Serial Entrepreneurship in China[*]

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Abstract

This paper studies entrepreneurship and the creation of new firms in China through the lens of serial entrepreneurs, i.e. entrepreneurs who establish more than one firm, and their differences with non-serial entrepreneurs. Drawing on data on the universe of all firms in China, we document key facts about serial entrepreneurship in China since the early 1990s and develop a theoretical framework to rationalize the role of endowments, ability, and capital market frictions in their behavior. We also examine the key determinants of the sectoral choice for serial entrepreneurs' second firms. Quantitatively, serial entrepreneurs are more productive, raise more capital, and operate larger firms than non-serial entrepreneurs. Moreover, serial entrepreneurs with greater liquidity and firms similar in their productivity are more likely to operate these firms concurrently rather than sequentially. We also find that less productive serial entrepreneurs are more likely to switch sectors when establishing new firms, with the choice of sector influenced by considerations of risk diversification, upstream and downstream linkages, and sectoral complementarities.

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1 Introduction

The creation of new productive firms is an important engine of growth, especially in emerging economies. China's high growth has been accompanied by high rates of entry of new firms that on average have been significantly more productive than existing firms (Brandt, Van Biesebroeck and Zhang (2012)). While most entrepreneurs start only a single firm during their lifetime, some entrepreneurs start and operate a series of firms. A small number of studies for other countries document that in upwards of a quarter of all firms may be those of such *serial entrepreneurs* (SEs).

This paper studies entrepreneurship and the creation of new firms in China through the lens of serial entrepreneurs and their differences with entrepreneurs who only start a single firm (*non-serial entrepreneurs*). These differences are informative about the underlying frictions and dynamics of entrepreneurship. In principle, serial entrepreneurs could be highly able individuals good at identifying new business opportunities; alternatively, their advantage may lie in access to scarce factors or connections, which helps them access finance and overcome barriers that might exist. If the former, we expect them to be better than average; if the latter, we expect the opposite. We also explore sectoral choices of SEs which are revealing of other frictions these entrepreneurs face.

Studying serial entrepreneurs is often constrained by data availability. One needs data capturing entrepreneurial activity of individuals over their lifetime, as well as data on the outcomes of these firms. In this paper, we leverage two unique data sources for Chinese firms: the Business Registry of China and the Inspection Database. These data allow us to document salient facts about entrepreneurship and serial entrepreneurship over the period between 1995-2015. The Business Registry of China contains information on all firms that have ever operated in China and includes unique identifiers for the main owner(s) of each firm at the time of establishment, which allow us to identify serial entrepreneurs. These data also allow us to observe sectoral choices of serial entrepreneurs, most notably, the sector and location of the second firm given the choices with respect to the first. The Inspection Data, which runs from 2008 to 2012, provide annual information on firms' assets, liabilities, total sales, profits, and taxes paid. We link these data sources and use the data to calculate relative TFP, debt, equity, and capital for each firm.

To guide our empirical measurements, we develop a simple two-period model of firm creation, in the spirit of Hopenhayn (1992). Each period, potential entrepreneurs receive the option to start a new firm with a stochastic productivity. Operating a firm requires capital, and entrepreneurs can use their own equity or rent capital from banks. The model has one key friction that captures frictions in capital markets – the interest rate for borrowing is higher than the return on bank deposits.

The theory has a number of implications. We first study the allocation of capital and debt across firms with different productivity. According to the model, both installed capital and debt should be larger for more productive firms because it is optimal to install more capital in firms with higher TFP. High-TFP firms are therefore more likely to be debt financed. The data for Chinese firms conform tightly with these predictions.

We then study implications for how SE should differ from non-serial entrepreneurs. The theory predicts that the first firm started by an SE should be more productive than other firms in the same industry. However, the predictions for TFP of the subsequent firms started by the SE depend crucially on the economic forces and frictions prevalent in the economy. The productivity of these firms is shaped by a fundamental trade-off between persistence of productivity (i.e., across different productivity draws for an individual entrepreneur) and the entrepreneurs' access to scarce factors. On the one hand, if productivity is highly persistent across different firms which an individual might start, then SE will become positively selected on productivity, and one should observe that the firms of the SE are more productive than other firms. On the other hand, if the main advantage of SE is their ability to get access to scarce factors such as capital, then SE will become negatively selected on productivity, and one should observe that the firms of the SE are less productive than other firms

In line with the productivity-persistence force, we find that the 1st-SE firm is significantly more productive than other firms in their industry. Moreover, the 2nd-SE firm is even more productive. Relative to their peers, the 1st- and 2nd-SE firms are 20% and 30% more productive, respectively. We conclude that the evidence in China points toward entrepreneurs becoming SEs for efficiency reasons – productivity is highly persistent across firms started by the same entrepreneur and better entrepreneurs start more firms.

We also study the extent to which SEs operate multiple firms concurrently or in a sequence, i.e., that old firms are closed when new firms are established. Our theory predicts that entrepreneurs who have larger endowments and/or have a more productive first firm are more likely to operate firms concurrently. Moreover, SEs with firms that have relatively similar TFP are also more likely to run them concurrently. Conversely, SEs with a larger gap in TFP between firms − one firm being substantially more productive than the other − are more likely to run these firms sequentially due to a larger opportunity cost of capital. These predictions are borne out in the data. This evidence points to financial frictions as an important feature of entrepreneurship in China, consistent with the view that access to finance has been difficult for private entrepreneurs in China (Hsieh and Klenow (2009); Song, Storesletten and Zilibotti (2011); Lardy (2019)).

To study migration across sectors, we extend the model to incorporate a choice of industry for subsequent firms, given the initial industry of the first firm. We consider several motives for sectoral choice, including (1) learning about own comparative advantage for a particular sector; and (2) diversification of sector-specific risk. The key assumption is that the persistence of TFP draws across firms is larger for firms operating in the same industry than for firms in more distant industries. This captures a form of learning in the spirit of the Jovanovic (1979) learning model: if one is relatively successful (unsuccessful) at operating a firm in a particular sector s, then a future firm started in sector s by the same entrepreneur can also be expected to be relatively successful (unsuccessful). The model predicts that firms started in the same sector by the same entrepreneur should be more productive than firms started in different sectors. To study diversification, we assume that each sector has an industry-specific return to capital. These returns are imperfectly correlated across sectors, which creates a hedging motive for sector choice.

The theoretical predictions for sectoral migration are born out in the data. While the vast majority of serial entrepreneurs start firms in different industries (82% of SE locate their 2nd-SE firm in a different 3-digit industry), the firms that operate in the same industry are substantially more productive than other firms. Both the 1st- and the 2nd-SE firm have on average about 50% larger TFP than other firms in their industry. Entrepreneurs's sectoral choices suggest a motive for diversification. Sectors with a lower covariance (of return to capital) with the sector of the first firm is chosen more frequently. Moreover, the firms in the sectors with low covariance (with the first sector) have lower TFP on average. Finally, conditional on switching sectors, entrepreneurs are more likely to choose sectors with strong input-output linkages and sectors that share the same downstream and/or upstream links.

Our paper contributes to the small but growing literature that recognizes that entrepreneurship is a "serial" activity, i.e. entrepreneurs establish multiple firms over their lifetimes. A number of studies document that serial entrepreneurship is common in the US and other countries.[1] These and

[1]See, for example, Holmes and Schmitz (1990, 1995), Chari, Golosov and Tsyvinsky (2005), and Lafontaine and Shaw (2016) for the US; Westhead and Wright (1998) for the UK; Wagner (2003) for Germany; Hyytinen and Ilmakunnas (2007) for Finland; Amaral, Baptista and Lima (2011) and Rocha, Carneiro and Amorim Varum (2015) for Portugal; Shaw and Sorenson (2019) for Denmark; Carbonara, Tran and Santarelli (2020) for Vietnam.

other studies discuss the relative importance of entrepreneurial learning by doing, ability, and luck in understanding serial entrepreneurship.[2] The paper closest to our study is Feliz, Karmakar and Sedlacek (2021), developed independently of our paper. Their paper shows that serial entrepreneurs in Portugal have larger and more productive firms.

We contribute to the literature on serial entrepreneurship in several ways. First, using the universe of all firms in one country (China) we conduct a comprehensive empirical analysis on serial entrepreneurship and map out the rich empirical facts and patterns related to the firms started by serial entrepreneurs. Second, we develop a theoretical framework that is consistent with the documented facts and use it to highlight the key features needed to understand the emergence of serial entrepreneurs and the performance of the firms they operate. Finally, we highlight the fact that the observed behavior of serial entrepreneurs reflects, and thus sheds light on, the existing underlying frictions in the economy that determine the behavior of all entrepreneurs.

Our paper also contributes to the broader literature on entrepreneurship (e.g., Quadrini (2000) and Cagetti and De Nardi (2006)) and the effect of distortions and misallocations on economic development and growth (see e.g., Restuccia and Rogerson (2008) and Hsieh and Klenow (2009)). In this context, a country's financial system is seen as critical to the nexus between entrepreneurship and growth (King and Levine (1993a,b)). Especially important is the role of liquidity, intermediation, and financial constraints (Evans and Jovanovic (1989)), which may prevent individuals from starting new firms and may lead to a misallocation of resources among currently operating firms (e.g., Erosa (2001), Buera, Kaboski and Shin (2011), Midrigan and Xu (2014), and Moll (2014)). These papers, however, do not analyze serial entrepreneurship.

The rest of the paper is organized as follows. Section 2 describes the datasets used in the paper and provides an introductory discussion of entrepreneurship and serial entrepreneurship in China. Sections 3 and 4 lay out a stylized model of entrepreneurship and serial entrepreneurship. Section 5 confronts the theoretical predictions with our Chinese data on serial entrepreneurship. Section 6 extends the theoretical and empirical analysis to study the sectoral migration choices of serial entrepreneurs, i.e., the industry where a serial entrepreneur locates the second firm. Section 7 concludes.

2 Datasets and a First Look at Serial Entrepreneurs

2.1 Business Registry of China

Our primary data source for analyzing the behaviour of serial entrepreneurs is the Business Registry of China Database which is maintained by the State Administration of Industry and Commerce (SAIC). From now on we will refer to it as the *Registry Data*.

The Registry Data captures all firms established in China since 1949. It contains information on the year of establishment, exit date (if applicable), primary 4-digit industry, background of its legal representative, registered capital[3], and investors in the firm and their share. The firm investors are classified into three groups − individuals, enterprises, or the government. For each investor, we know their total paid-in capital and date of investment into the firm. Unique investor identifiers (IDs) allow us to trace out each entrepreneur's investment history. We use a snapshot of the data

[2]See, for example, Plehn-Dujowich (2010), Gompers, Kovner, Lerner and Sharfstein (2010), Zhang (2011), Chen (2013), Parker (2013, 2014), Rocha et al. (2015).

[3]Registered capital is total capital contributed by all investors in the firm. The amount is authorized by the company's Article of Association. Before 2013, the Company Law required shareholders to put up at least 20% of the total registered capital initially, with the remaining investment paid within two years after the establishment of the firm.

at the end of 2015 and report all empirical facts for the post-1995 time period.[4]

The structure of the dataset. The Registry Data, and thus the information available to us, has the following structure.

- *Operating firms in 2015.* For all existing firms, as of the end of 2015, the Registry Data provides information on the current ownership of the registered capital in the firm. For each investor in the firm we know the value and their share of registered capital and the year it was acquired.

- *Firms that went out of business before 2015.* For firms that went out of business in year T, prior to 2015, the Registry Data provides information on the ownership of the registered capital in the firm in year T. For each investor in the firm we know the value and share of their registered capital in year T and the year it was acquired.

As we discuss later in section 2.3, this organization of the dataset allows us to have a very precise view of the ownership structure of the Chinese firms in our baseline sample.

2.2 Inspection Database

The Registry Data provides comprehensive ownership information on all firms ever established in China since 1949. To analyze firm performance, we draw on complementary data collected by SAIC that provides annual information on firm's assets, liabilities, total sales, total profit, net profit, and total taxes. We will refer to these data as the *Inspection Data*. Beginning in 2008, local SAIC offices required all firms to report annually financial information for the purposes of an "inspection" procedure that ensured that firms were operating normally and running legal businesses. Failure to report this information to SAIC for two consecutive years would result in the cancellation of the firm's license to operate. SAIC collected this information manually in the early years of the system and some of it was lost for certain prefectures. After 2010 the government began to collect the data digitally. In the analysis which uses the Inspection Data, we exclude prefectures that have a reporting ratio lower than 35% in a particular year: this drops 130 prefectures in total, concentrated in 7 provinces. In Appendix Table A-1 we provide a summary of the fraction of firms reporting information in the Inspection Data by firm type − Non-SE, 1st-SE, and 2nd-SE − which reveals similar reporting ratios by these types of firms. Appendix Table A-2 shows the overall number of firms in the Inspection Data.

2.3 Business Registry of China: Ownership Information

Table 1 provides information on the ownership types of firms in China between 1995 and 2015. In order to classify firms into various ownership categories we identify the largest shareholder in a firm: either an individual, an enterprise, or the government. For a declining fraction of firms − primarily township and village enterprises, and in later years farmer cooperatives − shareholder information is not reported. We classify those as *Unreported* in Table 1.

[4] There are snapshots of the Business Registry for later years, but these data are less reliable. A combination of reform of the Business Registry system in 2014 and evaluation of local government officials based on new firm entry likely contributed to shell (fake) companies. Simultaneously, stricter rules regarding firm liquidation that increased these costs likely reduced firm exit. In Table 4 below, the slightly higher (lower) rate of entry (exit) in 2014 and 2015 for both serial and non-serial firms may be related to these issues. As explained more fully below, most of our analysis uses data through 2012.

Table 1: Firms in China, by Ownership Type, 1995-2015.

year	Based on largest shareholder							Unreported
			Individual			Enterprise		
	Total	Unregistered	Single	Multiple	No citizenship ID	Single	Multiple	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1995	1,457,329	709,692	66,947	250,516	165,818	189,245	75,111	1,532,662
1996	1,675,342	758,753	85,332	351,309	184,755	200,269	94,924	1,579,656
1997	1,907,279	797,393	106,645	473,316	206,033	209,425	114,467	1,545,534
1998	2,182,114	812,351	141,774	646,663	230,609	215,259	135,458	1,425,792
1999	2,439,234	806,841	178,605	830,434	251,745	219,445	152,164	1,284,798
2000	2,749,463	792,553	231,699	1,065,079	271,104	219,101	169,927	1,108,930
2001	3,091,073	761,611	304,829	1,341,393	285,475	213,002	184,763	940,454
2002	3,531,398	744,745	397,362	1,671,247	308,757	208,769	200,518	801,128
2003	4,068,805	717,224	500,710	2,089,711	337,575	203,974	219,611	693,573
2004	4,683,522	688,064	632,550	2,567,293	359,492	199,981	236,142	613,136
2005	5,293,533	660,887	754,241	3,042,218	383,052	200,103	253,032	546,330
2006	5,892,335	635,424	942,968	3,445,815	393,093	207,488	267,547	492,238
2007	6,314,605	601,419	1,098,363	3,727,884	394,416	215,001	277,522	432,639
2008	6,760,176	572,309	1,254,446	4,029,552	395,541	223,055	285,273	400,159
2009	7,459,774	558,796	1,453,433	4,501,876	410,116	235,553	300,000	383,655
2010	8,414,674	550,504	1,702,511	5,137,976	444,406	254,355	324,922	368,765
2011	9,525,736	553,162	1,996,708	5,860,749	485,805	275,550	353,762	357,342
2012	10,516,738	551,856	2,276,148	6,482,165	530,644	295,692	380,233	372,727
2013	12,088,562	583,246	2,813,584	7,349,829	603,813	322,968	415,122	419,006
2014	14,768,622	625,102	3,730,847	8,633,440	930,598	372,453	476,182	459,305
2015	17,936,962	763,254	4,977,494	10,025,547	1,181,655	434,367	554,645	583,680

Note: Calculated from SAIC Registration Database. Firms with shareholder information is identified by those reporting the largest shareholder. The largest shareholder has three status. The first status is unregistered unit, like government and administration at central and local level. The second status is individual. The last status is entrepreneurial investors. The firms of which the largest shareholder is individual(enterprise) can be separated to firms with single investor(who is largest shareholder by definition) and multiple investors. Some of individual largest shareholder don't report the citizenship ID which is identifier for us to track the entrepreneurial activity.

Firms for which the largest investor is not registered are classified as *Unregistered*. In most cases, the largest investor is an unincorporated enterprise, i.e. an enterprise that had not been formally incorporated as part of China's Corporate Law in 2004. These include collective enterprises and enterprises "owned by the whole people," i.e., effectively state-owned.

Firms for which an individual is the largest investor are classified as *Individual*. We further disaggregate the *Individual* firms into three groups: (i) Single, if there is only one investor, (ii) Multiple, if there are multiple investors, and (iii) firms for which there is no information on the ID of the individual largest shareholder. Firms for which an enterprise is the largest investor are classified as an *Enterprise*. These are also divided into two groups based on whether the enterprise is the only investor in the firm or not.

As Table 1 illustrates, China has experienced a significant rise in the number of firms operating in the economy − from around 3 million (columns (1) and (8)) in 1995 to 18.5 million in 2015. Most of this increase is driven by a dramatic increase in firms with individual investors: either single or multiple. Even though these *Individual* firms are smaller than the *Enterprise* and the *Unregistered* firms, based on their average registered capital as reported in Table 2, the rapid increase in their numbers makes them the main engine of growth in China over this period.

Table 2: Average Registered Capital, in Millions of Yuans, by Ownership Type, 1995-2015.

Year	Total	Unregistered	Individual		Enterprise	
			Single	Multiple	Single	Multiple
1995	7.65	8.77	0.87	2.41	9.66	24.35
1996	7.37	8.82	0.88	2.35	9.82	22.04
1997	7.14	8.93	0.92	2.31	10.24	20.70
1998	6.84	9.20	0.90	2.22	10.76	19.80
1999	6.87	10.12	0.91	2.16	12.20	19.52
2000	6.83	11.02	0.92	2.11	14.40	19.65
2001	6.74	12.09	0.87	2.10	16.47	20.53
2002	6.57	13.21	0.82	2.07	18.82	21.17
2003	6.66	14.97	0.82	2.03	25.15	22.26
2004	6.47	16.68	0.85	2.01	27.37	24.35
2005	6.31	18.54	0.86	2.02	28.87	25.38
2006	6.24	20.71	0.86	2.06	29.63	26.53
2007	6.63	25.69	0.89	2.17	31.23	28.67
2008	6.72	28.29	0.95	2.26	32.32	30.92
2009	6.70	30.32	1.00	2.34	33.96	33.14
2010	6.75	32.76	1.08	2.49	35.35	35.61
2011	6.85	34.77	1.16	2.71	36.90	39.01
2012	7.02	36.81	1.23	2.90	39.20	42.49
2013	7.04	38.63	1.23	3.04	40.73	45.80
2014	7.16	39.02	1.53	3.52	41.52	49.28
2015	7.56	35.76	1.98	4.21	42.65	53.69

Universe of firms in the analysis. The analysis in this paper is focused on firms for which the largest shareholder is an individual: either single or multiple, as classified in columns (3) and (4) in Table 1. The share of these firms, excluding the *Unreported* firms in column (8), increases from 22% of all firms in 1995 to 84% in 2015. By 2015, as reported in Appendix Table A-3 which excludes the *Unreported* firms, these firms held 38% of all the registered capital in the economy.

Since we have a "snapshot" of the Registry data at the end of 2015, the organization of the dataset implies that we cannot reconstruct the entire ownership history of each firm since its establishment. If we had access to earlier "snapshots" of the dataset, then that would be feasible. However, this is not a serious drawback for the analysis on our baseline sample of *Individual* firms, either single or multiple. For almost all *Individual* firms, either operating or out of business in 2015, the individual that currently owns the firm or owned it when it went out of business is also the individual that established it. We are able to infer this from the data since in those cases the year in which the firm was established is identical to the year in which the individual acquired the registered capital in the firm.

Entrepreneur. Based on the universe of firms in our analysis, an entrepreneur will be defined as an individual investor with the largest share in a firm at the time of the firm's establishment or acquired later.

2.4 Serial Entrepreneurs in the Business Registry of China

We now provide our definition of a serial entrepreneur, describe how we identify firms that belong to serial entrepreneurs, and discuss several preliminary findings regarding serial entrepreneur firms.

Serial entrepreneur. We define a serial entrepreneur as an investor that is or has been defined as the "Entrepreneur" for more than one firm. In other words, a serial entrepreneur is an individual that is the largest shareholder, not necessarily concurrently, in at least two firms.

Identifying a serial entrepreneur (SE) firm. We look at the whole 1995-2015 time period in order to identify an individual as a serial entrepreneur. Then, using each firm's establishment date, we classify each serial entrepreneurs' firms as first (1st-SE), second (2nd-SE), and so forth. All other firms are classified as firms belonging to individuals that are not serial entrepreneurs, or Non-SE firms.

SE firms over time. Table 3 highlights the fact that the role of SE firms has increased over time. First, as shown in column (2), the fraction of SE firms increased from 6% in 1995 to 28% in 2015. Second, as seen in column (4), the share of registered capital in SE firms increased from 10% in 1995 to 48% in 2015. Third, the average registered capital in SE firms is about two times larger than in Non-SE firms and has increased over time.

The expanding role over time of SE firms, in terms of their number, can be a product of differences in either entry or exit patterns, which are reported in Table 4.[5] A new firm is classified as an SE firm here only if the entrepreneur had previously started a firm. Thus, by definition, the first firm of a serial entrepreneur (1st-SE) will be grouped with the Non-SE group. Entry rates for both SE and Non-SE firms decrease over time, from nearly 50% in 1995 to 20% in 2013. Entry rates for SE firms, however, are consistently higher, contributing to the expansion of SE firms over time documented in Table 3. Exit rates for SE and Non-SE firms are fairly similar for both groups and rise up through 2007 before falling afterwards. In summary, the growing role of SE firms over time is due to their higher entry rates and larger registered capital.

Finally, we document that in the majority of cases new SE firms are started while the previously established SE firm is still operating. Column (1) in Table 5 lists firms, for each entrepreneur, based on the date of establishment. Column (2) in Table 5, reports only the newly established firms for which the previously established firm is still operating: e.g., 2nd-SE firm while the 1st-SE firm is still operating, or 3rd-SE firm while the 2nd-SE firm is still operating. Clearly, most of the new firms are run concurrently with the previously established firms: e.g., 82% of the serial entrepreneurs establish their second firm concurrently with their first firm.

[5]Because of a reform in the registry system, entry (exit) rates in 2014 and 2015 are not comparable with estimates for earlier years, and likely over (under) estimate true rates.

Table 3: Serial Entrepreneur Firms, 1995-2015.

Year	Number of firms	SE(%)	Total capital (in trill.)	SE(%)	Mean registered capital (in mill.)	
					SE	Non-SE
	(1)	(2)	(3)	(4)	(5)	(6)
1995	317,463	6.25	0.66	9.67	3.23	2.01
1996	436,641	6.73	0.90	11.47	3.52	1.95
1997	579,961	7.33	1.19	13.01	3.65	1.93
1998	788,437	8.39	1.56	15.22	3.60	1.83
1999	1,009,039	9.56	1.95	17.00	3.44	1.78
2000	1,296,778	10.99	2.46	19.68	3.40	1.71
2001	1,646,222	12.56	3.08	21.98	3.27	1.67
2002	2,068,609	14.20	3.78	24.42	3.15	1.61
2003	2,590,421	15.99	4.65	27.62	3.10	1.55
2004	3,199,843	17.40	5.69	29.98	3.06	1.51
2005	3,796,459	18.83	6.81	31.86	3.03	1.51
2006	4,388,783	19.94	7.92	33.84	3.06	1.49
2007	4,826,247	20.74	9.05	35.55	3.21	1.52
2008	5,283,998	21.38	10.28	36.81	3.35	1.56
2009	5,955,309	22.22	11.98	38.73	3.51	1.59
2010	6,840,487	23.27	14.66	41.00	3.78	1.65
2011	7,857,457	24.14	18.21	43.29	4.16	1.73
2012	8,758,313	24.84	21.60	44.41	4.41	1.82
2013	10,163,413	25.38	25.81	45.50	4.55	1.85
2014	12,364,287	26.66	36.12	46.60	5.11	2.13
2015	15,003,041	28.12	52.07	47.61	5.88	2.53

Note: Calculated from SAIC Registration Database. SE is short for Serial Entrepreneur, who has multiple largest shareholder experience by the end of a given year. Capital is calculated by the registered capital (considering both the initial registered capital and the subsequent change over time)

3 A Static Model of Entrepreneurship: TFP, Capital, Equity, and Debt

We now lay out a model of entrepreneurship. Before studying the decision to become a serial entrepreneur, we first analyze the decision to start a firm, i.e. to become an entrepreneur in a static setting. We will later (in Section 4) interpret this as the first period of a dynamic model, where we study serial entrepreneurship. Capital market frictions play a prominent role in China ((Hsieh and Klenow (2009); Song et al. (2011)), and in such an environment, both endowments (equity) and entrepreneurial ability matter for the decision to start a firm. The static model will allow us to derive theoretical predictions about the relationship between total factor productivity (TFP), assets, debt and equity.

Consider an economy populated by a fixed set of (potential) entrepreneurs who may choose to operate firms. Firms produce a homogenous good with decreasing returns to scale. The production function is Cobb-Douglas,

$$y_i = z_i^{1-\eta} \left(k_i^{1-\alpha} n_i^{\alpha} \right)^{\eta} , \tag{1}$$

where y_i is the firm's value added, k_i is the firm's capital stock, n_i is the firm's employment, z_i is

Table 4: Entry and Exit Dynamics of Firms, by Serial Entrepreneur Status.

Year	SE					Non-SE				
	Survival	New	Entry rate(%)	Exit	Exit rate(%)	Survival	New	Entry rate(%)	Exit	Exit rate(%)
1995	11,927	4,179	52.07	277	3.45	305,536	100,901	49.00	1,280	0.62
1996	17,218	5,749	48.20	458	3.84	419,423	117,661	38.51	3,774	1.24
1997	24,491	8,249	47.91	976	5.67	555,470	144,640	34.49	8,593	2.05
1998	37,988	14,587	59.56	1,090	4.45	750,449	211,858	38.14	16,879	3.04
1999	56,127	20,392	53.68	2,253	5.93	952,912	237,552	31.65	35,089	4.68
2000	83,364	30,601	54.52	3,364	5.99	1,213,414	306,305	32.14	45,803	4.81
2001	122,054	44,154	52.97	5,464	6.55	1,524,168	377,097	31.08	66,343	5.47
2002	175,840	62,024	50.82	8,238	6.75	1,892,769	456,490	29.95	87,889	5.77
2003	253,241	89,596	50.95	12,195	6.94	2,337,180	567,899	30.00	123,488	6.52
2004	346,332	110,354	43.58	17,263	6.82	2,853,511	667,987	28.58	151,656	6.49
2005	450,866	128,561	37.12	24,027	6.94	3,345,593	679,236	23.80	187,154	6.56
2006	559,919	141,525	31.39	32,472	7.20	3,828,864	713,019	21.31	229,748	6.87
2007	652,858	142,149	25.39	49,210	8.79	4,173,389	685,536	17.90	341,011	8.91
2008	747,330	147,141	22.54	52,669	8.07	4,536,668	698,927	16.75	335,648	8.04
2009	882,778	191,005	25.56	55,557	7.43	5,072,531	867,186	19.12	331,323	7.30
2010	1,067,319	243,724	27.61	59,183	6.70	5,773,168	1,038,829	20.48	338,192	6.67
2011	1,277,409	278,403	26.08	68,313	6.40	6,580,048	1,188,530	20.59	381,650	6.61
2012	1,473,304	280,765	21.98	84,870	6.64	7,285,009	1,159,783	17.63	454,822	6.91
2013	1,747,848	363,485	24.67	88,941	6.04	8,415,565	1,555,977	21.36	425,421	5.84
2014	2,219,313	543,016	31.07	71,551	4.09	10,144,974	2,067,448	24.57	338,039	4.02
2015	2,850,524	712,073	32.09	80,862	3.64	12,152,517	2,363,088	23.29	355,545	3.50

Note: Calculated by authors from SAIC Registration Database. Survival firms is the number of stock of firms at each year. Entry rate is the number of new established firms at each year divided by the number of stock of firms one year before.

Table 5: Firms Run Concurrently by Serial Entrepreneurs.

Type	Number of Firms (1)	Number of Firms of Entrepreneurs with Prior Firm Still Operating (2)	Concurrent Ratio (in %) (3)
Non-SE	14,160,389		
1st-SE	2,387,476		
2nd-SE	2,387,476	1,962,328	82.2
3rd-SE	610,251	568,620	93.2
4th-SE	208,171	201,330	96.7
5th-SE +	84,952	83,293	98.0
Total	19,838,715	19,363,436	85.6

Note: Calculated by authors from SAIC Registration Database for firms established in 1995-2015. Concurrently run firms are those that are established while the previous firm is still operating.

the firm's total factor productivity, $\eta \in (0,1)$, and $\alpha \in (0,1)$. There is a fixed cost ν for operating the firm.

Firms hire labor at a constant wage rate w. There exists a financial intermediary which takes deposits and offer loans. The financial contracts pay off at the end of the period. The intermediary offers a gross return R_s on savings deposits and charges a return R_b on lending to entrepreneurs.[6] There is a spread in interest rates between deposits and debt; $R_s < R_b$.[7] The borrowing-lending spread is the only friction in the model.

The entrepreneur starts with equity $e \geq 0$ and an opportunity to operate (or start) one firm with potential TFP z. The entrepreneur has two alternative investment opportunities for her equity. She can either invest capital k in the new firm or invest in deposits s or both. She can also borrow b to finance the capital inputs. The entrepreneur's budget constraint is $k = e + b - s$. It is convenient to use this budget constraint to substitute out deposits from the problem; $s = e + b - k$. Conditional on having chosen to operate, the firm's objective is given by

$$\begin{aligned} \Pi &= \max_{k,n,b} \{y - wn - R_b b + R_s (e + b - k)\} \\ & \quad \text{subject to} \\ b &\geq 0, \qquad s = e + b - k \geq 0. \end{aligned}$$

Note first that since $R_s < R_b$, it will never be optimal to have positive borrowing and deposits simultaneously. An entrepreneur who is a net borrower will therefore always invest all his/her equity in the firm. Moreover, for simplicity we abstract from depreciation on capital.

The problem can be separated into three different cases: (1) positive deposits; (2) positive debt; and (3) constrained, i.e., zero deposits and zero debt. Thus, an entrepreneur is either constrained, choosing $k = e$ and $n = \arg\max_n \left\{z^{1-\eta} \left(e^{1-\alpha} n^{\alpha}\right)^{\eta} - wn\right\}$, or unconstrained and choosing $(k, n) = \arg\max_{k,n} \{y - wn - R_i (k - e)\}$, where R_i is entrepreneur i's effective cost of capital, with $R_i = R_s$ for net depositors and $R_i = R_b$ for net borrowers. We summarize the optimal allocation in the following proposition.

Proposition 1. *Consider an entrepreneur with equity e and an option to operate one firm with TFP z. The entrepreneur will operate the firm if and only if TFP is sufficiently large, $z \geq z^* (e)$, where the entry threshold is given by*

$$z^* (e) = \begin{cases} z_b^* (e) & e \leq e_b^* \\ z_c^* (e) & \frac{e}{z} \in (k_b^*, k_s^*) \\ z_s^* & e \geq e_s^* = \frac{v}{1-\eta} \frac{(1-\alpha)\eta}{R_s} \end{cases}, \tag{2}$$

where

$$\begin{aligned} e_b^* &= \frac{\nu}{1-\eta} \frac{(1-\alpha)\eta}{R_b + (R_b - R_s) \frac{(1-\alpha)\eta}{1-\eta}} \\ e_s^* &= z_s^* k_s^* = \frac{v}{1-\eta} \frac{(1-\alpha)\eta}{R_s} \\ z_b^* (e) &= \frac{\nu - (R_b - R_s) e}{1-\eta} \left(\frac{R_b}{(1-\alpha)\eta}\right)^{\frac{(1-\alpha)\eta}{1-\eta}} \left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\eta}} \\ z_s^* &\equiv \frac{v}{1-\eta} \left(\frac{(1-\alpha)\eta}{R_s}\right)^{-\frac{(1-\alpha)\eta}{1-\eta}} \left(\frac{\alpha\eta}{w}\right)^{-\frac{\alpha\eta}{1-\eta}} \\ z_c^* (e) &= \left(\frac{\nu + R_s e}{1-\alpha\eta}\right)^{\frac{1-\alpha\eta}{1-\eta}} (e)^{-\frac{(1-\alpha)\eta}{1-\eta}} \left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\eta}}, \end{aligned}$$

[6] The economy can be interpreted as a small open economy insofar as the prices w, R_s, and R_b are taken as given.

[7] In the exposition of the model we abstract from output wedges. Introducing a common output wedge for all firms would not affect any of our theoretical results.

and where $k_b^* < k_s^*$ *and these constants are given by*

$$k_j^* \equiv \left(\frac{(1-\alpha)\,\eta}{R_j} \right)^{\frac{1-\alpha\eta}{1-\eta}} \left(\frac{\alpha\eta}{w} \right)^{\frac{\alpha\eta}{1-\eta}},$$

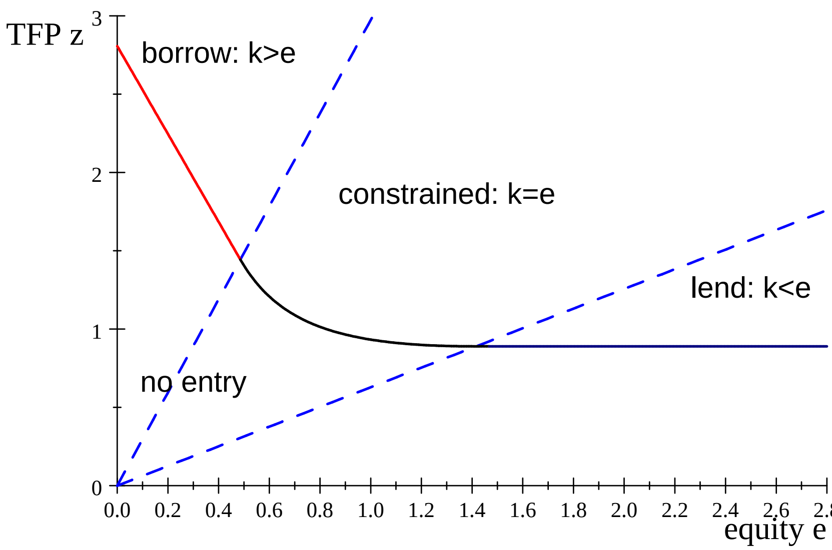
where $j \in \{b, s\}$. *Moreover, the optimal installed capital in the firm is given by the function* $k^*(z, e)$,

$$\frac{k^*(z,e)}{z} = \begin{cases} k_b^* & \frac{e}{z} \leq k_b^* \\ \frac{e}{z} & \frac{e}{z} \in (k_b^*, k_s^*) \\ k_s^* & \frac{e}{z} \geq k_s^* \end{cases} . \tag{3}$$

Proof. The proof is in the appendix. □

Figure 1 illustrates how the combination of e and z fall into four distinct regimes: no entry, unconstrained, constrained, and borrowing. The solid graph $z^*(e)$ marks the indifference between entry and no entry. The entrepreneur chooses to operate the firm if TFP is $z \geq z^*(e)$ and does not enter if z is below. Note that $z^*(e)$ is falling in e, especially for poor entrepreneurs who have low e. The reason is that the value of operating the firm is larger the more equity the entrepreneur has. Finally, when equity is sufficiently abundant, the threshold $z^*(e)$ is constant.

Figure 1: Entry Decision.



Notes: The figure shows the entry decision for an entrepreneur with equity e and the option to run a firm with TFP z.

Consider now the implied choices of debt and assets, given an allocation of e and z. Define the debt of a firm as assets minus equity, i.e. $d \equiv k - e$. It follows that the debt-equity ratio in the model is given by

$$\frac{d}{e} = \frac{k^*(z,e) - e}{e} = \begin{cases} \frac{k_b^*}{e} z - 1 & e \leq z k_b^* \\ 0 & e \in (z k_b^*, z k_s^*) \\ \frac{k_s^*}{e} z - 1 & e \geq z k_s^* \end{cases}$$

We conclude that the debt-equity ratio is monotone falling in equity and monotone increasing in TFP.

The following corollary summarizes the implications of Proposition 1.

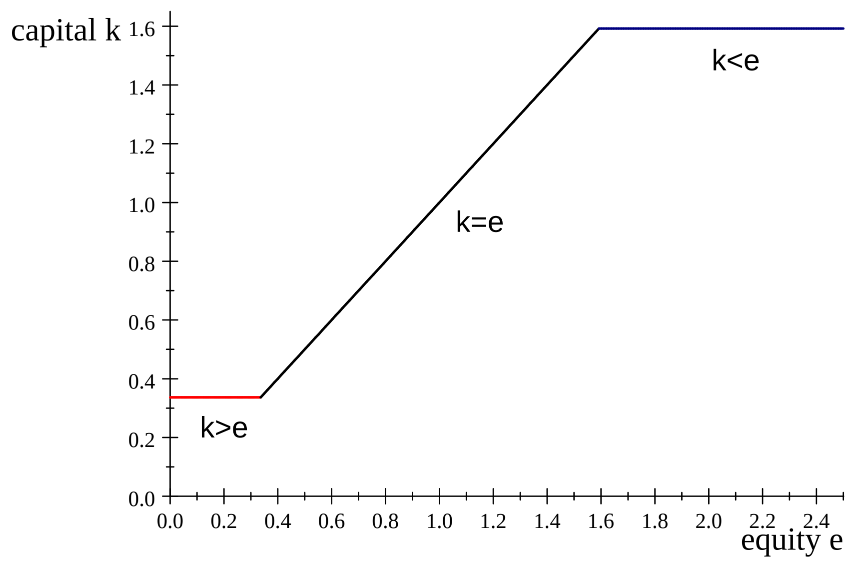
Corollary 1. *The allocations implied by equations (2)-(3) yield the following theoretical predictions about the empirical relationship between equity, capital, debt, and TFP of firms.*

1. *Conditional on TFP, capital is monotone increasing in equity. Moreover, capital per efficiency unit (k/z) is monotone increasing in equity per efficiency unit (e/z).*
2. *Capital is monotone increasing in TFP.*
3. *The debt-equity ratio is monotone increasing in TFP and monotone decreasing in equity. Moreover, when equity is larger, the debt-equity ratio increases less steeply in TFP.*

Proof: Implications 1 and 2 follow directly from equation (3). Consider now implication 3. Suppose first that $e < zk_b^*$. From equation (3) the debt is $d = zk_b^* - e$, implying that d/e is strictly increasing in z, conditional on e. Next, suppose that $e > zk_s^*$. The debt is then $d = zk_s^* - e$, implying that d/e is strictly increasing in z conditional on e. Finally, suppose that $e \in [zk_b^*, zk_s^*]$. In this case $k = e$, so debt is zero and, hence, non-decreasing in z. QED

Figure 2 illustrates Part 1 of Corollary 1, i.e., the choice of investments as a function of equity (holding TFP constant).

Figure 2: Installed Capital.



Notes: The figure shows the installed capital as a function of equity e for a given level of TFP z.

Finally it is useful to consider a special case of this model when capital markets are perfect, i.e., when there is no borrowing-lending spread ($R_s = R_b$). In this case, capital would be proportional to TFP and independent of equity. Moreover, if the economy was going through a process of improvements in financial markets that involved a narrowing of the borrowing-lending spread, one would expect to see a steeper association (higher correlation) between capital and TFP and a lower correlation between capital and equity over time.

4 The Model: Becoming a Serial Entrepreneur

We interpret the static model in the previous section as the first period in a two-period dynamic model. To simplify the problem, we assume that the entrepreneur consumes at the end of the second period, so all potential profits from the first period are saved for the second period. Having established the entrepreneurs' and firms' decisions in the first period, we now study the entrepreneurs' choice in the second period.

At the beginning of the period an entrepreneur has equity e and receives a stochastic draw z_2 for a potential new firm. In addition, those entrepreneurs who started and operated a firm in the first period may continue to do so in the second period. The productivity z_1 of the first firm is constant over time. An entrepreneur may choose to operate zero, one, or two firms in the second period. We assume that the entrepreneur can move capital and workers between firms at no cost and that the fixed cost ν has to be paid each period for each firm in operation. It follows that when the entrepreneur at the beginning of the second period has two potential firms available (one from each period), these firms are symmetric in the sense that the history is irrelevant – the only relevant aspect of each firm is their respective TFP.

The following proposition characterizes the optimal decisions for an entrepreneur who operated a firm in the first period with TFP z_1 and receives an option to start a new firm with TFP z_2. The proposition has two parts. The first part states conditions under which the entrepreneur chooses to become a SE. The second part concerns the decision to run two firms concurrently or to operate just the most productive firm.

Proposition 2. *Consider an entrepreneur with equity e who operated a firm in the first period with TFP z_1 and who has a draw of a potential firm in period 2 with TFP z_2.*

***Part A**: The entrepreneur will operate the 2nd-SE firm and become a SE if z_2 is sufficiently large. There exists a threshold function $Z : \mathbb{R}^2 \to \mathbb{R}$ such that the entrepreneur will operate the 2nd-SE firm if and only if $z_2 \geq Z(z_1, e)$. The threshold function Z, which is characterized in the appendix, is monotone decreasing in equity e and monotone increasing in TFP z_1. Moreover, Z satisfies $Z(z_1, e) \leq z_1$.*

***Part B**: Suppose e, z_1, and z_2 are sufficiently large so that $\min\{z_1, z_2\} \geq z^*(e/2)$. Then the entrepreneur will operate the two firms concurrently if z_1 is sufficiently close to z_2. Moreover, the number of concurrent firms is monotone decreasing in the absolute TFP difference $|z_2 - z_1|$. Conversely, if $\min\{z_1, z_2\} < z^*(e/2)$ then only one firm will operate. Conditional on TFP (z_1, z_2), the number of firms operated concurrently is monotone increasing in equity.*

We sketch the proof of Proposition 2 here, and in the appendix provide a complete proof of Proposition 2. The proof rests on three main steps, which we lay out now.

First, since it was optimal to operate the first firm (with TFP z_1) in the first period, it must also be better to operate this firm in the second period than not operating any firms.[8] Since the firms are symmetric, this implies that the most productive firm will always be operated. It follows that $z_2 > z_1$ is a sufficient condition for the second firms to be operated and for the entrepreneur to become a SE. This is why the threshold function satisfies $Z(z_1, e) \leq z_1$.

Second, if the new firm is less productive than the first firm ($z_2 \leq z_1$), the entrepreneur will either operate both firms concurrently – and be recorded as a serial entrepreneur – or continue operating only the first one – and be recorded as a non-serial entrepreneur. Note that even if $z_2 < z_1$ it might be optimal to start the second firm and become a SE, provided that it is optimal

[8] The reason is that the wages and interest rates are assumed to be constant over time. Moreover, the entrepreneur's equity e must be at least as large as what the entrepreneur had available in the beginning of the first period – otherwise it would not have been optimal to operate the firm in the first period.

to operate the two firms concurrently. Proposition 2 implies that if $z_2 < z_1$, then the entrepreneur will operate two firms concurrently and become a SE if z_2 is sufficiently large: $z_2 \in [Z(z_1, e), z_1]$. When equity is more abundant, the opportunity cost of equity is lower. Therefore, entrepreneurs with more equity are more likely to start the second firm. It follows that $Z(z_1, e)$ is monotone decreasing in e and that the number of firms operated concurrently is monotone increasing in e. In the proof of Proposition 2 we show that when the most productive firm has a TFP $z \in [z_s^*, z_b^*(0))$, there exists a threshold level of equity $\tilde{e}(z_1, z_2) \geq 0$ such that the entrepreneur will operate two firms concurrently if the entrepreneur has equity $e \geq \tilde{e}(z_1, z_2)$; one firm if $e < \tilde{e}(z_1, z_2)$ and $\max\{z_1, z_2\} \geq z^*(e)$; and zero firms if $\max\{z_1, z_2\} < z^*(e)$.[9]

Third, the TFP difference $|z_2 - z_1|$ between the firms matter. For a given amount of equity, the opportunity cost of operating the least productive firm is increasing in TFP of the most productive firm. Intuitively, if the TFP difference $|z_2 - z_1|$ is sufficiently large, it is optimal to allocate the entire endowment of the scarce factor to the most productive firm. Therefore, the threshold $Z(z_1, e)$ is monotone increasing in z_1 while the number of concurrent firms is monotone decreasing in the TFP difference $|z_2 - z_1|$. In other words, the larger the difference in TFP, the lower the chance that the entrepreneur will operate both firms concurrently. Note that if $z_1 = z_2$, equity would be divided equally between the firms if they were to operate concurrently. In this case, both firms would operate if and only if $z_2 \geq z^*(e/2)$.

Proposition 2 has implications for how serial entrepreneurs differ from non-serial entrepreneurs. To obtain sharp predictions for how SE firms differ from each other and from non-serial firms (Non-SE), it is necessary to make assumptions about the correlation of the TFP draws of the firms and the initial wealth of the entrepreneur.

Assumption 1. *Assume that initial equity in the first period has a non-negative correlation with the initial TFP draw,* $corr(e_0, z) \geq 0$.

Assumption 2. *Assume that the TFP of potential firms drawn in the first and second period are related via an AR(1) process,*

$$z_{i2} = \rho z_{i1} + \varepsilon_i, \tag{4}$$

where $\rho \in [0, 1]$ *captures the autocorrelation of TFP and the random component* ε_i *is drawn from a symmetric distribution with* $E(\varepsilon) = 0$ *and c.d.f.* F_ε.

Recall that profits after the first period are increasing in TFP of the 1st-SE firm. Therefore, equity e in the beginning of the 2nd period will be larger than initial equity the larger is the TFP of the 1st-SE firm. Assumption 1 then implies that the correlation between equity e and the initial TFP draw z will be larger than the correlation with the initial equity e_0, $corr(e, z) > corr(e_0, z) \geq 0$. From Part B of Proposition 2, the probability that the 2nd-SE firm will operate (and the entrepreneur will be a SE) is increasing in the entrepreneur's e in the beginning of the second period. Both these forces imply that entrepreneurs who operate firms in the first period are positively selected. Namely, the higher the TFP in the first period the larger is the probability of becoming a SE. This argument holds true even with $\rho = 0$. For $\rho > 0$, the positive selection is stronger.[10]

We state these predictions as a proposition (see the appendix for the formal proof).

[9]Note that the assumptions that at least one firm has TFP $z \geq z_s^*$ and equity is sufficiently abundant guarantee that at least one firm will operate. Conversely, if both draws for potential firms had TFP $z < z_s^*$, then it would not be optimal to operate any firms, regardless of e.

[10]We sketch the proof of this positive-selection claim here. See the proof of Proposition 3 for a complete statement. The proof relies on showing that adding the condition that TFP in the second period is sufficiently large, $z_{i2} \geq b$ for some b which is monotone decreasing in z_{i1}, changes the probability density function of z_{i1} conditional on operating in the first period ($z_{i1} \geq z^*(e_0)$) by multiplying the probability density function of z_{i1} by a weight that is increasing

Proposition 3. *Suppose Assumption 1 holds. Then the TFP in the first firm of the serial entrepreneur is larger on average than the TFP in non-serial firms started at the same time. Moreover, the initial capital of the 1st-SE firm is larger on average than the initial capital in Non-SE firms.*

The parameter regulating the persistence of TFP draws, ρ, plays an important role for the observed TFP of the 2nd-SE firm. First, when ρ is sufficiently large, the 2nd-SE firm will on average have a larger TFP than the 1st-SE firm. To see this, consider the extreme case when $\rho = 1$, which implies that $E\{z_2\} = z_1$. This is due to our maintained assumption that the distribution of TFP draws for new firms is symmetric. This implies that there is positive selection for the 2nd-SE firm because the entrepreneur would choose to operate it only if the realization of ε were sufficiently large. For example, the firm would not be operated if $z_2 = z_1 + \varepsilon < z_s^*$. It follows that conditional on the 2nd-SE firm operating (and $\rho = 1$), the expected TFP is larger than the TFP for the 1st-SE firm, i.e., $E\{z_2|\text{ 2nd-SE firm operates}\} > z_1$. Second, when ρ is sufficiently low, the 2nd-SE firm will on average have a lower TFP than the 1st-SE firm. To see this, consider the extreme case when the TFP draws are independent (i.e., $\rho = 0$). Since the threshold function $z^*(e)$ is monotone decreasing, the threshold for operation of the 2nd-SE firm is lower the larger is e. Thus, there will be negative selection on TFP for entrepreneurs with large e. Since equity e in the second period is increasing in TFP of the 1st-SE firm, it follows that when $\rho = 0$, the average TFP of 2nd-SE firms will be lower than the average TFP of 1st-SE and Non-SE firms (see a formal proof in the appendix).

We summarize this in the following prediction,

Proposition 4. *Suppose Assumption 2 holds. Then there exists a threshold $\bar{\rho} \in (0, 1)$ such that if $\rho > \bar{\rho}$, then the TFP of the 2nd-SE firm is larger on average than the TFP of non-SE firms and TFP of the 1st-SE firm. Conversely, if $\rho < \bar{\rho}$ then the second SE firm has a lower average TFP than the non-serial firm.*

Proof. As argued in the text, when $\rho = 0$ and the TFP distribution is stationary, then the average TFP of the second SE is lower than the average TFP for Non-SE. Moreover, when $\rho \to 1$, average TFP of the second SE is larger than the average TFP for the first SE and, from Proposition 3, also larger than the TFP for the Non-SE. The existence of the threshold $\bar{\rho} \in (0, 1)$ follows from the fact that the expected TFP of the second SE is continuous and monotone increasing in ρ. □

Our theory has implications for how SE firms that are run concurrently differ from SE firms that are non-concurrent. Consider first the TFP of the 1st- and 2nd-SE firms. Part B of Proposition 2 states that conditional on e and the TFP of the 1st-SE firm, the probability that the firms will operate concurrently is falling in the TFP of the 2nd-SE firm. In other words, the more productive is the 2nd-SE firm, the larger is the chance that the 1st-SE firm will cease operation. Conversely, conditional on e and the TFP of the 2nd-SE firm, the more productive is the 1st-SE firm, the larger is the chance that the firms will be run concurrently.[11] This leads to our predictions about concurrent versus non-concurrent serial entrepreneurs, which we state in the following proposition.

in z_{i1}. The fact that equity in the second period is also increasing in z_{i1} implies that the threshold for operation is falling in z_{i1}. The new probability density function of z_{i1} conditional on z_{i2} being sufficiently large therefore first order dominates the probability density function without the condition on z_{i2}. This in turn implies a higher expected value for z_{i1}. Finally, note from Proposition 1 that the installed capital in the first SE firm is monotone increasing in TFP.

[11] Note also that if the TFP of the 1st-SE firm is sufficiently higher than the TFP draw of the potential 2nd-SE firm, the entrepreneur would not start the 2nd-SE firm and she would be recorded as a non-serial entrepreneur.

Proposition 5. *TFP of 2nd-SE is lower for concurrently run SE firms than of 2nd-SE for non-concurrently run SE firms. Conversely, TFP of the 1st-SE firm is larger for concurrently run SE firms than of 1st-SE for non-concurrently run SE firms.*

The predictions of Proposition 5 are driven by a combination of two assumptions: decreasing return to scale and the presence of a scarce factor – capital in our model.[12] Intuitively, it is optimal to share this factor across concurrently run firms if they have relatively similar productivity, and to allocate all of it to the most productive firm if the difference in productivity is large.

5 Empirical Evidence from the Inspection Data

We now turn to the Inspection Data for the period 2008-2012 and show that the key theoretical predictions of the model developed in Sections 3-4 are consistent with the empirical facts in China.

5.1 Theoretical Predictions Summarized

It is convenient to summarize the theoretical predictions of our model. Proposition 1 and Corollary 1 in Section 3 has predictions regarding debt, equity, TFP, and capital for each individual firm. Namely, conditional on equity in a firm, the more productive firms should have more capital and, hence, more debt. We label these predictions as follows,

- *Theoretical Prediction A*: Assets are increasing in TFP, conditional on equity.
- *Theoretical Prediction B*: Assets are increasing in equity, conditional on TFP.
- *Theoretical Prediction C*: Debt-equity ratio is increasing in TFP and decreasing in equity. The larger equity, the smaller the increase in the debt-equity ratio with TFP.

Propositions 3 and 4 in Section 4 contain the main results on how the firms of serial entrepreneurs differ from non-serial firms, which we summarize as follows,

- *Theoretical Prediction D*: Capital and TFP of 1st-SE firms are larger than capital and TFP of Non-SE firms.
- *Theoretical Prediction E*: If ρ is sufficiently large, then capital and TFP of 2nd-SE firms are larger than capital and TFP of 1st-SE firms.

Proposition 5 contains the main results on how concurrently run firms of serial entrepreneurs differ from their non-concurrently run firms. This can be summarized in:

- *Theoretical Prediction F*: TFP of 1st-SE (2nd-SE) firms is higher (lower) for concurrently run 1st-SE (2nd-SE) firms than those run non-concurrently.

5.2 Measuring Firm TFP

Before testing the theoretical predictions, we outline how me measure (relative) TFP.

The Inspection Data do not have all the information required to compute a firm's level of TFP directly. However, we can use data on capital and value added to calculate a firm's TFP *relative*

[12] Note that Proposition 5 does not require Assumptions 1 and 2.

to the average TFP in a group of firms that face the same wage rate w.[13] We focus on firms within a province-industry-year cell, and assume implicitly that all firms in a province-industry cell in a particular year pay the same wage rate w. The other variables are also computed relative to that variable's average of all firms in a province-industry-year cell.

Using the first-order condition for labor, equation (A-1), to derive an expression for a firm's labor demand n and substituting this into the production function (1) yields

$$y_i = z_i^{1-\eta} k_i^{(1-\alpha)\eta} \left(\frac{\alpha\eta}{w} y_i\right)^{\alpha\eta}.$$

This provides an expression for TFP as a function of capital, value added, and the wage rate,

$$z_i = y_i^{\frac{1-\alpha\eta}{1-\eta}} \left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\eta}} k_i^{-\frac{(1-\alpha)\eta}{1-\eta}}.$$

The average TFP $\bar{z}$ in a province-industry-year cell is then

$$\bar{z} = \sum_i \omega_i y_i^{\frac{1-\alpha\eta}{1-\eta}} \left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\eta}} k_i^{-\frac{(1-\alpha)\eta}{1-\eta}},$$

where ω_i is the relative weight in value added of each observation i. Then, the TFP of firm i relative to the average TFP $\bar{z}$ in a particular province-industry-year cell is:

$$\frac{z_i}{\bar{z}} = \frac{y_i^{\frac{1-\alpha\eta}{1-\eta}} k_i^{-\frac{(1-\alpha)\eta}{1-\eta}}}{\sum_i \omega_i y_i^{\frac{1-\alpha\eta}{1-\eta}} k_i^{-\frac{(1-\alpha)\eta}{1-\eta}}}. \tag{5}$$

This ratio can be computed using available data on firm i's value added y_i and capital k_i.

5.3 Correlation of Assets and Debt-Equity Ratios with TFP

We start with the predictions regarding debt, equity, TFP, and capital for each individual firm.

Figures 3 and 4 and Table 6 show that the Theoretical Predictions *A*-*B*-*C* are consistent with the data. The figures are constructed by first dividing the sample into four quartiles of equity (with the first quartile containing the 25% of firms with the lowest equity, etc.) Then the firms in each quartile are again sorted based on their TFP into twenty quantiles. For each such ventile we then calculate average TFP, assets, and debt-equity ratio and present these in scatter plots in Figures 3-4.

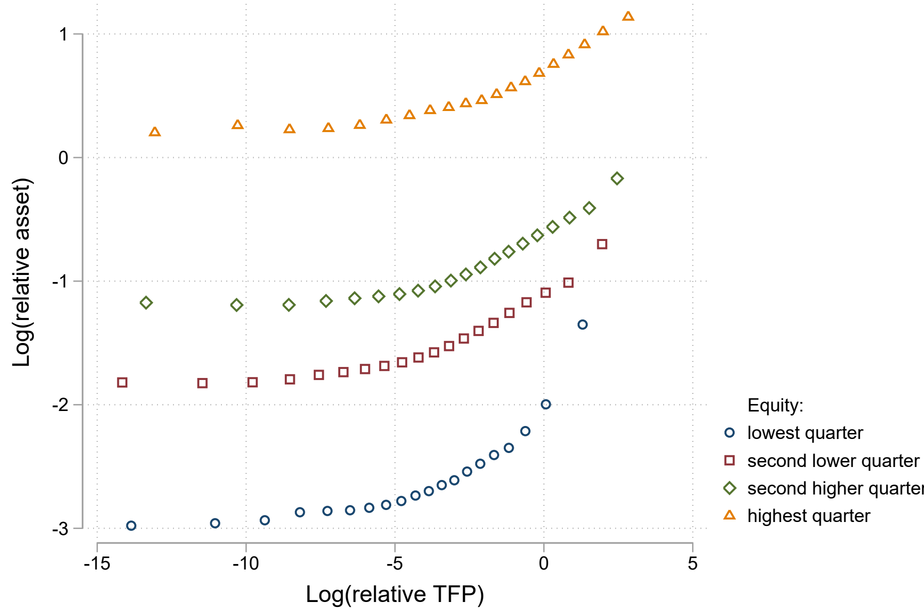
Figure 3 and column (1) in Table 6 document the relationship between firms' assets and TFP. Not surprisingly, firms with higher TFP have more assets and are thus larger. This is consistent with Theoretical Prediction *A* above. However, the increase is much more pronounced for firms with TFP above the median than for firms below the median.

Figure 3 also shows that as we move from lower to higher equity quarters the entire profile of assets shifts upwards. This is in line with Theoretical Prediction *B*.

Figure 4 and column (2) in Table 6 document the relationship between firms' debt-equity ratio and TFP. The debt-equity profile is increasing with TFP within each quartile of equity. Moreover, as we move from lower to higher equity quartiles, the entire debt-equity profile shifts downward and the slope with respect to TFP becomes flatter. These findings are consistent with Theoretical Prediction *C*.

[13] This calculation of TFP is robust to the introduction of an output wedge, as long as all firms in the group have the same wedge.

Figure 3: Capital and Relative TFP, Inspection Data, 2008-2012.



Notes: The figure shows the relationship between assets and TFP. Firms are sorted into four quartiles according to their equity. For each equity quartile, firms are ranked on TFP and sorted into twenty quantiles. Each point in the figure plots average TFP and average assets for firms in the quantile. All variables are computed relative to their averages of all firms in the same province-industry-year cell.

5.4 Financial Performance of Non-SE and SE Firms

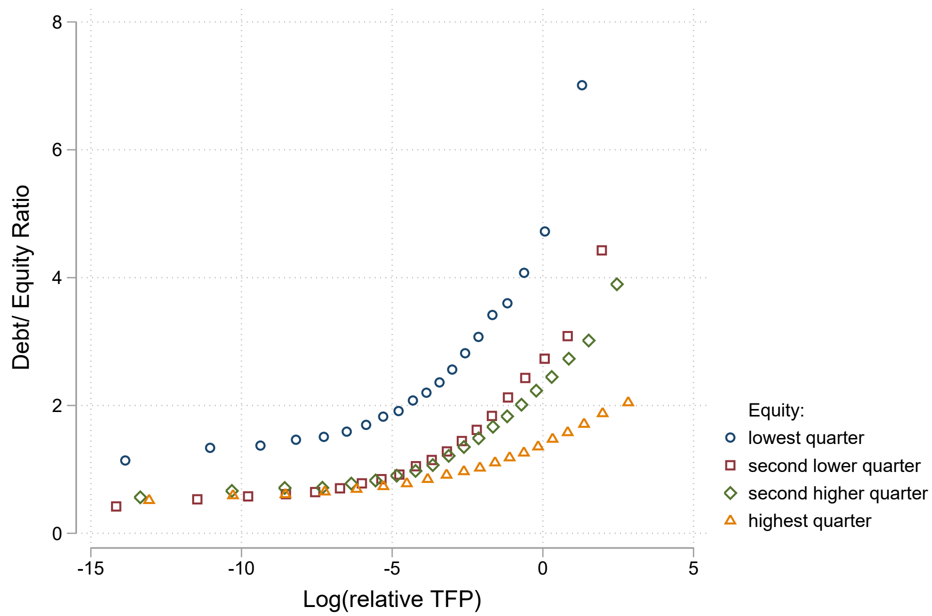
Serial entrepreneurs versus non-serial entrepreneurs. We now study the predictions for how serial and non-serial entrepreneurs differ from each other. The 2008-2012 Inspection Data provide empirical support for the Theoretical Predictions *D*-*E*. Table 7 shows that there are indeed systematic differences between Non-SE, 1st-SE, and 2nd-SE firms. Two main facts stand out. First, 1st-SE firms have higher registered capital, assets, equity, revenue, and TFP than Non-SE firms. This is in line with Theoretical Prediction *D*. Second, 2nd-SE firms have higher registered capital, assets, equity, revenue, and TFP than 1st-SE firms. This is consistent with Theoretical Prediction *E* provided that ρ is sufficiently large.[14]

Concurrent and non-concurrent SE firms. Consider now the decision to operate SE firms concurrently or non-concurrently. A large fraction of the 2nd-SE firms, 82%, are ran concurrently with the 1st-SE firm, while in 18% of the cases the 1st-SE firm is closed when operating the 2nd-SE firm.

In Table 8 we consider TFP and equity of 1st-SE and 2nd-SE firms, depending on whether they are run concurrently or not. The table shows that SE firms that are operated concurrently differ systematically from SE firms that are operated non-concurrently. On the one hand, columns (1) and (2) in Table 8 show that 1st-SE firms that are closed down when the 2nd-SE firm is started have a 9% lower TFP and 5% lower equity than those 1st-SE firms that are run concurrently with the

[14]In Table 12 below we show that the TFPs of the 1st and 2nd-SE firms of a serial entrepreneur are indeed positively correlated.

Figure 4: Debt-Equity Ratio and Relative TFP, Inspection Data, 2008-2012.



Notes: The figure shows the relationship between the debt-equity ratios and TFP. Firms are sorted into four quartiles according to their equity. For each equity quartile, firms are ranked on TFP and sorted into twenty quantiles. Each point in the figure plots average TFP and average debt over average equity for firms in the quantile. All variables are computed relative to their averages of all firms in the same province-industry-year cell.

2nd-SE firm. On the other hand, Columns (3) and (4) show that 2nd-SE firms that are currently operated by entrepreneurs who have closed down their first firm (1st-SE) have an 11% higher TFP and 13% lower equity than those 2nd-SE firms that are run concurrently with the 1st-SE firm. These patterns are consistent with Theoretical Prediction F of the model.

This result indicates that the TFP draws for 1st-SE and 2nd-SE firms, together with the equity endowments of these entrepreneurs, are forces that determine whether a serial entrepreneur starts subsequent firms and when the initial firm is closed down. This conclusion is consistent with evidence Feliz et al. (2021) document for Portugal.

5.5 Auxiliary Predictions of the Model

We close this section by considering two auxiliary predictions of the model.

Capital intensity across firms owned by the same SE. Consider entrepreneurs who are running concurrent firms. The key mechanism of the model is that the entrepreneur uses revenue from the first firm to fund the second firm. Absent capital adjustment costs, the SE should equalize the marginal product of capital (MPK) across firms, implying that

$$\tilde{R}_1 = \tilde{R}_2 \quad (6)$$

$$(1-\alpha)\,\eta\frac{y_i}{k_i} = (1-\alpha)\,\eta\frac{y_i}{k_i} \quad (7)$$

The theoretical prediction of equation (7) is that if the firms are in the same industry, or if the industry capital intensity $(1-\alpha)\,\eta$ is similar for the SE firms when they are in different industries,

Table 6: Debt-Equity Ratio, Capital, and Relative TFP, Conditional on Equity, Inspection Data, 2008-2012.

	Log Assets	Debt-Equity Ratio
	(1)	(2)
Log TFP	0.08***	0.30***
2nd quarter of equity	0.98***	-1.71***
3rd quarter of equity	1.50***	-1.94***
4th quarter of equity	2.84***	-2.87***
TFP*2nd quarter of equity	-0.02***	-0.10***
TFP*3rd quarter of equity	-0.02***	-0.12***
TFP*4th quarter of equity	-0.03***	-0.22***
Age	0.05***	0.15***
Age squared	-0.00***	-0.00***
Observations	10,647,773	10,647,773
Adjusted R-squared	0.64	0.05

Notes: The table shows the relationship between assets and the debt-equity ratio and TFP. The results are computed for different quartiles in the equity distribution. All variables, except age, are computed relative to their averages of all firms in the same province-industry-year cell. *** − statistically significant at the 1% level.

Table 7: Financial Performance of Firms, Inspection Data, 2008-2012.

	Log Registered Capital	Log Assets	Log Equity	Log Revenue	Log Relative TFP
	(1)	(2)	(3)	(4)	(5)
1st-SE	0.27***	0.40***	0.35***	0.34***	0.20***
2nd-SE	0.50***	0.64***	0.55***	0.54***	0.30***
Age	0.08***	0.16***	0.12***	0.22***	0.31***
Age squared	-0.00***	-0.00***	-0.00***	-0.01***	-0.01***
Observations	10,607,113	10,647,773	10,647,773	10,647,773	10,647,773
R-square	0.05	0.11	0.08	0.08	0.03

Notes: The table compares the financial performance of 1st-SE and 2nd-SE firms, relative to Non-SE firms. All variables, except age, are computed relative to their averages of all firms in the same province-industry-year cell. *** − statistically significant at the 1% level.

Table 8: Financial Performance of Firms, Concurrent vs Non-concurrent SE Firms, Inspection Data, 2008-2012.

	1st-SE		2nd-SE	
	Log TFP	Log Equity	Log TFP	Log Equity
	(1)	(2)	(3)	(4)
Non-concurrent	-0.09***	-0.05***	0.11***	-0.13***
Age	0.27***	0.14***	0.46***	0.16***
Age squared	-0.01***	-0.00***	-0.02***	-0.01***
Observations	1,849,074	1,849,074	1,532,123	1,532,123
Adjusted R-squared	0.02	0.08	0.02	0.05

Notes: The table compares the TFP and equity of 1st-SE (2nd-SE) firms that are run non-concurrently, relative to 1st-SE (2nd-SE) firms that are run concurrently. TFP and equity are computed relative to their averages of all firms in the same province-industry-year cell. *** − statistically significant at the 1% level.

then the capital-output ratios should be equalized across firms:

$$\frac{y_1}{k_1} = \frac{y_2}{k_2}.$$

In this case the correlation $corr\left(\ln \frac{y_1}{k_1}, \ln \frac{y_2}{k_2}\right)$ should be high.

We evaluate this prediction in four ways. We first restrict attention to serial entrepreneurs who operate two firms concurrently in the same 3-digit industry. The correlation in capital productivity (i.e., value added per unit of capital) across firms owned by the same entrepreneur is 0.23. Next, widening the sample to entrepreneurs who operate two firms concurrently in similar industries, i.e., same 1-digit, but different 3-digit industries, the correlation falls slightly to 0.15. Third, when considering entrepreneurs with concurrent firms in industries with similar capital intensities, the correlation is 0.18. Here, we define sectors as having similar intensity if log of the capital intensity of the sector of the 2nd-SE firm is no more than five percent higher or lower than that of the 1st-SE firm, where we take the capital intensities from Hsieh and Klenow (2009). Finally, we expand the sample to include all concurrently run firms and allow the capital intensities to differ across sectors. Equation (7) then implies that we should evaluate the correlation $corr\left(\ln(1-\alpha_1)\frac{y_1}{k_1}, \ln(1-\alpha_2)\frac{y_2}{k_2}\right)$, which is 0.18 in our data. All these correlations are significantly different from zero at a 1% level of significance. By contrast, the correlation is zero for any two randomly drawn firms.

We conclude that this behavior is consistent with serial entrepreneurs pooling capital across firms.

Increasing role of SE over time. Over time, the share of SE firms will increase. This is driven by two forces:

1. More entrepreneurs will have had time to start a second firm (given that no potential entrepreneurs had an existing firm when entering period 1).
2. Existing entrepreneurs accumulate more equity over time. This increases the probability they will start firms.

Both forces contribute to increasing the share of firms operated by serial entrepreneurs over time. Table 3 documented the increased importance of SE firms over the 1995-2015 period.

6 Sectoral and Geographical Migration Patterns for Serial Entrepreneurs

The analysis so far has highlighted the importance of equity, individual ability, firm productivity shocks, and financial frictions for understanding individual's decisions to become an entrepreneur and then a serial entrepreneur. In this section we focus on additional dimensions of the decisions of serial entrepreneurs relating to sectoral and geographical choices of 2nd-SE firms. As we shall see, factors such as sectoral learning, upstream-downstream sectoral linkages and input-output complementarities, and diversification of risk play a significant role in determining the sector of the 2nd-SE firm.

6.1 Preliminary Facts

We start by documenting the distribution of serial and non-serial firms across sectors and the sectoral and geographical location choices (migration patterns) for the second firm.

Industrial distribution of entrants. Table 9 reports – separately for Non-SE, 1st-SE, and 2nd-SE firms – the distribution across industries for new entrants in 2005 and 2010. We report two measures of the distribution of entrants: unconditional and conditional. Overall, the unconditional distribution across sectors is similar among these types of firms. The unconditional share measures the actual distribution of new entrants. A large fraction of them, more than 30%, go into Wholesale and Retail Trade, around 20% go into Manufacturing, and around 10% go into Enterprise and Business Service. In order to control for the underlying distribution of firms across sectors, we compute a conditional share that measures the distribution of entrants relative to the distribution of all firms across industries in the previous year. A measure above (below) one means that firms are more (less) likely to enter that sector relative to the existing sectoral distribution of firms. The main message then is that firms of serial entrepreneur, both 1st-SE and 2nd-SE, are more likely than the Non-SE firms to enter Finance, Real Estate, Enterprise and Business Service, and R&D, sectors that represent 20% of all firms.

Geographical and sectoral location for 2nd-SE firms. Consider now the geographical and sectoral location of the 2nd-SE firm and any differences with the 1st-SE firm. As reported in Table 10, we find that serial entrepreneurs usually establish their second firm in the same prefecture as their first firm: 72.5% of the serial entrepreneurs remain in the same prefecture where they established their first firm, 9.5% establish their second firm in the same province, but a different prefecture, and 17.9% establish their second firm in a different province. However, the 2nd-SE firm is more likely to be in a different 3-digit sector than the 1st-SE firm: only 15.6% of the 2nd-SE firms are established in the same 3-digit industry as the 1st-SE firm. Around 25% of the 2nd-SE firms are started in an industry similar (i.e., the same 1-digit code, but a different 3-digit code) to the one of the 1st-SE firm while around 60% of the 2nd-SE firms are started in an industry that is distant (i.e., different 1-digit code) to the one of the 1st-SE firm.

In Table 11 we separate serial entrepreneurs into local – those that establish their 1st-SE firm in the prefecture in which they were born – and non-local. While the main patterns documented in Table 10 are robust, we find that local serial entrepreneurs are more likely than non-local ones

Table 9: Share of Entrants in Different Industries, Non-SE and SE Firms, 2005 and 2010.

	2005						2010					
Industry	Unconditional share			Conditional share			Unconditional share			Conditional share		
	Non-SE	1st-SE	2nd-SE	Non-SE	1st-SE	2nd-SE	Non-SE	1st-SE	2nd-SE	Non-SE	1st-SE	2nd-SE
Agriculture	2.32	2.09	2.05	1.31	1.18	1.16	3.35	2.62	2.54	1.42	1.11	1.08
Mining	0.77	0.94	0.99	1.08	1.31	1.38	0.33	0.43	0.54	0.48	0.63	0.78
Manufacturing	23.04	20.88	22.83	0.77	0.70	0.76	18.49	15.86	18.41	0.73	0.63	0.73
Power	0.41	0.36	0.54	0.84	0.74	1.10	0.18	0.18	0.33	0.39	0.40	0.73
Construction	5.48	5.46	4.87	1.17	1.16	1.04	5.86	5.48	4.86	1.12	1.05	0.93
Wholesale and Retail	34.40	34.05	31.33	1.00	0.98	0.91	39.16	38.23	34.45	1.15	1.12	1.01
Transportation	3.07	3.18	2.93	1.43	1.49	1.37	2.70	2.62	2.32	1.02	0.99	0.87
Accommodation	1.43	1.49	2.17	0.89	0.92	1.34	1.11	1.23	1.67	0.77	0.85	1.16
IT	3.79	3.62	3.17	1.17	1.12	0.98	3.35	3.38	2.89	0.94	0.95	0.81
Finance	0.19	0.27	0.41	0.94	1.32	2.02	0.30	0.54	0.95	1.00	1.79	3.13
Real Estate	2.26	3.08	4.17	0.82	1.13	1.52	3.00	4.21	5.80	0.97	1.37	1.88
Enterprise & Business Service	10.70	12.14	12.24	1.38	1.57	1.58	11.01	13.42	13.60	1.13	1.38	1.40
R&D	6.18	6.90	6.90	1.20	1.34	1.34	6.38	7.32	7.51	1.07	1.23	1.26
Public Facility	0.46	0.46	0.52	0.89	0.89	1.00	0.36	0.38	0.45	0.79	0.82	0.97
Resident service	3.41	2.99	2.73	1.17	1.03	0.94	2.82	2.42	1.97	0.97	0.83	0.68
Education	0.18	0.20	0.17	1.43	1.60	1.34	0.11	0.13	0.11	0.84	0.97	0.84
Social Work	0.17	0.19	0.24	1.46	1.69	2.10	0.08	0.08	0.11	0.62	0.59	0.83
Entertainment	1.64	1.62	1.66	1.36	1.34	1.37	1.38	1.45	1.48	0.94	0.98	1.00
Public administration	0.07	0.08	0.06	0.86	0.96	0.81	0.01	0.00	0.00	0.31	0.19	0.19
NGO	0.02	0.02	0.03	0.31	0.30	0.35	0.00	0.00	0.00	0.08	0.03	0.02

Note: Calculated by author from SAIC Registration Database. Unconditional share of each sector at a given year of a particular SE group is the number of new established firms of a given SE group of a sector divided by the total new established firms of a given SE group. Conditional share of each sector is the ratio of unconditional share divided by the fraction of a given sector in the stock of firms one year before.

to start their 2nd-SE firm in the same prefecture (82.0% vs 60.8%). On the other hand, local and non-local serial entrepreneurs are equally likely to start their 2nd-SE firm in a similar or distant 3-digit industry.

Table 10: Geographical and Sectoral Location.

3-digit Industry	Same	Similar	Distant	Same (%)	Similar (%)	Distant (%)	Total (%)
Same Prefecture	406,346	598,545	1,402,772	12.24	18.03	42.27	72.54
Same Province	41,473	76,892	198,855	1.25	2.32	5.99	9.56
Different Province	68,137	145,567	380,331	2.05	4.39	11.46	17.90
Total				15.55	24.74	59.72	100.0

Notes: Industries are similar if they have the same 1-digit, but different 3-digit, codes. Industries are distant if they have a different 1-digit code.

6.2 Theory: Determinants of Sectoral Choices

So far, we have analyzed entrepreneur behavior in a one-sector model. This section extends the model to one of multiple sectors. We focus exclusively on entrepreneurs who have operated a firm in the first period, and study their sectoral choice for the second firm. Namely, what determines the sector in which the serial entrepreneur starts firms (2nd-SE) after having started the first firm

Table 11: Geographical and Sectoral Location, by Local and Non-local SEs.

First firm in birth place	Total	3-digit Industry	Same (%)	Similar (%)	Distant (%)	Total (%)
No	1,446,970	Same Prefecture	11.24	14.69	34.86	60.78
		Same Province	1.74	3.13	7.77	12.64
		Different Province	3.21	6.67	16.70	26.58
		Total(%)	16.19	24.49	59.32	
Yes	1,809,682	Same Prefecture	13.05	20.64	48.30	82.00
		Same Province	0.85	1.64	4.52	7.00
		Different Province	1.14	2.57	7.30	11.00
		Total(%)	15.04	24.85	60.12	

Notes: Industries are similar if they have the same 1-digit, but different 3-digit, codes. Industries are distant if they have a different 1-digit code.

(1st-SE)? Moreover, how do serial entrepreneurs who switch sector differ from those who stay in the sector of the first firm?

We analyze three mechanisms for sectoral choice: (i) selection through learning about entrepreneurial abilities; (ii) considerations of diversification of risk; and (iii) upstream-downstream sectoral linkages and input-output complementarities.

6.2.1 Learning Sector-Specific Abilities

We now assume that there several sectors $s \in S = \{1, 2, ..., N\}$ producing the same homogeneous good. A firm established in a particular sector must remain in that sector. Following Jovanovic (1979), an entrepreneur has different abilities in each sector, which are ex-ante unknown. After operating the first firm (1st-SE) in a sector s, the entrepreneur is free to choose to obtain the draw for a potential new firm in any sector $s' \in S$.

Given an initial sector s, there are three types of sectors for the second firm: the same sector (s), similar sectors (denoted S^+), and distant sectors (denoted S^-). These sectors are mutually exclusive. We focus on a mechanism where the persistence of TFP across firms is lower the further away one moves from the sector of the first firm.

The key assumption is that productivity of a second firm in sector s' depends on the sector s of the first firm and the productivity of the first firm, z_{1s}. If the entrepreneur chooses to make a TFP draw in the same sector s as the first firm, the TFP process will be the same as in equation (4), i.e., $z_{2s} = \rho z_{1s} + \varepsilon$, where $\rho > 0$. If the entrepreneur chooses to make a TFP draw in a sector similar to the sector s of the first firm, the TFP for the 2nd-SE firm $s^+ \in S^+$ will follow the process $z_{2s^+} = \rho^+ \cdot z_{1s} + \bar{z} + \varepsilon$, where the persistence ρ^+ is assumed to be lower than for the same sector ($\rho^+ < \rho$). Moreover, when operating in a similar sector, the entrepreneur gets an additive gain $\bar{z}$. The motivation for this assumption is that having operated a firm in sector s will give a direct and additive productivity gain in similar sectors s^+ due to for example complementarities.[15] Finally, if the entrepreneur chooses to make a TFP draw in a sector distant from the sector s of the first firm, the TFP for the second firm $s^- \in S^-$ will be $z_{2s^-} = \rho^- \cdot z_{1s} + \varepsilon$, where the persistence ρ^-

[15] We could have alternatively assumed that both the same sector s and the similar sector $s^+ \in S^+$ get the additive gain $\bar{z}$. The qualitative predictions of Proposition 6 below are robust to such an alternative setup.

is assumed to be lower than for the similar sectors ($\rho^- < \rho^+$). For simplicity, we assume that the stochastic innovation ε to TFP is independent and identically distributed across sectors.

Summing up, given section s and TFP z_{1s} for the 1st-SE firm, the TFP for the 2nd-SE firm is given by

$$z_2 = \begin{cases} \rho z_{1s} + \varepsilon & \text{if stay in same sector } s \\ \rho^+ \cdot z_{1s} + \bar{z} + \varepsilon & \text{if switch to similar sector } s^+ \in S^+ \\ \rho^- \cdot z_{1s} + \varepsilon & \text{if switch to distant sector } s^- \in S^- \end{cases}$$

We assume that all sectors are ex-ante identical in the sense that the distribution of the TFP draw for the initial firm and the unconditional expectation of total profits are the same for all initial sectors $s \in S$.

The optimal choice of where to sample a TFP draw for the firm in the 2nd period is characterized in the following proposition.

Proposition 6. *Consider an entrepreneur who operated a firm in sector s with TFP z_{1s} in the first period.*

- ***Part A: Sector choice***. *If TFP of the 1st-SE firm is sufficiently large, $z_{1s} > \bar{Z}$, the entrepreneur remains in the same sector s. If z_{1s} is sufficiently low, $z_{1s} < \underline{Z}$, the entrepreneur switches to a distant sector $s^- \in S^-$. For intermediate values of TFP, $z_{1s} \in \left(\underline{Z}, \bar{Z}\right)$, the entrepreneur switches to a similar sector $s^+ \in S^+$. The entrepreneur is indifferent between sector s and S^+ (S^+ and S^-) when $z_{1s} = \bar{Z}$ ($z_{1s} = \underline{Z}$). The thresholds are defined as $\bar{Z} \equiv \bar{z}/\left(\rho - \rho^+\right) \geq 0$ and $\underline{Z} \equiv -\bar{z}/\left(\rho^+ - \rho^-\right) \leq 0$.*

- ***Part B: TFP***. *Average TFP for the 1st-SE firm is highest for entrepreneurs who stay in the same sector, intermediate for those who go to similar sectors, and lowest for those who migrate to distant sectors. If R_s is sufficiently close to R_b, the same ranking must also apply to the average TFP for the 2nd-SE firm.*

Proof. The optimal choice maximizes z_2 because profits are monotone increasing in z_2. Therefore, the entrepreneur remains in the same sector rather than switching to a similar sector if $\rho z_{1s} + \varepsilon > \rho^+ \cdot z_{1s} + \bar{z} + \varepsilon$, which is satisfied if

$$z_{1s} > \bar{Z} \equiv \frac{\bar{z}}{\rho - \rho^+} \geq 0.$$

When $z_{1s} = \bar{Z}$ the entreprepreneur is indifferent. Moreover, the entrepreneur chooses a distant sector over a similar sector if $\rho^+ \cdot z_{1s} + \bar{z} + \varepsilon \geq \rho^- \cdot z_{1s} + \varepsilon$, which is satisfied if

$$z_{1s} < -\frac{\bar{z}}{\rho^+ - \rho^-} \equiv \underline{Z} < 0$$

When $z_{1s} = \underline{Z}$ the entreprepreneur is indifferent. Since $\bar{z} \geq 0$, it follows immediately that $\bar{Z} \geq 0 > \underline{Z}$. This establishes the ranking of expected TFP for the 1st-SE firm. To prove that the ranking of expected TFP for the 2nd-SE firm is the same as for the 1st SE firm, we note that the negative selection due to equity is arbitrarily small when R_s is sufficiently close to R_b. The ranking then follows immediately from the productivity persistence channel and $\rho > \rho^+ > \rho^-$. □

Proposition 6 shows that the difference in persistence induces threshold behavior in terms of TFP: when TFP of the first firm is above a threshold $\bar{Z}$, the entrepreneur stays in the current sector, while the entrepreneur switches to a distant sector if initial TFP is below $\underline{Z}$ and to a similar sector if TFP is intermediate. Note that the complementary gain $\bar{z}$ is necessary to generate some migration to similar sectors. If there were no complementarity gain, i.e., $\bar{z} = 0$, the entrepreneur would remain in s if $z_{1s} \geq 0$ (in which case persistence is beneficial) and switch to a distant sector otherwise (in which case persistence is harmful). Thus, the complementarity gain compensates for the disadvantage of an intermediate persistence.

This threshold behavior in sector choice induces positive selection for the entrepreneurs who remain in the same sector and negative selection for those who search for potential firms in different sectors. This captures the spirit of the Jovanovic (1979) learning model. In fact, his model can be interpreted as a special case of our model when $\rho = 1$, $\rho^- = 0$, and $\bar{z} = 0$. The predictions for TFP of the 1st-SE firm follow immediately from the ranking of the thresholds. The average TFP draw for potential firms in the second period have the same ranking as for the 1st-SE firm due to the maintained assumption that $\rho > \rho^+ > \rho^-$. However, the predictions about the *observed* average TFP of the 2nd-SE firm are more subtle. The deterministic component of z_2 induces positive correlation between z_1 and z_2 while the effect of retained earnings from the first period induces negative correlation due to the negative selection of 2nd period firms for richer entrepreneurs (higher equity implies lower threshold). If financial frictions are sufficiently small, i.e., when R_s is sufficiently close to R_b, the deterministic component must dominate, guaranteeing the samen ranking of average TFP for the 2nd-SE firm as for the 1st-SE firm.

6.2.2 Diversification of Risk

We now explore determinants of sector choice for the 2nd-SE firm over and above learning about abilities. We start with risk diversification and illustrate the mechanism with the aid of a simple portfolio model.

To simplify the exposition, we focus on entrepreneurs who started and operated a firm in sector s in the first period and who have decided to solicit TFP draws for potential firms in a new sector $s' \neq s$.[16] We make three changes to the model relative to the previous analysis. First, we assume that the entrepreneur has linear-quadratic preferences over final wealth W, given by the net savings plus profits in the firms. It follows immediately that the objective function of the entrepreneur can be expressed as a function of the mean and variance of W,

$$E\{u(W)\} = a \cdot E(W) - \frac{b}{2} \cdot Var(W),$$

where a and b are positive parameters.[17]

Second, we now assume that the entrepreneur i obtains one (idiosyncratic) draw $z_{i,s'}$ for every sector $s' \neq s$ and chooses which of these firms to operate after having observed all draws. Third, to embed a meaningful portfolio diversification motive, we assume that output of a firm i in sector s has a sector-specific return to capital δ_s in addition to the regular idiosyncratic component of production, $y_{i,s}$,

$$Y_{i,s} = y_{i,s} + \delta_s k_{i,s},$$

where $y_{i,s} = z_{i,s}^{1-\eta} \left(k_{i,s}^{1-\alpha} n_{i,s}^{\alpha} \right)^{\eta}$ is the regular idiosyncratic production (cf. equation (1)) and $k_{i,s}$ and $n_{i,s}$ are the factor inputs to the firm. The sector-specific returns $\delta_{s'}$ have the same univariate

[16] For simplicity we now abstract from the similar sectors, implying that $s' \in S^-$.

[17] We implicitly assume that the range for W is such that utility is increasing in W for all realizations of W.

distribution for all sectors, although the covariance with initial sector, $Cov(\delta_{s'}, \delta_s)$, can differ across sectors. Without loss of generality, we normalize the mean realization of δ to zero.

Since output in each firm is additive in the idiosyncratic production and sector-specific return, the final wealth is additively separable in idiosyncratic and sector-specific terms. Let $\Pi_i = W_i - (\delta_s k_{i,s} + \delta_{s'} k_{i,s'})$ denote the profits net of the sector-specific returns. Note that decisions are made *before* the realization of the sector-specific return $\delta_{s'}$ but *after* the realization of the idiosyncratic components. Therefore, Π_i is deterministic. It follows that expected utility is given by

$$E\{u(W_i)\} = a \cdot \Pi_i - 2b \cdot [Var(\delta_s) + Cov(\delta_s, \delta_{s'})].$$

Note that the expected utility is falling in the covariance between the sector-specific returns to capital. We state the main predictions of this section in the following proposition.

Proposition 7. *Consider the problem for an entrepreneur who has an existing firm in sector s and a set of idiosyncratic draws potential firms $\{z_{s'}\}_{s' \neq s}$. The probability that the entrepreneur chooses sector s' is falling in the covariance $Cov(\delta_{s'}, \delta_s)$. Moreover, conditional on choosing sector s', the average TFP of the 2nd-SE firm is increasing in $Cov(\delta_{s'}, \delta_s)$.*

Proof. Consider two sectors with identical realizations of the idiosyncratic draws $z_{s'} = z_{\tilde{s}}$. Since the sector-specific return to capital has the same mean and variance in all sectors and $E\{u(W)\}$ is strictly falling in the covariance term, sector s' will be strictly preferred to sector $\tilde{s}$ if and only if $Cov(\delta_{s'}, \delta_s) < Cov(\delta_{\tilde{s}}, \delta_s)$. Since the distribution of δ is the same for all sectors, it follows immediately that when $Cov(\delta_{s'}, \delta_s) < Cov(\delta_{\tilde{s}}, \delta_s)$ then sector s' will be preferred more often than sector $\tilde{s}$. Moreover, when sector $\tilde{s}$ is chosen, then it must be that sector $\tilde{s}$ has the largest TFP, $z_{\tilde{s}} > z_{s'}$. This implies that 2nd-SE firms in sectors with a larger covariance with the sector of the 1st-SE firm will on average have a larger TFP. □

6.2.3 Upstream-Downstream Integration and Input-Output Complementarities

A natural extension of our simple multi-sector model in Section 6.2.2 is to allow for input-output linkages and trade in intermediate goods.

Consider two firms that have large potential gains from trade with each other. Rather than modeling such trade and input-output linkages explicitly, we simply appeal to Williamson (1975) transaction-cost theory and postulate that having joint ownership of these firms can mitigate the potential information asymmetries and transaction costs of trade.[18] This implies that an entrepreneur with a firm in sector s has a comparative advantage of operating in sectors that trade with firms in sector s.

If the only difference across potential sectors s' is the strength of their linkages with sector s, then it follows immediately that sectors with stronger links will be chosen more often. Note, however, that it is difficult to obtain sharp predictions for TFP of the 2nd-SE firm. The reason is that the theory is not informative about which firm benefits from the linkages, be it the 1st-SE, 2nd-SE, or both.

6.3 Empirics: Determinants of Sectoral Choices

We start by summarizing the theoretical predictions regarding sector choice.

[18] This might be considered as a hybrid approach to mitigating transaction costs, in between pure trade and full vertical integration.

- *Theoretical Prediction G*: Proposition 6 implies that average TFP for 1st-SE firms is larger for SE entrepreneurs whose 2nd-SE firm is in the same sector as the 1st-SE, intermediate for SE with 2nd-SE in similar sectors, and lowest for SE with 2nd-SE in distant sectors. If financial frictions are sufficiently small, this ranking applies also for the 2nd-SE firm.
- *Theoretical Prediction H*: Proposition 7 implies that when entrepreneurs choose a distant sector for their 2nd-SE firm, they are more likely to locate in a sector s' whose average return on capital has a lower covariance with the average return on capital in sector s of the 1st-SE firm. Moreover, the average TFP of the 2nd-SE firm is increasing in this covariance.
- *Theoretical Prediction I*: Entrepreneurs are more likely to start a 2nd-SE firm in sectors which are more integrated with or have stronger input-output linkages with the sector of the 1st-SE firm than in sectors with weak links.

6.3.1 Testing the Learning Mechanism

We first document that the persistence of TFP shocks of serial firms is larger for firms started in the same sector than for entrepreneurs started in different sectors. Recall that this is a key assumption in Proposition 6. Table 12 shows that the persistence in TFP shocks is higher for firms in the same 3-digit industries, lower for the firms of serial entrepreneurs that are in similar 3-digit industries, and even lower for serial firms that are in distant 3-digit industries. This confirms that the assumption underlying Proposition 6 is supported in the data.

Table 12: Persistence in TFPs for 1st- and 2nd-SE Firms, Conditional on Industry, Inspection Data, 2008-2012.

	Log 2nd-SE TFP		
	Same Industry	Similar Industry	Distant Industry
	(1)	(2)	(3)
Log 1st-SE TFP	0.25***	0.19***	0.10***
Age of 1st-SE	0.23***	0.25***	0.22***
Age difference	0.24***	0.25***	0.21***
Observations	44,234	62,983	131,377
Adjusted R-squared	0.08	0.06	0.03

Notes: The table reports the persistence in the TFP of 1st- and 2nd-SE firms. TFP is computed relative to the average of all firms in the same province-industry-year cell. Industries are similar if they have the same 1-digit, but different 3-digit, codes. Industries are distant if they have a different 1-digit code. *** − statistically significant at the 1% level.

Consider now the implications from Proposition 6 regarding the ranking of TFP for the serial entrepreneurs who stay in the same sector versus switching to similar or distant sectors. Table 13 shows that these predictions are born out in the Inspection Data: the TFP of both 1st- and 2nd-SE firms are more than 60% higher when both firms are in the same 3-digit industry as compared to SE firms in distant 3-digit sectors, where "distant" is defined as a different 1-digit industry. Further, the TFP of the 1st-SE and 2nd-SE firm are, respectively, around 17% and 26% higher when both firms are in the same 3-digit industry as compared to SE firms in similar 3-digit industries, where "similar" is defined as the same 1-digit industry but different 3-digit industry. This empirical evidence is consistent with Theoretical Prediction G.

Table 13: TFPs for 1st- and 2nd-SE Firms, Conditional on Industry, Inspection Data, 2008-2012.

	log 1st-SE TFP	log 2nd-SE TFP	
	(1)	(2)	(3)
Similar Industry	-0.17***	-0.26***	-0.26***
Distant Industry	-0.64***	-0.63***	-0.63***
Distant Industry * Covariance			0.21***
Age	0.27***	0.51***	0.51***
Age squared	-0.01***	-0.02***	-0.02***
Observations	238,594	238,594	238,594
Adjusted R-squared	0.02	0.03	0.03

Notes: The table compares the TFP of 1st-SE (2nd-SE) firms that are in the same 3-digit industry, relative to 1st-SE (2nd-SE) firms that are in similar or distant 3-digit industries. Industries are similar if they have the same 1-digit, but different 3-digit, codes. Industries are distant if they have a different 1-digit code. TFP is computed relative to the averages of all firms in the same province-industry-year cell. The variable Covariance is the covariance of the return of assets between each two sectors. This variable is standardized to have mean zero and a standard deviation of one. The notation *** signifies statistically significance at the 1% level.

6.3.2 Testing the Mechanisms of Diversification and Linkages

We now explain how we measure the correlation of returns across sectors, input-output linkages, input-output complementarities, and excess probabilities of sector choice.

Measuring Covariance of sector-specific returns. The diversification theory requires that we measure the returns on firms in each sector, and the joint distribution (the variance-covariance matrix) of these returns.

We construct an empirical measure of the return on capital in sector i in period t as:

$$r_{i,t} = \frac{profits_{i,t}}{assets_{i,t}},$$

where profits and assets are from the Inspection Data over the 2010-2012 period. We calculate average returns for each 3-digit industry and use the empirical realizations to estimate the covariance matrix of returns.

Upstream and downstream integration. We capture the downstream and upstream sectoral linkages using the methodology in Fan and Lang (2000). Taking a serial entrepreneur with a 1st-SE firm in industry i and a 2nd-SE firm in industry j, the "upstream" index is defined as the dollar value of industry j's output required to produce 1 dollar's worth of industry i's output while the "downstream" index is defined as the dollar value of industry i's output required to produce 1 dollar's worth of industry j's output. We use the 2007 Chinese Input-Output tables to compute these indices.[19]

Input and output complementarity. In order to study any potential input and output complementarity links between the firms of serial entrepreneurs, we construct the following two indices. The "output complementarity" index is the correlation coefficient between b_{ik} and b_{jk}, where b_{ik} (b_{ik}) is the percentage of industry i (j) output supplied to each intermediate industry k. This index captures the degree to which industries i and j share outputs. The "input complementarity" index on the other hand is defined as the correlation coefficient between v_{ik} and v_{jk}, where v_{ik} (v_{ik}) is the percentage of inputs from each intermediate industry k used in industry i (j) output. This index captures the degree to which industries i and j share inputs. We use the 2007 Chinese Input-Output tables to compute these indices.

Excess probability measure. In order to study the quantitative importance of the measures described above in determining the sectoral choice of a 2nd-SE firm, we construct an excess probability measure: the normalized probability of starting the 2nd-SE firm in sector j, given that the 1st-SE firm is in sector i. Consider serial entrepreneurs with a 1st-SE firm in industry i and a 2nd-SE firm in industry j. We calculate the percentage of serial entrepreneurs that move from i to j each year when they start their 2nd-SE firm − this is computed as the number of serial entrepreneurs from i to j divided by total number of serial entrepreneurs in industry i. This measure is then normalized by the share of industry j in total incumbents last year.

Table 14: Sectoral Choice and Business Linkages.

	(1)	(2)	(3)	(4)	(5)
Dependent variable:			excess probability		
Downstream Integrated	1.038***				0.787***
	(0.227)				(0.209)
Upstream Integrated		0.748***			0.511***
		(0.106)			(0.099)
Complementarity			1.520***		1.257***
			(0.120)		(0.124)
Covariance				-0.048	-0.074*
				(0.043)	(0.040)
Constant	1.140***	1.132***	1.168***	1.112***	1.191***
	(0.183)	(0.183)	(0.182)	(0.183)	(0.183)
Observations	316,008	316,008	316,008	316,008	316,008

Note: We control for the sector of the 1st-SE firm and the year the 2nd-SE firm is established. The weight for regressions is the number of new entrants of each sector of the 1st-SE.

[19]The 2007 Chinese Input-Output tables have 135 sectors that cover most of the 2-digit and 3-digit manufacturing sectors and 1-digit service sectors.

Findings. Table 14 reports the results of a regression of the excess probability measure on our measure of covariance, downstream and upstream integration, and complementarity.[20] In the regression, we control for the sector of the 1st-SE firm and the year the 2nd-SE firm is established. The results reported in column (5) indicate that serial entrepreneurs are more likely to start their 2nd-SE firm in a sector that is upstream integrated, downstream integrated, complementary, and with a negative covariance index with the sector of their 1st-SE firm. These results confirm Theoretical Predictions G and I.

Finally, the third column of Table 13 shows that the TFP of the 2nd-SE firm is increasing in the covariance between returns in the sectors of the 1st-SE and 2nd-SE firms. This confirms the second part of Theoretical Prediction G. Note that the measure of covariance in the regression is standardized so that this variable has mean zero and a standard deviation equal to one. The coefficient of 0.21 therefore implies that increasing this variable (the covariance) by one standard deviation (of the cross-sectional dispersion in covariance) will increase TFP by 21%. This effect is effect is significant, both from an economic and a statistical point of view.

7 Conclusion

There is an extensive literature studying entrepreneurship, however much less is known about serial entrepreneurship. In the paper, we draw on data on the universe of all firms in China to document key facts about entrepreneurship and serial entrepreneurship in China since the early 1990s. We then examine these data through the lens of a model of serial entrepreneurship in which potential entrepreneurs face capital market frictions in the form of a borrowing-lending spread. Our model generates sharp predictions relating to the effect of endowments, abilities and capital market frictions on the likelihood of both entrepreneurship and serial entrepreneurship, differences between serial and non-serial firms, and 1st- and 2nd-serial firms. We extend the model to study migration patterns for serial entrepreneurs in terms of what sector they locate their 2nd-SE firm. The theoretical predictions are borne out by the data.

Our results suggest that ability is a major driver of serial entrepreneurship: Not only are SEs more productive, but the fact that they become successively more productive with the creation of new firms suggests that entrepreneurial ability is persistent. We also find evidence that financial frictions are important for explaining prominent features of serial entrepreneurship in China, especially in the context of entrepreneurs choosing to operate firms concurrently or in sequence. Furthermore, serial entrepreneurs who switch sectors are less productive, which we interpret as additional evidence for persistence of productivity and the role of sector-specific learning. The exact choice of sector, on the other hand, is driven by risk diversification and sectoral linkages, hinting at the presence of other types of frictions in the economy and possible tradeoffs in these choices.

[20] Input and output complementarity are combined into one measure.

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APPENDICES

A Tables

Table A-1: Reporting Ratio of Inspection Data, Different Type of Entrepreneur

Year	Non-SE	1st-SE	2nd-SE
2008	60.97%	63.55%	64.16%
2009	63.99%	66.33%	67.37%
2010	67.12%	69.01%	70.43%
2011	68.43%	69.85%	71.20%
2012	68.29%	69.46%	70.16%

Table A-2: Number of Firms in the Inspection Data, 2008-2012

Year	Number of Firms
2008	1,355,596
2009	1,604,817
2010	1,901,459
2011	2,219,169
2012	2,483,643
Total	9,564,684

Table A-3: Share of Registered Capital, by Ownership Type, 1995-2015.

Year	Total(Trillion)	Unregistered(%)	Individual(%)			Enterprise(%)		Share of baseline sample: (2)+(3)
			Single	Multiple	No citizenship ID	Single	Multiple	
		(1)	(2)	(3)	(4)	(5)	(6)	
1995	11.10	55.76	0.53	5.44	5.50	16.40	16.37	5.97
1996	12.30	54.15	0.61	6.69	5.69	15.93	16.92	7.30
1997	13.56	52.25	0.72	8.05	5.83	15.75	17.40	8.77
1998	14.88	50.03	0.85	9.64	5.99	15.51	17.97	10.49
1999	16.71	48.71	0.97	10.71	5.89	15.96	17.76	11.68
2000	18.73	46.49	1.14	12.01	5.77	16.78	17.80	13.15
2001	20.77	44.20	1.28	13.53	5.91	16.83	18.25	14.81
2002	23.14	42.40	1.40	14.94	6.00	16.92	18.34	16.34
2003	27.04	39.62	1.51	15.70	6.19	18.91	18.07	17.21
2004	30.26	37.85	1.77	17.02	6.33	18.03	19.00	18.79
2005	33.36	36.67	1.95	18.45	6.41	17.28	19.24	20.40
2006	36.72	35.78	2.21	19.36	6.60	16.72	19.32	21.57
2007	41.84	36.87	2.33	19.29	6.47	16.03	19.01	21.63
2008	45.37	35.64	2.63	20.03	6.39	15.87	19.44	22.66
2009	49.97	33.86	2.92	21.06	6.28	15.99	19.89	23.98
2010	56.75	31.74	3.25	22.58	6.21	15.83	20.38	25.83
2011	65.22	29.46	3.56	24.36	5.88	15.58	21.16	27.92
2012	73.81	27.50	3.80	25.46	5.66	15.69	21.88	29.27
2013	85.06	26.47	4.08	26.26	5.40	15.45	22.34	30.34
2014	105.65	23.07	5.42	28.78	5.90	14.63	22.21	34.19
2015	135.55	20.12	7.26	31.16	5.84	13.66	21.96	38.41

B Proof of Proposition 1

B.1 Entrepreneurs with Positive Deposits

Consider first a non-borrowing entrepreneur who has positive deposits. We label this as an *unconstrained* entrepreneur. Since this entrepreneur has chosen $s > 0$, she must have $b = 0$ and $k < e$. The entrepreneur solves the problem

$$\begin{aligned}\Pi(e, z; 1) &= \max_{k,n} \{y - wn - R_s k\} + eR_s \\ &= \max_{k,n} \left\{z^{1-\eta} \left(k^{1-\alpha} n^{\alpha}\right)^{\eta} - wn - R_s (k - e)\right\}.\end{aligned}$$

The first-order conditions are given by

$$\alpha\eta y = wn, \tag{A-1}$$

$$(1-\alpha)\eta y = R_s k, \tag{A-2}$$

Plugging this back into the production function yields an expression for output in terms of z and equity. The optimal allocations for capital, labor, and profits then follow directly from the first-order conditions. In particular, for unconstrained entrepreneurs the optimal allocations are given by equation (A-3),

$$\begin{aligned}y^* &= z \cdot \bar{y}(R_s, w) \\ k^* &= z\frac{(1-\alpha)\eta}{R_s} \cdot \bar{y}(R_s, w) \equiv zk_s^* \\ n^* &= z\frac{\alpha\eta}{w} \cdot \bar{y}(R_s, w)\end{aligned} \tag{A-3}$$

and where profits are $\Pi(z, e, 1) = z \cdot (1-\eta) \cdot \bar{y}(R_s, w) + R_s e$ and the input composite $\bar{y}$ is given by

$$\bar{y}(R_s, w) \equiv \left(\frac{(1-\alpha)\eta}{R_s}\right)^{\frac{(1-\alpha)\eta}{1-\eta}} \left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}}.$$

Consider now the unconstrained entrepreneur's decision whether or not to enter. The entrepreneur will enter if profits exceed the opportunity cost, which is depositing the equity in the bank. Given the prices and state variables, the condition $\Pi(z, e, j) - \nu \geq R_s e$ implies a cutoff z_s^* such that all potential entrepreneurs with $z \geq z_s^*$ will choose to operate firms, where s denotes "saver" and z_s^* is given by

$$z_s^* \equiv \frac{v}{1-\eta} \left(\frac{(1-\alpha)\eta}{R_s}\right)^{-\frac{(1-\alpha)\eta}{1-\eta}} \left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\eta}}.$$

This threshold is independent of equity since equity is irrelevant for the unconstrained entrepreneur. Moreover, the threshold is increasing in the wage rate (since higher wages lower profits) and increasing in R_s (since higher returns on deposits increase the alternative value of equity). The unconstrained entrepreneur will install a capital stock given by $k^*(z, e) = zk_s^*$ (see equation (3)). It follows that the potential entrepreneur will be an unconstrained entrepreneur and operate the firm if and only if two conditions are simultaneously satisfied: (1) $z \geq z_s^*$ and (2) $e \geq z \cdot k_s^*$. Namely, both TFP and equity must be sufficiently large. Moreover, denote the lower bound on equity for an unconstrained entrepreneur as $e_s^* \equiv z_s^* k_s^* = \frac{v}{1-\eta} \frac{(1-\alpha)\eta}{R_s}$.

B.2 Entrepreneurs with Positive Borrowing

Next, consider an entrepreneur who chooses strictly positive debt ($b > 0$). Since $R_s < R_b$, this entrepreneur invests all her equity in the firm so $s = 0$ and $k > e$. We label this as a *borrower*. A borrower solves the problem

$$\Pi(e, z; 2) = \max_{k,n} \{y - wn - R_b (k - e)\}$$

The relevant rate of return for a borrower is R_b. The first-order conditions and the optimal allocations are given by equations (A-1)-(A-2) and (A-3), where R_s is replaced by R_b.

Consider now entry for the borrowers. Their TFP threshold for operating the firm is that the return on equity in the firm is larger than or equal to the opportunity cost of investing the equity in deposits earning a rate R_s. Namely, the threshold z_b^* (where the subscript b denotes "borrower") is given by the solution to the equation $\Pi(z_b^*, e, 2) - \nu = R_s e$. This implies

$$\begin{aligned}R_s e &= (1-\eta) z \cdot \bar{y}(R_b, w) + R_b e - \nu \\ &\Rightarrow\end{aligned}$$

$$z_b^*(e) = \left(\frac{R_b}{(1-\alpha)\eta}\right)^{\frac{(1-\alpha)\eta}{1-\eta}} \left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\eta}} \frac{1}{1-\eta}\left[\nu - (R_b - R_s)e\right]$$

Note that the threshold is linear and strictly falling in e. This is because the return on capital in the firm, R_b, exceeds the return on deposits. Therefore, the value of operating a firm is larger the larger is e.

The borrowing entrepreneur will invest $k^*(z,e) = zk_b^*$ (see equation (3)). It follows that the potential entrepreneur will be a borrowing entrepreneur and operate the firm if and only if two conditions are simultaneously satisfied: (1) $z \geq z_b^*(e)$; and (2) $e < z \cdot k_b^*$. In other words, the entrepreneur will be a borrowing entrepreneur if TFP is sufficiently large and equity sufficiently low. It is convenient to define the constant e_b^* as the solution to the equation $e_b^* = z_b^*(e_b^*)\,k_b^*$, i.e.,

$$e_b^* \equiv \frac{\nu}{1-\eta}\frac{(1-\alpha)\eta}{R_b + (R_b - R_s)\frac{(1-\alpha)\eta}{1-\eta}} < e_s^*.$$

B.3 Constrained Entrepreneurs

Finally, consider an entrepreneur who chooses zero borrowing and zero savings, so $k = e$. We label this a *constrained* entrepreneur. This entrepreneur solves the problem

$$\Pi(e,z;0) = \max_n \left\{z^{1-\eta}\left(e^{1-\alpha}n^{\alpha}\right)^{\eta} - wn\right\}.$$

The first-order condition for employment n, equation (A-1), applies, while equation (A-2) becomes an inequality, $R_s e < (1-\alpha)\eta y < R_b e$. For constrained entrepreneurs the optimal allocations are given by equation (A-4),

$$\begin{aligned}
y_c^* &= z^{\frac{1-\eta}{1-\alpha\eta}}(e)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}}\left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\alpha\eta}} \\
k_c^* &= e \\
n_c^* &= z^{\frac{1-\eta}{1-\alpha\eta}}(e)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}}\left(\frac{\alpha\eta}{w}\right)^{\frac{1}{1-\alpha\eta}} = \frac{\alpha\eta}{w}\cdot y_c^* \\
\Pi(e,z,0) &= (1-\alpha\eta)\,z^{\frac{1-\eta}{1-\alpha\eta}}(e)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}}\left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\alpha\eta}} = (1-\alpha\eta)\cdot y_c^*,
\end{aligned} \quad \text{(A-4)}$$

where the subscript c denotes "constrained."

The analysis of the unconstrained and borrowing cases implies that the potential entrepreneur will be constrained if and only if

$$k_b^* \leq \frac{e}{z} < k_s^*.$$

Note that the return to equity for constrained entrepreneurs is in between R_s and R_b. Moreover, equity is smaller than the capital installed for the unconstrained entrepreneur and larger than that of a borrowing entrepreneur: $e < zk_s^*$ and $e > zk_b^*$.

Consider now the entry decision for the constrained entrepreneurs. The entrepreneur will enter if operating the firm is better than depositing the equity, i.e., if $\Pi(e,z,0) - \nu \geq R_s e$. This condition implies a threshold z_c^* given by

$$z_c^*(e) \geq \left(\frac{\nu + R_s e}{1-\alpha\eta}\right)^{\frac{1-\alpha\eta}{1-\eta}}(e)^{-\frac{(1-\alpha)\eta}{1-\eta}}\left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\eta}}$$

Equity affects the threshold for constrained entrepreneurs in two opposing ways. On the one hand, a larger equity increases the value of the firm. This tends to reduce the threshold. On the other hand, a larger equity increases the opportunity cost of deposits, which tends to decrease the threshold. The former effect dominates and the comparative statics of the threshold with respect to e is given by

$$\frac{\partial \ln(z_c^*(e))}{\partial \ln e} = \frac{1-\alpha\eta}{1-\eta}\frac{R_s e}{\nu + R_s e} - \frac{(1-\alpha)\eta}{1-\eta} \leq 0,$$

where the inequality is strict for $e < e_s^* = \frac{\nu}{1-\eta}\frac{(1-\alpha)\eta}{R_s}$ and holds with equality for $e = e_s^*$.

C Proof of Proposition 2

We first state a useful proposition on the choice of operating firms concurrently or not (Proposition 8). We then turn to the proof of of Proposition 2.

For convenience we relabel the two (potential) firms as h and l, where h indicates the firm with high TFP and l the firm with low TFP ($z_b \geq z_l$). This is without loss of generality because of the symmetry property. Thus, in the second period the timing of arrival of the potential firm is irrelevant.

The decision to operate zero or at least one firm is characterized by Proposition 1. Namely, the potential entrepreneur will operate at least one firm if and only if the TFP of the most productive firm is above the threshold $z_b \geq z^*(e)$. The choice of operating one or two firms concurrently depends on the amount of equity e and on the TFP of the two potential firms. Since the entrepreneur can costlessly move capital across firms, it is optimal to allocate capital and workers in each firm so as to equate the marginal product of capital and labor across firms if the firms are operated concurrently.

The following proposition characterizes the choice for an entrepreneur who has the option to operate two firms concurrently.

Proposition 8. *The entrepreneur will operate at least one firm if and only if z_b is sufficiently large: $z_b \geq z^*(e)$. If $z_b \geq z^*(e)$, the entrepreneur will operate two firms concurrently if the following conditions are satisfied.*

1. ***Rich entrepreneur: positive deposits even when operating two firms.*** *Suppose $e \geq (z_l + z_b) k_s^*$. The entrepreneur will operate two firms concurrently if*

$$z_l \geq z_s^*.$$

In this case, the capital allocation in firm $j \in \{h, l\}$ is

$$k_j = z_j k_s^*,$$

and total debt is

$$d = (z_l + z_b) k_s^* - e < 0.$$

2. ***Constrained if operating two firms.*** *Suppose $e \in ((z_l + z_b) k_b^*, (z_l + z_b) k_s^*)$. The entrepreneur will operate two firms concurrently if z_l is sufficiently close to z_b. The conditions are as follows.*

   (a) ***Positive deposits when operating one firm.*** *Suppose $e \geq z_b k_s^*$. The entrepreneur will operate two firms concurrently if*

$$(z_l + z_b)^{\frac{1-\eta}{1-\alpha\eta}} (e)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}} \geq z_b \cdot \frac{1-\eta}{1-\alpha\eta} \cdot \left(\frac{(1-\alpha)\eta}{R_s}\right)^{\frac{(1-\alpha)\eta}{1-\eta}} + \frac{R_s e + \nu}{1-\alpha\eta} \left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\eta}}$$

   (b) ***Constrained if operating one firm.*** *Suppose $e < z_b k_s^*$. The entrepreneur will operate two firms concurrently if $(z_l + z_b)^{\frac{1-\eta}{1-\alpha\eta}} \geq (z_b)^{\frac{1-\eta}{1-\alpha\eta}} + \left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\alpha\eta}} \frac{\nu}{1-\alpha\eta} (e)^{-\frac{(1-\alpha)\eta}{1-\alpha\eta}}$.*

   If the entrepreneur operates two firms concurrently, the capital allocation in firm $j \in \{h, l\}$ and total debt will be

$$\begin{aligned} k_j &= \frac{z_j}{z_l + z_b} e, \\ d &= 0. \end{aligned}$$

3. ***Borrowing if operating two firms.*** *Suppose $e \leq (z_l + z_b) k_b^*$. If the entrepreneur operates two firms concurrently, the capital allocation in firm $j \in \{h, l\}$ and total debt will be*

$$\begin{aligned} k_j &= z_j k_b^*, \\ d &= (z_l + z_b) k_b^* - e > 0. \end{aligned}$$

The entrepreneur will operate two firms concurrently if z_l is sufficiently close to z_b. The conditions are as follows.

   (a) ***Positive deposits when running one firm.*** *Suppose $e \geq z_b k_s^*$. The entrepreneur will operate two firms if*

$$z_l \geq z_b \left(\left(\frac{R_b}{R_s}\right)^{\frac{(1-\alpha)\eta}{1-\eta}} - 1 \right) + [(1-\alpha)\eta]^{-\frac{(1-\alpha)\eta}{1-\eta}} \left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\eta}} \frac{[\nu - (R_b - R_s) e]}{1-\eta}.$$

(b) ***Borrowing if running two firms, constrained if running one firm.*** *Suppose* $e \in (z_b k_b^*, z_b k_s^*)$*. The entrepreneur will operate two firms concurrently if*

$$\begin{aligned} z_l &\geq -z_b + \frac{1-\alpha\eta}{1-\eta} (z_b)^{\frac{1-\eta}{1-\alpha\eta}} (e)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}} \frac{\left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}}}{k_b^*} + \frac{1}{k_b^*} \frac{\nu - R_b e}{1-\eta} \\ &= \left(\frac{1-\alpha\eta}{1-\eta} (z_b)^{-\eta\frac{1-\alpha}{1-\alpha\eta}} (e)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}} \left(\frac{R_b}{(1-\alpha)\eta} \right)^{\frac{1-\alpha\eta}{1-\eta}} - 1 \right) z_b + \frac{1}{k_b^*} \frac{\nu - R_b e}{1-\eta}. \end{aligned}$$

(c) ***Poor entrepreneur: borrowing even when running just one firm.*** *Suppose* $e \leq z_b k_b^*$*. The entrepreneur will operate two firms concurrently if*

$$z_l \geq z^* (0) .$$

C.1 Entrepreneurs with positive deposits and two firms

Consider first an entrepreneur who would be unconstrained (having positive deposits) if she were to operate two firms. The alternative to running two firms and having positive deposits would be to run one or zero firms and have positive deposits. In either case, the marginal return to capital must be R_s. The optimal allocations for each firm must be given by equation (A-3) and the total profits are

$$\begin{aligned} \Pi_1 (e, z_l, z_b) &\equiv \Pi (0, z_l; 1) + \Pi (e, z_b; 1) - 2\nu \\ &= (z_l + z_b) \cdot (1-\eta) \cdot \bar{y} (R_s, w) + R_s e - 2\nu. \end{aligned}$$

The entrepreneur will operate two firms and have positive deposits if and only if the following two conditions are satisfied: $z_s^* \leq \min \{z_l, z_b\} = z_l$ and

$$e \geq (z_l + z_b) k_s^*.$$

Namely, that equity and TFP in the two firms must be sufficiently large.

C.2 Entrepreneurs with positive borrowing

Next, consider a borrowing entrepreneur who operates two firms and chooses strictly positive debt ($b > 0$). Conditional on operating two firms, the optimal allocations are still given by equations (A-3) and (A-1)-(A-2) with R_b as the relevant rate of return. In particular, the capital stock in each firm i is $k^* (z_i, e) = z_i k_b^*$ (see equation (3)). The entrepreneur will prefer to operate two firms if profits with two firms exceed those of operating only the most productive firm and also larger than the opportunity cost of depositing the equity (runnings zero firms). A necessary condition for wanting to borrow and operate both firms is that equity is less than installed capital if operating both firms, i.e., $e < (z_l + z_b) k_b^*$.

Note first that the entrepreneur will operate two firms only if it she would choose to operate the most productive firm over not operating any firms. Formally, this condition is ensured if $z_b \geq z^* (e)$, where the function z^* is defined in equation (2). Suppose now that this condition is satisfied. The choice between operating both firms or operating just the most productive one is then given by the following inequality condition

$$\Pi (0, z_l; 2) + \Pi (0, z_b; 2) + eR_b - 2\nu \geq \Pi^* (e, z_b) - \nu, \tag{A-5}$$

where we exploit the fact that if borrowing, the marginal product of capital must be R_b, which in turn implies that $\Pi (e, z; 2) = \Pi (0, z; 2) + eR_b$.

Calculate the maximum equity the entrepreneur could have and still want to operate two firms and borrow. This would be the case if, when operating two firms, the entrepreneur invests all equity in her own firms, borrows zero, and is indifferent between borrowing or not on the margin. Namely, the equity in each firm i is $z_i k_b^*$ so that total equity is $e \leq (z_l + z_b) k_b^*$ and the marginal return on capital in each firm is exactly R_b.

This gives rise to three cases. Assume first that the entrepreneur would be borrowing even when running just one firm. Namely, $e \leq z_b k_b^*$. The choice between operating both firms or operating just the most productive one is then given by the following inequality condition

$$\begin{aligned} \Pi (0, z_l; 2) + \Pi (e, z_b; 2) - 2\nu &\geq \Pi (e, z_b; 2) - \nu \\ &\Rightarrow \\ \Pi (0, z_l; 2) &\geq \nu, \end{aligned}$$

implying that the entrepreneur will operate two firms if and only if $z_l \geq z_b^*(0)$ where, recall,

$$z_b^*(0) = \frac{\nu}{1-\eta}\left(\frac{R_b}{(1-\alpha)\eta}\right)^{\frac{(1-\alpha)\eta}{1-\eta}}\left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\eta}}.$$

Second, suppose that equity is abundant, $e \geq z_b k_s^*$, in which case the entrepreneur would be unconstrained if operating only one firm and borrowing if operating two firms (we maintain the assumption that the entrepreneur would be borrowing if operating both firms, $e < (z_l + z_b) k_b^*$). The choice between operating both firms or operating just the most productive one is then given by the following inequality condition

$$\begin{aligned}
\Pi(0, z_l; 2) + \Pi(0, z_b; 2) + R_b e - 2\nu &\geq \Pi(0, z_b; 1) + R_s e - \nu \\
&\Rightarrow \\
(z_l + z_b)(1-\eta) \cdot \bar{y}(R_b, w) + R_b e - 2\nu &\geq z_b (1-\eta) \cdot \bar{y}(R_s, w) + R_s e - \nu
\end{aligned}$$

$$\begin{aligned}
(z_l + z_b)(1-\eta) \cdot \frac{R_b}{(1-\alpha)\eta} k_b^* &\geq (1-\eta) z_b \cdot \frac{R_s}{(1-\alpha)\eta} k_s^* - (R_b - R_s) e + \nu \\
(z_l + z_b) R_b k_b^* &\geq z_b \cdot R_s k_s^* + \frac{(1-\alpha)\eta}{(1-\eta)}\left[\nu - (R_b - R_s) e\right] \\
(z_l + z_b) R_b \left(\frac{(1-\alpha)\eta}{R_b}\right)^{\frac{1-\alpha\eta}{1-\eta}}\left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}} &\geq z_b \cdot R_s \left(\frac{(1-\alpha)\eta}{R_s}\right)^{\frac{1-\alpha\eta}{1-\eta}}\left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}} + \frac{(1-\alpha)\eta}{(1-\eta)}\left[\nu - (R_b - R_s) e\right] \\
(z_l + z_b)(R_b)^{1-\frac{1-\alpha\eta}{1-\eta}} &\geq z_b \cdot (R_s)^{1-\frac{1-\alpha\eta}{1-\eta}} + \left[(1-\alpha)\eta\right]^{-\frac{1-\alpha\eta}{1-\eta}}\left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\eta}}\frac{(1-\alpha)\eta}{(1-\eta)}\left[\nu - (R_b - R_s) e\right],
\end{aligned}$$

which boils down to a lower bound on z_l which is falling in equity e and increasing in z_b;

$$z_l \geq z_b \cdot \left(\left(\frac{R_b}{R_s}\right)^{\frac{(1-\alpha)\eta}{1-\eta}} - 1\right) + \left[(1-\alpha)\eta\right]^{-\frac{(1-\alpha)\eta}{1-\eta}}\left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\eta}}\frac{\left[\nu - (R_b - R_s) e\right]}{1-\eta}$$

Finally, suppose equity is intermediate so the entrepreneur would be constrained if operating only one firm, i.e., $e \in (z_b k_b^*, z_b k_s^*)$ (again, we maintain the assumption that the entrepreneur would be borrowing if operating both firms, so $e < (z_l + z_b) k_b^*$). The choice between operating both firms or operating just the most productive one is then given by the following inequality condition

$$\begin{aligned}
\Pi(0, z_l; 2) + \Pi(0, z_b; 2) + R_b e - 2\nu &\geq \Pi(e, z_b; 0) - \nu \\
&\Rightarrow \\
(z_l + z_b)(1-\eta) \cdot \bar{y}(R_b, w) + R_b e &\geq (1-\alpha\eta)(z_b)^{\frac{1-\eta}{1-\alpha\eta}}(e)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}}\left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\alpha\eta}} + \nu \\
(z_l + z_b)(1-\eta)\left(\frac{(1-\alpha)\eta}{R_b}\right)^{\frac{(1-\alpha)\eta}{1-\eta}}\left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}} + R_b e &\geq (1-\alpha\eta)(z_b)^{\frac{1-\eta}{1-\alpha\eta}}(e)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}}\left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\alpha\eta}} + \nu \\
&\Rightarrow
\end{aligned}$$

$$\begin{aligned}
(z_l + z_b)\left(\frac{(1-\alpha)\eta}{R_b}\right)^{\frac{(1-\alpha)\eta}{1-\eta}} &\geq \frac{1-\alpha\eta}{1-\eta}(z_b)^{\frac{1-\eta}{1-\alpha\eta}}(e)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}} + \left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\eta}}\frac{\nu - R_b e}{1-\eta} \\
(z_l + z_b) &\geq \frac{1-\alpha\eta}{1-\eta}(z_b)^{\frac{1-\eta}{1-\alpha\eta}}(e)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}}\left(\frac{R_b}{(1-\alpha)\eta}\right)^{\frac{(1-\alpha)\eta}{1-\eta}} + \left(\frac{R_b}{(1-\alpha)\eta}\right)^{\frac{(1-\alpha)\eta}{1-\eta}}\left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\eta}}\frac{\nu - R_b e}{1-\eta} \\
z_l &\geq -z_b + \frac{1-\alpha\eta}{1-\eta}(z_b)^{\frac{1-\eta}{1-\alpha\eta}}(e)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}}\frac{\left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}}}{k_b^*} + \frac{1}{k_b^*}\frac{\nu - R_b e}{1-\eta},
\end{aligned}$$

which imposes a lower bound on z_l. This lower bound is falling in equity. Not sure if the lower bound is falling in z_b.

Note that the term

$$
\begin{aligned}
(z_b)^{\frac{1-\eta}{1-\alpha\eta}} (e)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}} \frac{\left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}}}{k_b^*} &\geq (z_b)^{\frac{1-\eta}{1-\alpha\eta}} (z_b k_b^*)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}} \frac{\left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}}}{k_b^*} \\
&= (z_b)^{\frac{1-\eta}{1-\alpha\eta}+\frac{(1-\alpha)\eta}{1-\alpha\eta}} (k_b^*)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}-1} \left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}} \\
&= z_b (k_b^*)^{-\frac{1-\eta}{1-\alpha\eta}} \left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}} \\
&= z_b \left(\left(\frac{(1-\alpha)\eta}{R_b}\right)^{\frac{1-\alpha\eta}{1-\eta}} \left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}}\right)^{-\frac{1-\eta}{1-\alpha\eta}} \left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}} \\
&= z_b \frac{R_b}{(1-\alpha)\eta} \left(\frac{\alpha\eta}{w}\right)^{-\frac{1-\eta}{1-\alpha\eta}\frac{\alpha\eta}{1-\eta}+\frac{\alpha\eta}{1-\eta}}
\end{aligned}
$$

C.3 Constrained entrepreneurs

Finally, consider an entrepreneur who would be constrained if operating two firms. In each firm, employment is set so the marginal product of labor equals the wage. This implies that for each firm j,

$$
n_j = (z_j)^{\frac{1-\eta}{1-\alpha\eta}} (k_j)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}} \left(\frac{\alpha\eta}{w}\right)^{\frac{1}{1-\alpha\eta}}.
$$

Moreover, the entrepreneur's equity is distributed across the firms so as to equalize the marginal product of capital across firms. This implies

$$
\begin{aligned}
(1-\alpha)\eta (z_l)^{1-\eta} \frac{\left(k_1^{1-\alpha} n_1^{\alpha}\right)^{\eta}}{k_1} &= (1-\alpha)\eta (z_b)^{1-\eta} \frac{\left(k_2^{1-\alpha} n_2^{\alpha}\right)^{\eta}}{k_2} \\
&\Rightarrow
\end{aligned}
$$

$$
\begin{aligned}
(z_l)^{1-\eta} (k_1)^{(1-\alpha)\eta-1} (n_1)^{\alpha\eta} &= (z_b)^{1-\eta} (k_2)^{(1-\alpha)\eta-1} (n_2)^{\alpha\eta} \\
(z_l)^{1-\eta} (k_1)^{(1-\alpha)\eta-1} \left((z_l)^{\frac{1-\eta}{1-\alpha\eta}} (k_1)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}} \left(\frac{\alpha\eta}{w}\right)^{\frac{1}{1-\alpha\eta}}\right)^{\alpha\eta} &= (z_b)^{1-\eta} (k_2)^{(1-\alpha)\eta-1} \left((z_b)^{\frac{1-\eta}{1-\alpha\eta}} (k_2)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}} \left(\frac{\alpha\eta}{w}\right)^{\frac{1}{1-\alpha\eta}}\right)^{\alpha\eta} \\
(z_l)^{1-\eta+\frac{(1-\eta)\alpha\eta}{1-\alpha\eta}} (k_1)^{(1-\alpha)\eta-1+\frac{(1-\alpha)\eta\alpha\eta}{1-\alpha\eta}} &= (z_b)^{1-\eta+\frac{(1-\eta)\alpha\eta}{1-\alpha\eta}} (k_2)^{(1-\alpha)\eta-1+\frac{(1-\alpha)\eta\alpha\eta}{1-\alpha\eta}} \\
(z_l)^{\frac{1-\eta}{1-\alpha\eta}} (k_1)^{-\frac{1-\eta}{1-\alpha\eta}} &= (z_b)^{\frac{1-\eta}{1-\alpha\eta}} (k_2)^{-\frac{1-\eta}{1-\alpha\eta}} \\
&\Rightarrow
\end{aligned}
$$

$$
k_1 = \frac{z_l}{z_b} k_2
$$

Since $k_1 + k_2 = e$, it follows that

$$
\begin{aligned}
e &= \frac{z_l}{z_b} k_2 + k_2 = \left(\frac{z_l}{z_b} + 1\right) k_2 \\
&\Rightarrow \\
k_2 &= \frac{z_b}{(z_l + z_b)} e \\
k_1 &= \frac{z_l}{(z_l + z_b)} e.
\end{aligned}
$$

The total profits are then

$$
\Pi\left(\frac{z_l}{(z_l + z_b)} e, z_b; 0\right) + \Pi\left(\frac{z_b}{(z_l + z_b)} e, z_b; 0\right) - 2\nu
$$

The maintained assumption is that the entrepreneur is constrained when operating two firms. Namely,

$$
(z_l + z_b) k_b^* < e < (z_l + z_b) k_s^*
$$

Suppose equity is sufficiently large that the entrepreneur is unconstrained when operating one firm ($e \geq z_b k_s^*$). Thus, $e \in [\max\{z_b k_s^*, (z_l+z_b) k_b^*\}, (z_l+z_b) k_s^*)$. In this case, the entrepreneur would operate two firms if

$$\Pi\left(\frac{z_l}{(z_l+z_b)}e, z_b; 0\right) + \Pi\left(\frac{z_b}{(z_l+z_b)}e, z_b; 0\right) - 2\nu \quad \geq \quad \Pi(0, z_b; 1) + R_s e - \nu$$

$$\Rightarrow$$

$$(z_l+z_b)^{\frac{1-\eta}{1-\alpha\eta}} (e)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}} \geq z_b \cdot \frac{1-\eta}{1-\alpha\eta} \cdot \left(\frac{(1-\alpha)\eta}{R_s}\right)^{\frac{(1-\alpha)\eta}{1-\eta}} + \frac{R_s e + \nu}{1-\alpha\eta}\left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\eta}}$$

This inequality is satisfied if and only if z_l is sufficiently close to z_b.

Suppose equity is sufficiently small that the entrepreneur is constrained even when operating one firm ($e < z_b k_s^*$). Thus, the parameters are such that

$$e \in ((z_l+z_b) k_b^*, z_b k_s^*).$$

In this case, the entrepreneur would operate two firms if

$$\Pi\left(\frac{z_l}{(z_l+z_b)}e, z_b; 0\right) + \Pi\left(\frac{z_b}{(z_l+z_b)}e, z_b; 0\right) - 2\nu \quad \geq \quad \Pi(e, z_b; 0) - \nu$$

$$\Rightarrow$$

$$(1-\alpha\eta)\left[(z_l)^{\frac{1-\eta}{1-\alpha\eta}}\left(\frac{z_l}{z_l+z_b}e\right)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}} + (z_b)^{\frac{1-\eta}{1-\alpha\eta}}\left(\frac{z_b}{z_l+z_b}e\right)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}}\right]\left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\alpha\eta}} \quad \geq \quad (1-\alpha\eta)(z_b)^{\frac{1-\eta}{1-\alpha\eta}}(e)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}}\left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\alpha\eta}} + \nu$$

$$\left[(z_l)^{\frac{1-\eta}{1-\alpha\eta}+\frac{(1-\alpha)\eta}{1-\alpha\eta}} + (z_b)^{\frac{1-\eta}{1-\alpha\eta}+\frac{(1-\alpha)\eta}{1-\alpha\eta}}\right]\left(\frac{e}{z_l+z_b}\right)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}} \quad \geq \quad (z_b)^{\frac{1-\eta}{1-\alpha\eta}}(e)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}} + \left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\alpha\eta}}\frac{\nu}{1-\alpha\eta}$$

$$\Rightarrow$$

$$(z_l+z_b)^{\frac{1-\eta}{1-\alpha\eta}} \geq (z_b)^{\frac{1-\eta}{1-\alpha\eta}} + \left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\alpha\eta}}\frac{\nu}{1-\alpha\eta}(e)^{-\frac{(1-\alpha)\eta}{1-\alpha\eta}}$$

This inequality is satisfied if and only if z_l is sufficiently close to z_b.

C.4 Proof of Proposition 8 TBC

Part A: We first show that for any level of TFP $z_l \in [z_s^*, z_b^*(0))$ and $z_b \geq z_l$ there exists a threshold level of equity $\tilde{e}(z_l, z_b) \geq 0$ such that the entrepreneur will operate two firms concurrently if the entrepreneur has equity $e \geq \tilde{e}(z_l, z_b)$, one firm if $e < \tilde{e}(z_l, z_b)$ and $z_b \geq z^*(e)$, and zero firms is $z_b < z^*(e)$.

Moreover, Proposition 1 implies that if $z_l < z_s^*$ the entrepreneur will not operate the least productive firm, while if $z_l \geq z_b^*(0)$ the entrepreneur will always operate two firms concurrently, regardless of the level of equity. This proves that conditional on TFP levels (z_l, z_b), the number of firms operated concurrently is monotone increasing in equity.

Part B: Note first that if $z_l = z_b$ then equity would be divided equally across firms if they were to operate concurrently. Therefore, both firms would operate if and only if $z_l \geq z^*(e/2)$. We now show that if $z_b > z_l$, there is a threshold $\tilde{z}(e, z_l)$ so that both firms would operate if $z_b \leq \tilde{z}(e, z_l)$ and only the most productive firm would operate if $z_b > \tilde{z}(e, z_l)$.

It follows that the number of concurrent firms is monotone decreasing in the difference $z_b - z_l$. QED

C.5 Proof of Proposition 3

Proposition 3amounts to proving that if $\rho \geq 0$ then

$$E[z|z \geq a, \rho z + \epsilon \geq b] \geq E[z|z \geq a],$$

where $a = z^*(e_0)$ and $b = z^*(e_1)$.

The main idea is to show that (1) adding the condition $\rho z + \epsilon \geq b$ is equivalent to multiplying an increasing function $h(z)$ to the pdf conditional on $z \geq a$, denoted as $f(z)$ and (2) generally, if we multiply pdf $f(z)$ by an increasing function $h(z)$ to get a new pdf $g(z)$, then $g(z)$ first order dominates $f(z)$ and leads to higher expected z.

First, denote unconditional pdf and cdf of z as $i(z)$ and $I(z)$, and pdf and cdf of ϵ as $j(z)$ and $J(z)$, then the pdf conditional on $z \geq a$ can be expressed as

$$f(z) = \frac{i(z)}{1-I(a)}, z \geq a.$$

Then pdf of z conditional on $z \geq a, \rho z + \epsilon \geq b$ is

$$\begin{aligned} g(z) &= f(z) \frac{\int_{b-\rho z}^{\infty} j(\epsilon)\, d\epsilon}{\int_a^{\infty} f(x) \int_{b-\rho x}^{\infty} j(\epsilon)\, d\epsilon dx} = f(z) \frac{1 - J(b - \rho z)}{\int_a^{\infty} f(x)(1 - J(b - \rho x))\, dx} \\ &\doteq f(z) \frac{h(z)}{\int_a^{\infty} f(x) h(x)\, dx}, \end{aligned}$$

where $h(z) = 1 - J(b - \rho z)$ is an increasing functions of z.

Next, we illustrate the impacts of multiplying $h(z)$ to a pdf $f(z)$. Define

$$g(z) = \frac{f(z) h(z)}{\int f(x) h(x)\, d(x)} \doteq \frac{f(z) h(z)}{H},$$

where H is a constant to turn $\int g(z)\, dz = 1$ and make g also a pdf.

Third, we show that g first order dominate (FOD) f, i.e., for any z, we have $G(z) < F(z)$. If z is small, such that $h(z) \leq H$, then

$$\begin{aligned} G(z) &= \int^{z} \frac{f(x) h(x)}{H} dx < \int^{z} \frac{f(x) h(z)}{H} dx \\ &= F(z). \end{aligned}$$

If z is large, such that $h(z) > H$, then

$$\begin{aligned} 1 - G(z) &= \int_{z} \frac{f(x) h(x)}{H} dx > \int_{z} \frac{f(x) h(z)}{H} dx \\ &= 1 - F(z). \end{aligned}$$

FOD implies higher expected value. To see this, note that for any z and $F(z)$, we can find a corresponding $y > z$ such that $G(y) = F(z)$, because $G(z) < F(z)$ and G is increasing. Then

$$\begin{aligned} E[z|F] &= \int z dF(z) = \int z dG(y) < \int y dG(y) = \int z dG(z) \\ &= E[z|G]. \end{aligned}$$

Finally, recall from Corollary 1 that conditional on operating one and only one firm, the installed capital is monotone increasing in TFP. Since average TFP of the 1st-SE firm is larger than the average TFP of the Non-SE, it follows that the initially installed capital of the 1st-SE is larger than that of the Non-SE firm. QED