathbb{E}\big[y^*(\theta)\,\big|\,\bar{\theta}_2^\dagger < \theta < F^{-1}(1-\ell)\big] \\
&= \Big[1 - F(\bar{\theta}_2^\dagger) - \ell\Big]\,\mathcal{Y}_2^*,
\end{aligned} \tag{21}$$

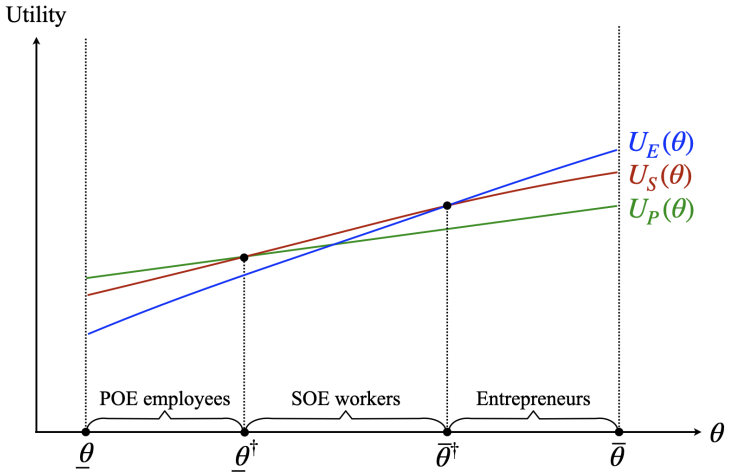
where the strict inequality follows from (20).

Combining (18) and (21) yields $\mathcal{Y}_2^* < \mathcal{Y}_3^*$. This concludes the proof. □

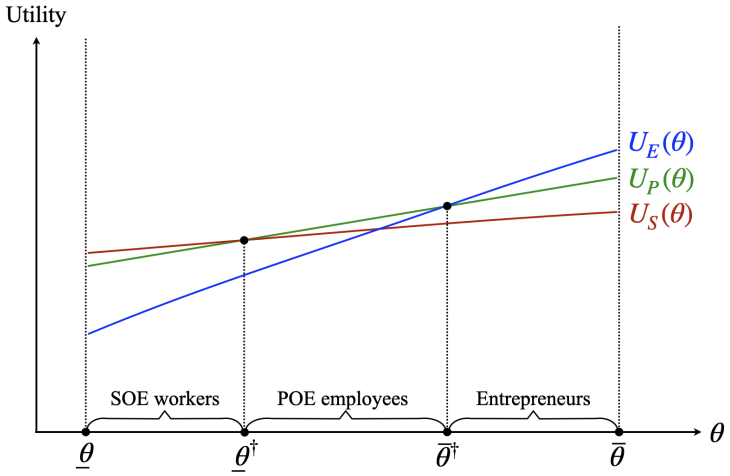
Figure A1: Individual's Occupational Choice and Different Ability Selection Patterns



(a) Most able individuals choose SOE jobs

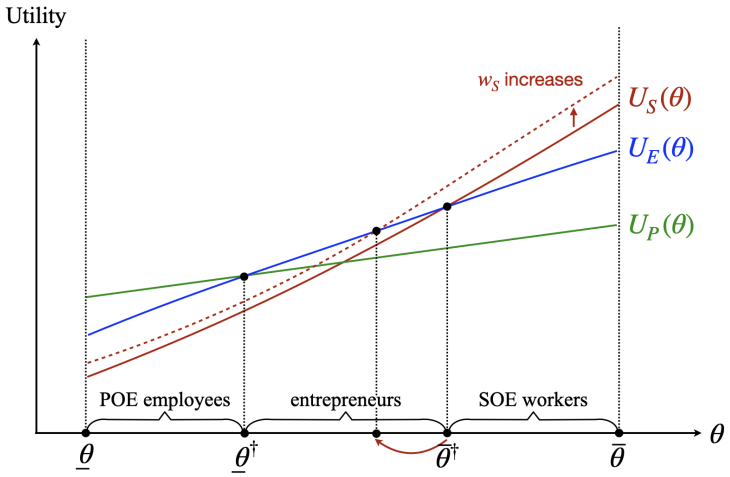


(b) Moderately able individuals choose SOE jobs

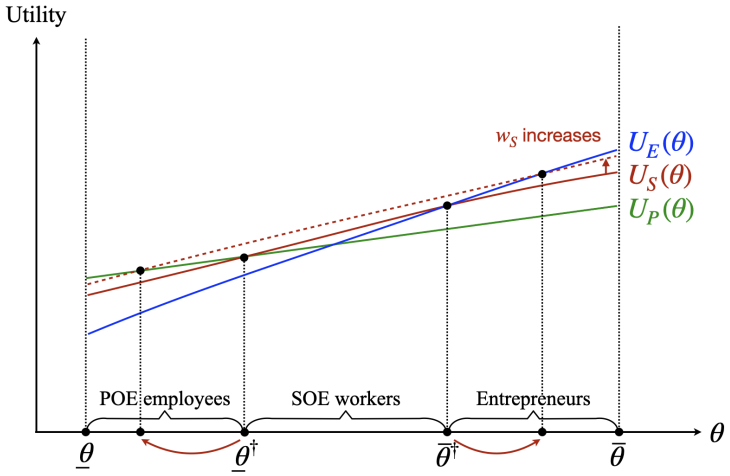


(c) Least able individuals choose SOE jobs

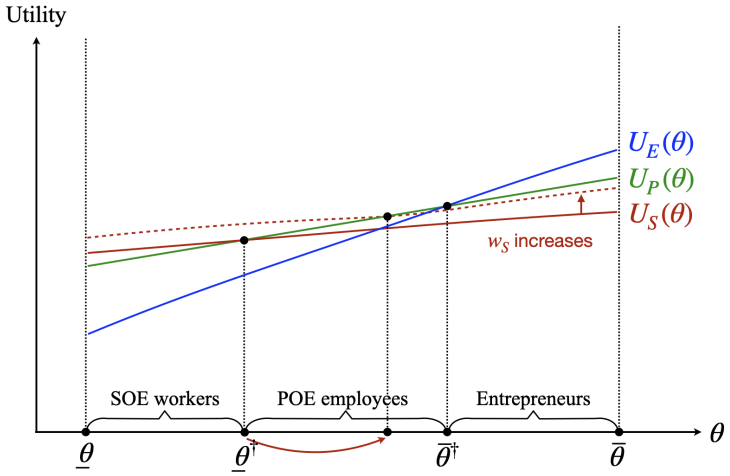
Figure A2: Impact of Wage in the SOE Sector on Individual's Occupational Choice



(a) Most able individuals choose SOE jobs



(b) Moderately able individuals choose SOE jobs



(c) Least able individuals choose SOE jobs

Table A1: SOE Employment and Layoff by Industry

	# SOE Employees 1995 (10 thousand)				National Layoff (2001-1995)	
	Mean	Std. Dev.	Min	Max	# (10 thousand)	%
Agriculture	21.1	22.0	0.8	92	193.9	0.31
Mining	27.8	28.1	0	132.8	432.4	0.52
Manufacturing	110.9	69.7	0.7	258.8	2132.3	0.64
Utilities	7.9	4.6	0.5	16.3	8.2	0.03
Construction	20.2	11.7	0.7	47.4	269.2	0.44
Geological investigation and prospecting	4.4	2.7	0.3	12.2	30.3	0.23
Transport, storage and telecommunication	22.6	12.3	1.9	46.3	158.7	0.23
Sales, trade, and catering	35.4	21.9	1.1	73.3	614.4	0.58
Finance and insurance	6.8	4.0	0.6	17.7	10.0	0.05
Real estate	2.1	1.7	0.1	6.4	2.4	0.04
Social service	10.5	7.3	0.5	28.3	4.7	0.01
Health care, sports, and social welfare	12.6	7.2	1.1	26.3	-45.6	-0.12
Education, culture, and arts	42.1	22.9	2.3	99.2	-190.4	-0.15
Scientific research and polytechnic service	5.6	4.9	0.3	25.2	30.0	0.18
Government agencies and social organizations	34.0	19.2	4.1	74.5	-64.8	-0.06

Note: This table presents the summary statistics for the pre-layoff SOE employment size and national layoff intensity by industry, which are used to construct our Bartik IV. The left panel corresponds to the SOE employment in 1995 at province-industry level. The right panel corresponds to the national industry level layoff intensity.

Table A2: Descriptive Statistics for CHNS Data

Variable	Obs	Mean	Std. Dev.	Min	Max
Panel A: Full Sample					
Annual income	7,067	2,896.91	3,702.36	0	79200
Education index	6,609	20.83	7.70	0	36
High school	7,267	0.33	0.47	0	1
Age	7,267	34.74	7.78	22	50
Gender (1=Female)	7,267	0.51	0.50	0	1
Household size	7,266	4.24	1.41	1	14
Marriage (1=Married)	7,244	0.87	0.34	0	1
Panel B: SOE Employees					
Annual income	4,530	2,756.52	3,052.57	0	72,000
Education index	4,124	23.21	6.33	0	36
High school	4,594	0.45	0.50	0	1
Age	4,594	34.63	7.70	22	50
Gender (1=Female)	4,594	0.53	0.50	0	1
Household size	4,594	4.02	1.37	1	14
Marriage (1=Married)	4,580	0.85	0.35	0	1
Panel C: Entrepreneurs					
Annual income	126	6,206.75	7,837.06	0	44781.33
Education index	116	21.05	6.68	0	34
High school	132	0.31	0.46	0	1
Age	132	35.60	6.61	22	50
Gender (1=Female)	132	0.58	0.50	0	1
Household size	132	4.77	2.06	2	12
Marriage (1=Married)	132	0.94	0.24	0	1
Panel D: POE Employees					
Annual income	2,420	2,977.76	4,337.22	0	79200
Education index	2,375	16.73	8.17	0	36
High school	2,546	0.13	0.34	0	1
Age	2,546	34.90	7.96	22	50
Gender (1=Female)	2,546	0.47	0.50	0	1
Household size	2,545	4.61	1.37	1	12
Marriage (1=Married)	2,537	0.90	0.30	0	1

Note: This table presents the summary statistics for the CHNS data collected before the 1998 massive SOE downsizing, namely, the 1989, 1991, 1993, and 1997 panels. The data sample includes the working population employed in the SOE sector, the POE sector, and the entrepreneurs. We restrict our sample to the urban population between normal working ages 22 and 50. Panel A reports the summary statistics for the full sample, and Panel B and Panel C report that for the SOE employee sample and entrepreneur sample separately.

Table A3: Ability Sorting by Occupation Choice

	log(Education Index)	High School
SOE	0.534***	0.323***
	(0.0451)	(0.0292)
Entrepreneur	0.254***	0.117**
	(0.0597)	(0.0471)
Age	-0.0253***	-0.00577***
	(0.00298)	(0.00126)
Gender (Female=1)	-0.290***	-0.0261***
	(0.0386)	(0.00793)
Household size	-0.0462***	-0.0188**
	(0.0102)	(0.00728)
Marital status (Married=1)	0.00211	-0.0660***
	(0.0400)	(0.0225)
Constant	4.079***	0.573***
	(0.145)	(0.0486)
Province*Year FE	Yes	Yes
Obs	6,563	7,214
R^2	0.250	0.160

Note: This table reports the results of estimating the selection effect based on the CHNS data collected before the 1998 massive SOE downsizing, namely, the 1989, 1991, 1993, and 1997 panels. The dependent variables are the log of education index (quality-years) and a dummy variable for finishing high school. The data sample includes the working population employed in the SOE sector, the POE sector, and the entrepreneurs. We restrict our sample to the urban population between normal working ages 22 and 50. Standard errors are clustered at the province-year level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table A4: SOE Selection on Ability: The Role of w_S

	log(Education Index)			High school		
	SOE	Entrepreneur	POE	SOE	Entrepreneur	POE
SOE wage premium (log)	-0.0701***	-0.467**	0.0386	-0.0511**	-0.635**	0.0967
	(0.0163)	(0.181)	(0.179)	(0.0247)	(0.285)	(0.0700)
Constant	4.543***	4.225**	4.995***	1.329***	8.532***	-0.0937
	(0.212)	(1.527)	(1.603)	(0.238)	(2.495)	(0.571)
Province FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	4,113	132	408	4,580	116	448
R^2	0.124	0.249	0.354	0.090	0.288	0.112

Note: This table reports the results of estimating the role of w_s in the selection channel based on the CHNS data with the log of education index and a dummy variable for finishing high school being the dependent variable, and the regional SOE wage premium being the key independent variable. The data sample includes the working population employed in the SOE sectors and the entrepreneurs during the pre-reform period, i.e. 1989, 1991, 1993, and 1997. We restrict our sample to the urban population, with the normal working ages between 22 and 50. Columns (1) and (4) report the regression results for SOE employee sample, Columns (2) and (5) report the regression results for the entrepreneur sample, and Columns (3) and (6) report the regression results for the POE employee sample. Standard errors are clustered at the province-year level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table A5: Effect of SOE Layoffs on Labor Cost

	log(City Average Wage)		
After $\times$ Layoff$_h$	0.385***	0.361***	0.299***
	(0.095)	(0.098)	(0.099)
log(Populatoin)		-0.077	-0.065
		(0.080)	(0.079)
GDP		0.000***	0.000***
		(0.000)	(0.000)
log(Employment)			-0.059***
			(0.011)
Constant	8.907***	9.344***	9.485***
	(0.017)	(0.466)	(0.467)
City FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Obs.	3,122	2,929	2,929
R^2	0.862	0.908	0.909

Note: We estimate Equation (5) at the city level, with the log of average annual wage being the dependent variable and the lay-off intensity measured at the province level. We control for city-level log of population, GDP level, and log of the total number of employment at the year-end. The data sample covers the period between 1993 to 2005. Standard errors are clustered at the province-by-year level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.

Table A6: Alternative Channel: Business Environment (Placebo)

	ROE	log(Profit)	log(Net income)
After $\times$Layoff$_h$	-0.0132	-0.573***	0.166
	(0.0188)	(0.178)	(0.273)
log(Registered capital)	Yes	Yes	Yes
Home Province FE	Yes	Yes	Yes
Firm Registration Province FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Establishment Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Obs.	303,611	325,939	357,165
R^2	0.536	0.514	0.332

Note: This table reports the results of estimating Equation (6) on firms established before 1998. The data sample includes the first firms established by each entrepreneur who entered market *between 1993 and 1998*. Standard errors are clustered at the home province-by-year-by-industry level. ***, **, and * represent significance at 1%, 5%, and 10%, respectively.