Serial Entrepreneurship in China*

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Abstract

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 theory of entrepreneurship driven by endowments, ability, and capital market frictions. We also examine 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, less productive serial entrepreneurs are more likely to switch sectors when establishing new firms, with the choice of sector influenced by 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. 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 selected because of highly persistent skills, i.e., individuals good at identifying new business opportunities; alternatively, their advantage may lie in better access to scarce factors or connections, which help them secure finance and overcome barriers that might exist. If serial entrepreneurship is driven by *persistent skills*, we expect them to be better than average; if driven by *non-skill advantages* such as connections and access to capital, we expect the opposite. We also study the mobility across sectors for SEs and explore how these choices are revealing of potential 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 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. Borrowing is limited by collateral constraints: entrepreneurs can collateralize only a fixed fraction of their capital stock.

The theory has a number of implications. We start with 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.

Our main focus is how SE differ from non-serial entrepreneurs. Their relative productivity is shaped by a fundamental trade-off between persistence of skills (i.e., productivity across different potential firms for an individual entrepreneur) and heterogeneity in entrepreneurs' non-skill advantages at starting firms. On the one hand, if skills are sufficiently persistent and potential entrepreneurs are identical except for the initial draw of TFP, the first firm started by a SE should on average be more productive than other firms in the same industry, and the second SE firm should be even more productive. The reason is that serial entrepreneurs are positively selected on TFP. On the other hand, if the persistence of skills is sufficiently low and some entrepreneurs have large non-skill advantages, serial entrepreneurs should have lower TFP than non-serial entrepreneurs, the reason being that serial entrepreneurs are selected on traits other than TFP.

We find that the empirical evidence is in line with the persistent-skills force dominating: 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 11% and 18% 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 sequentially, 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 (Brandt and Li (2003); 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 the choice of sector for the 2nd SE firm, 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 (60% 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. If the 2nd-SE firm is in a different 1-digit industry, then the TFPs for both 1st- and the 2nd-SE firms are around 67% lower than the case when the 1st- and the 2nd-SE firms are in the same 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 are 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

[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.

and other studies discuss the relative importance of entrepreneurial learning by doing, ability, and luck in understanding serial entrepreneurship.[2] Finally, Feliz, Karmakar and Sedlacek (2021) provides stylized facts on serial entrepreneurs in Portugal and find that they operate 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. Section 3 lays out a stylized model of entrepreneurship and serial entrepreneurship. Section 4 confronts the theoretical predictions with our Chinese data on serial entrepreneurship. Section 5 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 6 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 operating in China since 1949. It contains information on the year of establishment, exit date (if applicable), primary 4-digit industry, location, background of its legal representative, registered capital, and investors in the firm and their share.[3] 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.

[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. A small percentage of unincorporated firms such as TVEs do not have registered capital. We retain these firms but drop those incorporated firms with no registered capital information. We also drop firms, comprising 4.5% of the sample, with missing or invalid information on location and industry.

We use a snapshot of the data at the end of 2015, supplemented with information collected by SAIC on changes in the registered capital of firms, and report all empirical facts for the post-1995 time period.[4,5]

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 for regulatory purposes 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*. Responsibility for collection was delegated to local SAIC offices, and originally was done manually. In 2007, information began to be collected digitally, which contributed to a significant increase in its coverage.[6] The inspection system was abolished in 2014 as part of the reform of the business registry system, and replaced by an annual self-reporting system. For quality reasons, we restrict our use to 2008-2012. The Appendix provides more information on 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 − 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 accurate. 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 a growing number of 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 non-serial and serial firms may be related to these issues. As explained more fully below, most of our analysis uses data through 2012.

[5]SAIC records in a separate database all changes in firm location, registered capital, and ownership in the form of unstructured texts. We successfully extract and use the data on changes in registered capital of firms over time, which shows that approximately 10% of firms updated their initial registered capital. The ownership information is harder to extract because of the more complicated format of the data reported.

[6]Between 2007 and 2008, the number of prefectures that were not reporting declined from 159 to 98, and by 2012 fell to 81, which were concentrated in 7 provinces.

Table 1: Firms in China, by Ownership Type, Registry Data, 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	1,430,103	696,360	167,405	282,714	23,409	185,971	74,244	1,308,997
1996	1,643,682	744,208	190,893	388,025	30,089	196,750	93,717	1,316,905
1997	1,871,490	782,314	218,856	515,180	36,410	205,797	112,933	1,258,499
1998	2,140,039	796,678	258,381	695,444	44,544	211,512	133,480	1,116,969
1999	2,391,549	792,066	298,586	884,976	50,206	215,840	149,875	976,950
2000	2,695,474	777,957	349,285	1,126,996	58,210	215,650	167,376	814,285
2001	3,035,907	749,190	413,114	1,411,723	69,150	210,493	182,237	662,684
2002	3,471,415	732,381	502,352	1,750,830	81,662	206,339	197,851	551,899
2003	4,009,790	706,995	603,567	2,184,454	95,541	201,932	217,301	462,327
2004	4,618,975	678,845	728,560	2,667,475	112,286	197,961	233,848	387,707
2005	5,227,288	652,670	848,383	3,149,658	127,626	198,133	250,818	328,340
2006	5,823,894	627,669	1,025,673	3,557,152	142,378	205,643	265,379	285,420
2007	6,250,449	595,254	1,173,769	3,840,937	151,779	213,192	275,518	240,008
2008	6,694,951	566,598	1,323,365	4,142,290	158,127	221,270	283,301	214,270
2009	7,392,919	553,404	1,515,931	4,619,457	172,394	233,686	298,047	196,156
2010	8,344,938	545,334	1,763,082	5,267,974	193,274	252,365	322,909	180,745
2011	9,449,050	548,094	2,056,461	6,002,784	216,729	273,391	351,591	165,736
2012	10,433,087	546,815	2,341,327	6,636,122	237,491	293,355	377,977	149,325
2013	11,993,517	578,233	2,875,091	7,528,168	278,799	320,477	412,749	142,201
2014	14,664,539	619,902	3,847,231	8,899,364	454,639	369,777	473,626	138,690
2015	17,823,017	757,257	5,143,272	10,353,350	585,905	431,477	551,756	133,561

Notes: Authors' calculations from the Registry Data. Ownership type is identified based on the largest shareholder in a firm: either an individual, an enterprise, or the government.

Firms for which the largest investor is not registered are classified as *Unregistered*. In most of these cases, the largest investor is a government entity such as the State-owned Assets Supervision and Administration Commission (SASAC), or an unincorporated enterprise, i.e. an enterprise that had not been formally incorporated as part of China's Corporate Law in 2004, which include collectively- and state-owned enterprises.

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 largest individual 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 2.7 million (columns (1) plus (8)) in 1995 to 17.9 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, Registry Data, 1995-2015.

Year	Total	Unregistered	Individual		Enterprise	
			Single	Multiple	Single	Multiple
1995	7.28	8.40	1.74	2.69	9.45	22.35
1996	7.00	8.41	1.70	2.60	9.59	20.60
1997	6.76	8.45	1.71	2.52	10.02	19.29
1998	6.48	8.68	1.70	2.39	10.50	18.53
1999	6.52	9.51	1.70	2.30	12.13	18.23
2000	6.47	10.24	1.69	2.24	14.34	18.46
2001	6.37	11.07	1.70	2.22	16.47	19.38
2002	6.20	11.96	1.62	2.17	18.82	20.20
2003	6.29	13.43	1.65	2.18	25.26	21.13
2004	6.14	14.84	1.67	2.18	27.68	23.33
2005	6.03	16.53	1.68	2.21	29.31	24.52
2006	6.00	18.39	1.68	2.27	30.37	25.95
2007	6.52	23.36	1.74	2.42	32.54	29.21
2008	6.74	26.41	1.79	2.53	34.35	31.98
2009	6.91	28.99	1.84	2.70	36.59	35.30
2010	7.13	31.78	1.93	2.93	39.10	39.02
2011	7.32	34.20	1.96	3.18	41.23	43.01
2012	7.53	36.96	2.01	3.34	43.63	46.69
2013	7.62	39.58	1.95	3.51	44.78	50.63
2014	7.83	40.66	2.24	4.09	45.65	54.20
2015	7.71	35.94	2.44	4.40	43.63	55.29

Notes: Authors' calculations from the Registry Data.

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 31% of all firms in 1995 to 87% in 2015. By 2015, as reported in Appendix Table A-3 which also excludes the *Unreported* firms, these firms held 42.3% of all the registered capital in the economy, up from 10.1% in 1995.

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 of our baseline sample of *Individual* firms, either single or multiple. For more than 80% of 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 period up through 2015 in order to identify an individual as a serial entrepreneur. Any entrepreneur that established two or more firms by 2015 is classified as serial. 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. In the following analysis, we use *1st-SE* to represent the first firm of SE and *2nd-SE* to denote second and following firms of SE.[7]

SE firms over time. Table 3 highlights the changing role of SE firms over time in our data. By construction, we likely underestimate the number and role of SE firms in later years as the window for new entrepreneurs to start 2nd firms narrows. As shown in column (2), the fraction of SE firms increased from 30.6% in 1995 to 33.9% in 2005 before falling to 28.2% in 2015. We observe similar behavior with respect to registered capital of SE firms which increased from 42.6% in 1995 to a high of 50.0% in 2011 before falling to 46.9% in 2015. Over the entire period, the average registered capital in SE firms is about two times larger than in Non-SE firms and has increased over time.

The changing role over time of SE firms, in terms of their number, can be a product of differences in either entry or exit patterns, which we report separately by type of firm in Table 4.[8] Entry rates for 1st-SE firms lag those for Non-SE firms for most years, but this is more than offset by the higher entry rate for 2nd SE firms. 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 documented in Table 3 is due to the higher entry rates of 2nd SEs and larger registered capital of SEs.

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 or 1st-SE is still operating. Clearly, most of the new firms are run concurrently with the previously established firms: in total, 86.2% of the serial entrepreneurs establish their second firm and following firms concurrently with their previous firm.

[7]Following Lafontaine and Shaw (2016), we drop entrepreneurs who established more than twenty firms to exclude the opening of large chain stores in our analysis. This restriction eliminates only 542 entrepreneurs with a total of 188,266 firms, which is very small compared to the remaining 17,085,823 entrepreneurs with 20,608,549 firms

[8]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, Registry Data, 1995-2015.

Year	Number of firms		Total registered capital (in trill.)		Mean registered capital (in mill.)	
	Number	SE (%)	Capital	SE (%)	SE	Non-SE
	(1)	(2)	(3)	(4)	(5)	(6)
1995	353,319	30.61	0.82	42.58	3.22	1.91
1996	476,077	31.08	1.07	44.25	3.19	1.81
1997	625,160	31.58	1.38	43.98	3.07	1.80
1998	839,072	32.11	1.77	44.71	2.94	1.72
1999	1,065,698	32.65	2.19	45.11	2.84	1.67
2000	1,360,283	33.14	2.74	46.39	2.82	1.61
2001	1,714,500	33.54	3.42	46.54	2.77	1.61
2002	2,144,883	33.71	4.18	46.92	2.72	1.56
2003	2,681,983	33.90	5.27	47.35	2.75	1.57
2004	3,299,761	33.91	6.51	47.66	2.77	1.56
2005	3,906,842	33.93	7.83	47.68	2.82	1.59
2006	4,499,496	33.73	9.21	47.69	2.90	1.62
2007	4,938,521	33.64	10.70	48.06	3.09	1.70
2008	5,395,817	33.51	12.19	48.44	3.27	1.75
2009	6,072,664	33.29	14.55	49.03	3.53	1.83
2010	6,971,506	32.90	18.09	49.48	3.90	1.95
2011	8,003,341	32.27	22.29	49.99	4.31	2.06
2012	8,922,821	31.67	25.98	49.71	4.57	2.14
2013	10,347,113	30.58	31.05	49.32	4.84	2.19
2014	12,684,705	29.46	43.84	48.31	5.67	2.53
2015	15,351,831	28.21	60.22	46.94	6.53	2.90

Notes: Authors' calculations from the Registry Data. SE stands for Serial Entrepreneur firms. Capital is calculated based on the registered capital in a firm.

3 A Model of Entrepreneurship

We now lay out a model of entrepreneurship. Before studying the decision to become a serial entrepreneur, Section 3.1 analyzes the decision to start a firm, i.e. to become an entrepreneur in a static setting. In Section 3.2 we 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.

3.1 First Period: TFP, Capital, and Debt in a Static Model

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 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.

Table 4: Entry and Exit of Firms, by Serial Entrepreneur Status, Registry Data, 1995-2015.

Year	Non-SE					1st-SE					2nd-SE				
	Survival	New	Exit	Entry rate (%)	Exit rate (%)	Survival	New	Exit	Entry rate (%)	Exit rate (%)	Survival	New	Exit	Entry rate (%)	Exit rate (%)
1995	245,184	75,026	1,368	43.74	0.80	94,771	30,082	361	46.24	0.55	13,364	4,083	45	43.78	0.48
1996	328,122	86,795	3,857	35.40	1.57	129,162	35,493	1,102	37.45	1.16	18,793	5,656	227	42.32	1.70
1997	427,721	107,528	7,929	32.77	2.42	170,545	43,664	2,281	33.81	1.77	26,894	8,538	437	45.43	2.33
1998	569,607	155,760	13,874	36.42	3.24	229,270	62,946	4,221	36.91	2.48	40,195	14,167	866	52.68	3.22
1999	717,729	175,139	27,017	30.75	4.74	290,023	69,929	9,176	30.50	4.00	57,946	19,737	1,986	49.10	4.94
2000	909,536	227,523	35,716	31.70	4.98	366,075	87,945	11,893	30.32	4.10	84,672	29,718	2,992	51.29	5.16
2001	1,139,399	283,334	53,471	31.15	5.88	453,020	104,514	17,569	28.55	4.80	122,081	42,932	5,523	50.70	6.52
2002	1,421,780	350,911	68,530	30.80	6.01	548,311	120,301	25,010	26.56	5.52	174,792	60,755	8,044	49.77	6.59
2003	1,772,821	442,237	91,196	31.10	6.41	657,844	144,159	34,626	26.29	6.32	251,318	88,057	11,531	50.38	6.60
2004	2,180,848	525,563	117,536	29.65	6.63	776,224	160,930	42,550	24.46	6.47	342,689	108,407	17,036	43.14	6.78
2005	2,581,179	544,575	144,244	24.97	6.61	879,714	154,377	50,887	19.89	6.56	445,949	126,796	23,536	37.00	6.87
2006	2,981,665	580,523	180,037	22.49	6.97	965,436	145,174	59,452	16.50	6.76	552,395	138,356	31,910	31.03	7.16
2007	3,277,086	564,395	268,974	18.93	9.02	1,017,901	134,546	82,081	13.94	8.50	643,534	139,312	48,173	25.22	8.72
2008	3,587,587	577,054	266,553	17.61	8.13	1,071,828	132,180	78,253	12.99	7.69	736,402	144,553	51,685	22.46	8.03
2009	4,051,297	728,279	264,569	20.30	7.37	1,150,743	153,948	75,033	14.36	7.00	870,624	188,445	54,223	25.59	7.36
2010	4,677,688	898,131	271,740	22.17	6.71	1,239,215	161,397	72,925	14.03	6.34	1,054,603	241,401	57,422	27.73	6.60
2011	5,420,688	1,053,245	310,245	22.52	6.63	1,319,033	158,017	78,199	12.75	6.31	1,263,620	276,005	66,988	26.17	6.35
2012	6,097,177	1,051,010	374,521	19.39	6.91	1,366,441	133,261	85,853	10.10	6.51	1,459,203	278,569	82,986	22.05	6.57
2013	7,182,716	1,437,989	352,450	23.58	5.78	1,431,581	142,323	77,183	10.42	5.65	1,732,816	359,868	86,255	24.66	5.91
2014	8,947,389	2,046,414	281,741	28.49	3.92	1,515,725	141,247	57,103	9.87	3.99	2,221,591	557,685	68,910	32.18	3.98
2015	11,021,518	2,375,714	301,585	26.55	3.37	1,536,162	72,372	51,935	4.77	3.43	2,794,151	650,190	77,630	29.27	3.49

Notes: Authors' calculations from the Registry Data. Survival measures the number of firms in a given year while New and Exit denote the number of new and exiting firms in a given year, respectively.

Table 5: Firms Run Concurrently by Serial Entrepreneurs, Registry Data, 1995-2015.

Type	Number of Firms (1)	Number of Firms of Entrepreneurs with Prior Firm Still Operating (2)	Concurrent Ratio (in %) (3)
Non-SE	14,428,235	–	–
1st-SE	2,417,998	–	–
2nd-SE	2,477,153	2,044,358	82.5%
3rd-SE	636,878	594,934	93.4%
4th-SE	218,323	211,460	96.9%
5th-SE	89,340	87,691	98.2%
6th-SE+	91,447	90,674	99.2%
Total 2nd-SE+	3,513,141	3,029,117	86.2%

Notes: Authors' calculations from the Registry Data. Concurrently run firms are those that are established while the previous firm is still operating.

Firms hire labor at a constant wage rate w. Entrepreneurs finance capital $k = e + b$ through equity e and debt b. Banks offer loans at rate R but are not willing to lend more than a share $1 - 1/\lambda \in [0, 1)$ of installed capital, where $\lambda \geq 1$. This limits the installed capital stock to $k \leq \lambda e$. One can also deposit equity in banks at the same rate R.

The entrepreneur starts with equity $e \geq 0$ and an opportunity to operate (or start) one firm with potential TFP z. Conditional on having chosen to operate, the firm's objective is given by

$$\begin{aligned} \Pi &= \max_{k,n,b} \{y - wn - Rb\} \\ & \text{subject to} \\ b &\leq (\lambda - 1) e, \qquad k = e + b \geq 0. \end{aligned}$$

A constrained entrepreneur will always invest all his/her equity in the firm. For simplicity we abstract from depreciation on capital. The problem can be separated into two different cases: (1) unconstrained and (2) constrained, i.e., $b = (\lambda - 1) e$. Thus, an entrepreneur is either constrained, choosing $k = \lambda e$ and $n = \arg\max_n \left\{ z^{1-\eta} \left((\lambda e)^{1-\alpha} n^{\alpha} \right)^{\eta} - wn \right\}$, or unconstrained and choosing $(k, n) = \arg\max_{k,n} \{y - wn - Rk\}$. 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*

$$z^* (e) = \begin{cases} \left(\frac{\nu + R\lambda e}{1-\alpha\eta} \right)^{\frac{1-\alpha\eta}{1-\eta}} (\lambda e)^{-\frac{(1-\alpha)\eta}{1-\eta}} \left(\frac{w}{\alpha\eta} \right)^{\frac{\alpha\eta}{1-\eta}} & e < zk^*/\lambda \\ z^* & e \geq zk^*/\lambda \end{cases}, \tag{2}$$

where

$$\begin{aligned} k^* &\equiv \left(\frac{(1-\alpha)\eta}{R} \right)^{\frac{1-\alpha\eta}{1-\eta}} \left(\frac{\alpha\eta}{w} \right)^{\frac{\alpha\eta}{1-\eta}} \\ z^* &\equiv \frac{\eta}{1-\eta} \frac{1-\alpha}{R} \frac{\nu}{k^*}. \end{aligned}$$

Moreover, for operating firms the optimal installed capital and debt of the firm are given by the functions

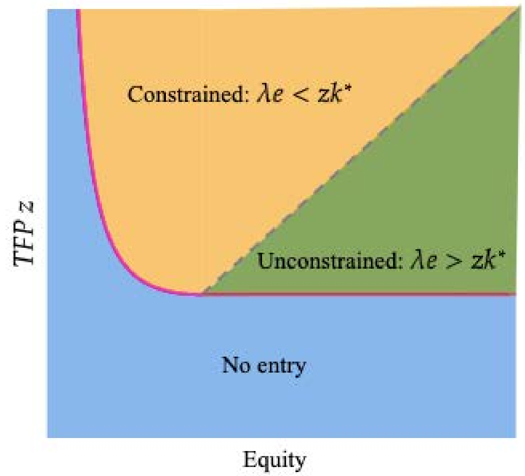
$$\begin{aligned} K^* (z, e) &= \begin{cases} \lambda e & \text{if } \lambda e < zk^* \\ zk^* & \text{if } \lambda e \geq zk^*/\lambda \end{cases} \\ B^* (z, e) &= \begin{cases} (\lambda - 1) e & \text{if } \lambda e < zk^* \\ zk^* - e & \text{if } \lambda e \geq zk^* \end{cases}. \end{aligned} \tag{3}$$

Proof. The proof is in the appendix. □

Figure 1 illustrates how the combination of e and z fall into three distinct regimes: no entry, unconstrained, and constrained. The solid graph $z^* (e)$ marks the indifference between entry and no entry. The entrepreneur chooses to operate the firm if and only if TFP is sufficiently large, $z \geq z^* (e)$. The function $z^*(e)$ is falling in the level of equity e, implying that a larger e is associated with a (weakly) lower threshold $z^*(e)$. The reason is that when e is low, the maximum capital that can be installed is also low. This in turn increases the need for a large TFP in order to recover the fixed cost.

The dashed line marks the border between constrained and unconstrained entrepreneurs. Along this line the optimal installed capital for an unconstrained entrepreneur is exactly $zk^* = \lambda e$. Note that if equity e is sufficiently large, the entrepreneur would be unconstrained for low levels of z and constrained when z is sufficiently large.

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.

The debt-equity ratio for the entrepreneur is given by

$$\frac{b}{e} = \frac{K^*(z,e) - e}{e} = \begin{cases} \lambda - 1 & \text{if } \lambda e < zk^* \\ \frac{zk^*}{e} - 1 & \text{if } \lambda e \geq zk^* \end{cases} \tag{4}$$

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. *Capital is monotone increasing in equity.*
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.*

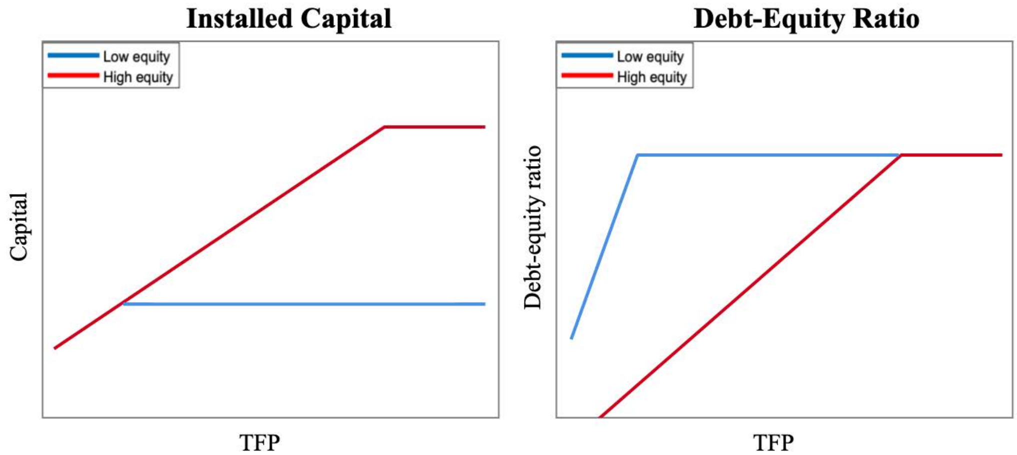
Proof: Implications 1 and 2 follow directly from equation (3) and implication 3 follows from from equation (4). QED

Figure 2 illustrates parts 2 and 3 of Corollary 1, i.e., the choice of capital and debt-equity ratio as functions of TFP.

3.2 The Dynamic 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.

Figure 2: Capital and Debt-Equity Ratio.



Notes: The figure shows the installed capital (left panel) and debt-equity ratio (right panel) for an entrepreneur operating one firm as a function of TFP z for two levels of initial equity.

At the beginning of the second 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, the birth date of each firm is irrelevant. The only relevant aspect of each firm is their respective TFP and it does not matter whether a firm was started in the first or the second period.

Our main focus is the mechanism of serial entrepreneurship originating from persistent skills. We now lay out this aspect of the model. The performance of SE firms relative to non-serial firms (Non-SE) and the performance of the first firm established by an SE versus her subsequent (newer) firm depend on how TFP draws for a potential entrepreneur are correlated over time, i.e., over the entrepreneur's life cycle. To obtain a transparent exposition, we assume that skills are positively autocorrelated.

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

$$z_{i2} = \rho z_{i1} + \varepsilon_i, \tag{5}$$

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

The parameter ρ captures the extent to which an entrepreneur's persistent innate ability matters for the productivity of potential firms she starts.

3.2.1 Persistent Skills in a Frictionless Benchmark

Consider first the case with perfect capital markets, i.e., when $\lambda \to \infty$. From Proposition 1, an entrepreneur will open a firm in the second period if and only if $z_2 \geq z^*$. Note that this decision is independent of equity and independent of the TFP draw z_1 for a possible firm in the first period.

To understand the relative performance of serial entrepreneurs in this setting it is useful to state a lemma on conditional expectations.

Lemma 1. *If $\rho \geq 0$ then*

$$E\{z|z \geq a \ \text{ and } \ G(z) + \epsilon \geq b\} \geq E\{z|z \geq a\},$$

where G is a monotone increasing function, z and ε are stochastic variables, and a and b are constants.

We sketch the proof of this lemma here, and provide a complete proof of Lemma 1 in the appendix. The proof relies on showing that adding the condition that an increasing function of z is sufficiently large, $G(z) + \epsilon \geq b$ for some b, changes the probability density function of z conditional on $z \geq a$ by multiplying it by a weight that is increasing in z. The lemma then follows from first-order stochastic dominance.

When setting $G(z) = \rho z$ and $a = b = z^*$ and interpreting z and $\rho z + \epsilon$ as the TFP draw in the first and second period, respectively, Lemma 1 implies that 1st-SE firms will on average have higher TFP than non-serial firms provided that $\rho > 0$. A similar argument establishes that 2nd-SE firms are on average also more productive than non-serial firms when $\rho > 0$.[9] The intuition is that when the draws are positively correlated, the TFP for the firms of an entrepreneur who twice obtains draws above the common threshold z^* must first-order stochastic dominate TFP for firms of entrepreneurs who obtained one draw above and one below the threshold.

The ranking of average TFP for the 1st-SE and the 2nd-SE depends on the persistence ρ of draws. In particular, if ρ is sufficiently close to unity, the 2nd-SE firm will on average have a higher TFP. To see this, note first that the left tail of the realized distribution of ε is always truncated because the entrepreneur would choose to enter with the 2nd firm only if $z_2 = \rho z_1 + \varepsilon \geq z^*$. Given z_1, this condition imposes a lower bound on ε. Second, with $\rho = 1$, the expected *potential* TFP for the 2nd firm is $z_2 = z_1 + E(\varepsilon) = z_1$. Because the entrepreneur would choose to operate it only if the realization of ε were sufficiently large, there is positive selection for the 2nd-SE firm. Therefore, conditional on entry, the realized TFP for 2nd-SE must have an expected TFP larger than z_1.

Finally, consider the case when TFP draws are i.i.d. over time ($\rho = 0$). When potential entrepreneurs are otherwise ex-ante identical, this implies that there is no information in being a SE. Therefore, SE and non-SE have the same expected TFP.

The discussion above leads to the following proposition.

Proposition 2. *Suppose there are no financial frictions ($\lambda \to \infty$). Consider an economy that has lasted for two periods.*

1. *If TFP draws are persistent ($\rho > 0$), both the 1st-SE and the 2nd-SE will have a larger expected TFP than non-serial entrepreneurs. If ρ is sufficiently large, the 2nd-SE will on average have a higher TFP than the 1st-SE.*

2. *If $\rho = 0$, non-serial and serial firms have the same expected TFP.*

3.2.2 Persistent Skills under Financial Frictions

Consider now the choices for entrepreneurs who face financial frictions in the form of a collateral constraint on borrowing ($\lambda < \infty$).

The following proposition characterizes the 2nd-period entry decisions for an entrepreneur who operated a firm in the first period.

[9] To see this, note that Lemma 1 also implies that $E\left[z_2|z_2 \geq b, z_2 \geq a - \epsilon/\rho\right] \geq E\left[z_2|z_2 \geq b\right]$, where $\tilde{\varepsilon} \equiv -\varepsilon/\rho$ is a stochastic variable and $z_1 = z_2/\rho - \varepsilon/\rho = z_2/\rho + \tilde{\varepsilon}$.

Proposition 3. *Consider the 2nd-period choice of an entrepreneur who operated a firm with TFP z_1 in the first period. The entrepreneur has equity e and a potential 2nd firm with TFP z_2. The entrepreneur will enter, operate the 2nd firm, and become a Serial Entrepreneur if and only if z_2 is sufficiently large, $z_2 \geq Z(z_1, e)$, where the threshold function Z is given by*

$$Z(z_1, e) = \begin{cases} z^* & \text{when} \quad \lambda e \geq (z_2 + z_1) k^* \\ \bar{Z}(z_1, e) & \text{when} \quad \lambda e \in [z_1 k^*, (z_2 + z_1) k^*) \\ \underline{Z}(z_1, e) & \text{when} \quad \lambda e < z_1 k^*, \end{cases}$$

and

$$\bar{Z}(z_1, e) = \left(1 + \frac{1-\eta}{1-\alpha\eta}\left(\frac{z_1 k^*}{\lambda e} - 1\right) + \frac{(1-\alpha)\eta}{1-\alpha\eta}\frac{1}{\lambda e}\frac{v}{R}\right)^{\frac{1-\alpha\eta}{1-\eta}} \frac{\lambda e}{k^*} - z_1$$

$$\underline{Z}(z_1, e) = \left((z_1)^{\frac{1-\eta}{1-\alpha\eta}} + \left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\alpha\eta}} \frac{\nu}{1-\alpha\eta} (\lambda e)^{-\frac{(1-\alpha)\eta}{1-\alpha\eta}}\right)^{\frac{1-\alpha\eta}{1-\eta}} - z_1.$$

The function Z satisfies $Z(z_1, e) \leq z_1$ and is monotone increasing in z_1 and monotone falling in e.

Figure 3 illustrates the decision to enter for a second firm. The graph shows the threshold $Z(z_1, e)$ for the TFP of the 2nd firm as a function of the TFP of the first firm z_1. If the TFP draws z_1 and z_2 are low relative to the entrepreneur's equity, she will be unconstrained in the sense that she has sufficient equity to fund both firms at the optimal size (area labeled "Unconstrained").[10] The threshold is therefore constant at $Z = z^*$.

For intermediate levels of z_1 and z_2 the entrepreneur will be constrained when operating two firms but unconstrained when operating one firm (area labeled "Constrained 2"). In this case the opportunity cost of equity is larger and this cost is increasing in z_1. Therefore, the threshold $Z(z_1, e)$ is monotone increasing in z_1. The dotted black line marks the combinations of z_1 and z_2 for which equity would be exactly sufficient to fund the most productive firm at the optimal size, $\lambda e = z_j k^*$.

For higher levels of z_1 and z_2 the entrepreneur will be constrained even when operating just one firm (area labeled "Constrained 1"). This further increases the opportunity cost of equity and the threshold keeps growing in z_1.

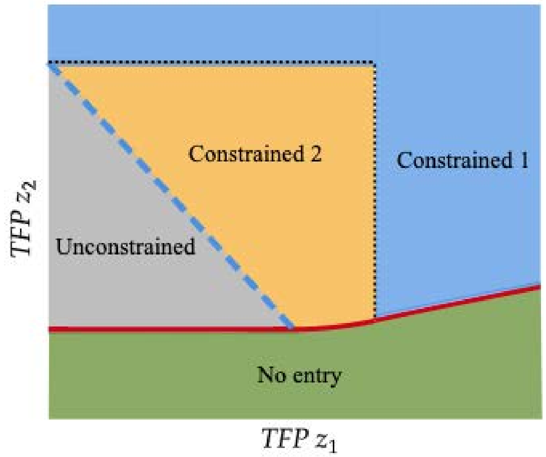
The opportunity cost of equity is lower when equity is more abundant. Entrepreneurs with more equity are therefore more likely to start the second firm. It follows that $Z(z_1, e)$ is monotone decreasing in e.

Note that $Z(z, e)$ is always below the 45-degree line in z. 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.[11] The fact that the birth date of each firm is irrelevant implies that the entrepreneur will always choose to operate the most productive firm in the second period. 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 $Z(z_1, e) \leq z_1$.

[10] The blue dashed line marks the combinations of z_1 and z_2 for which equity is exactly sufficient to fund both firms at the optimal size, $\lambda e = (z_1 + z_2)k^*$.

[11] 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.

Figure 3: Entry Decision for 2nd Firm.



Notes: The figure shows the entry threshold for the 2nd firm of entrepreneurs as a function of the TFP of the entrepreneur's first firm, z_1.

Operating firms concurrently or sequentially. Note that even if $z_2 < z_1$ it might be optimal to start the second firm (so long as $z_2 \geq Z(z_1, e)$). However, in this case the entrepreneur would prefer to keep operating the first firm. She would then be recorded as a serial entrepreneur. Conversely, if $z_2 < Z(z_1, e)$ the entrepreneur would pass on the 2nd firm and continue operating only the first one – and be recorded as a non-serial entrepreneur.

We now study in more detail the decision whether to operate both firms concurrently in the second period or, alternatively, close the first firm when starting the second firm. Recall that in the beginning of the second period, the birth date of each potential firms is irrelevant because capital can be freely allocated across firms and both the 1st and 2nd firm must pay the fixed operating cost ν if they operate in the second period. The optimal choice, which follows from Proposition 3, is characterized in the following corollary.

Corollary 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 sufficiently large to become a SE, $z_2 \geq Z(z_1, e)$. The entrepreneur will operate the two firms concurrently if z_1 is sufficiently close to z_2, i.e., if*

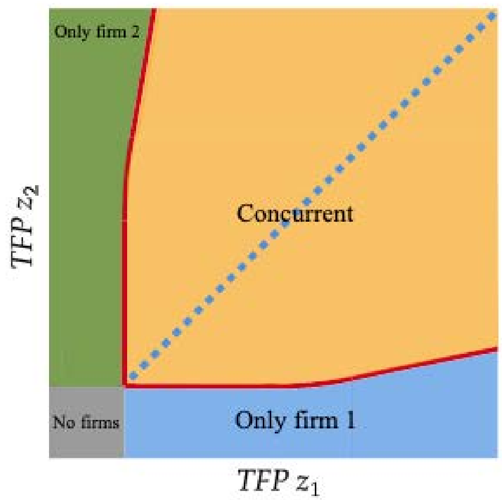
$$|z_2 - z_1| \leq |Z(z_2, e) - Z(z_1, e)| \tag{6}$$

The number of firms operated concurrently by an entrepreneur is monotone increasing in equity and monotone decreasing in the absolute TFP difference $|z_2 - z_1|$.

Proof: From Proposition 3, the two firms will be operated concurrently if both $z_2 \geq Z(z_1, e)$ and $z_1 \geq Z(z_2, e)$. The inequality condition (6) follows immediately as a necessary and sufficient condition for concurrent operation. QED

The TFP difference $z_1 - z_2$ matters because 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. Figure 4 illustrates this aspect of Corollary 2. In a range close to the 45-degree line – when z_1 is close to z_2 – it is optimal to operate the firms concurrently. However, when the difference $|z_2 - z_1|$ is large (one firm being much more productive), the opportunity cost of equity becomes so large that it is optimal to allocate all funds to one firm and not operate the least productive one. In other words, the larger the difference in TFP, the lower the chance that the entrepreneur will operate both firms concurrently. In the same vein, when equity is more abundant, the opportunity cost of equity is lower. This explains why more equity increases the chance that the entrepreneur will operate both firms concurrently.

Figure 4: Entry Decision for 2nd Firm.



Notes: The figure illustrates the choice of whether to operate two firms concurrently or to operate just the most productive firm in the second period. These choices are determined by the combinations of z_1 and z_2 in the regions marked as "Concurrent", "1st firm only", or versus "2nd firm only".

Installed capital and debt. We are now ready to characterize the debt of a SE and how much capital she would install in each firm. 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 ($z_h \geq z_l$). This is without loss of generality because the birth date of each firm is irrelevant, as discussed above.

Corollary 3. *Consider an entrepreneur who has the option to operate two firms with TFP $z_h \geq z_l$. The installed capital in firms h and l are given by*

$$K_h(z_h, z_l, e) = \begin{cases} \lambda e & when \quad z_l < Z(z_h, e) \ \ and\ \lambda e < z_h k^* \\ z_h k^* & when \quad z_l < Z(z_h, e) \ \ and\ \lambda e \geq z_h k^* \\ \frac{z_h}{z_h + z_l} \lambda e & when \quad z_l \geq Z(z_h, e) \ \ and\ \lambda e < (z_l + z_h) k^* \\ z_h k^* & when \quad z_l \geq \bar{Z}(z_h, e) \ \ and\ \lambda e \geq (z_l + z_h) k^* \end{cases},$$

$$K_l(z_h, z_l, e) = \begin{cases} 0 & when \quad z_l < Z(z_h, e) \\ \frac{z_l}{z_h + z_l} \lambda e & when \quad z_l \geq Z(z_h, e) \ \ and\ \lambda e < (z_l + z_h) k^* \\ z_l k^* & when \quad z_l \geq \bar{Z}(z_h, e) \ \ and\ \lambda e \geq (z_l + z_h) k^* \end{cases}.$$

The total debt of the entrepreneur is given by

$$B(z_h, z_l, e) = \begin{cases} (\lambda - 1) e & when \quad z_l < Z(z_h, e) \ \ and\ \lambda e < z_h k^* \\ z_h k^* - e & when \quad z_l < Z(z_h, e) \ \ and\ \lambda e \geq z_h k^* \\ (\lambda - 1) e & when \quad z_l \geq Z(z_h, e) \ \ and\ \lambda e < (z_l + z_h) k^* \\ (z_h + z_l) k^* - e & when \quad z_l \geq \bar{Z}(z_h, e) \ \ and\ \lambda e \geq (z_l + z_h) k^* \end{cases}.$$

The proof of Corollary 3 follows directly from the proof of Proposition 3. The main takeaway from Corollary 3 is that all the theoretical implications concerning capital, debt, and equity from the static model (see Corollary 3) extend to the dynamic model. Namely, both capital and the debt-equity ratio are increasing in the TFP of each firm and capital (in each firm) is increasing in equity.

TFP for serial entrepreneurs. We now return to the TFP of serial versus non-serial firms. Financial frictions affect the predictions of TFP for serial versus non-serial entrepreneurs. The reason is that the level of equity matters for the threshold $Z(z_1, e)$. The proof of Proposition 2 relied on all potential entrepreneurs having the same TFP threshold z^* for starting firms. However, if equity is correlated with the TFP draws, Lemma 1 will not necessarily apply. In particular, if equity and TFP z_1 were negatively correlated, then entrepreneurs with low TFP would have a lower threshold (at least in the first period) and would therefore be more likely to enter, thereby possibly overturning the TFP ranking in Proposition 2.

To address this issue we impose a restriction on the distribution of initial equity and the initial TFP draw z_1, namely that TFP and initial equity are positively related. We state this as a formal assumption.

Assumption 2. *Assume that initial equity is monotone increasing in the initial TFP draw* z_1*.*

We believe that Assumption 2 is plausible in light of the fact that TFP is strongly positively correlated with initial equity in the data. To illustrate this fact, Figure 5 shows a scatter plot of equity against TFP, where newly established firms − either non-serial firms or 1st-SE firms − are ranked according to their equity and averages are calculated for each ventile of equity.[12]

Assumption 2 guarantees a unique TFP threshold for entry. Namely, there exists a TFP level $z^{**} \geq z^*$ so that an entrepreneur in period 1 will enter if and only if her TFP draw z_1 satisfies $z_1 \geq z^{**}$. From Assumption 2, any entrepreneur with $z_1 > z^{**}$ has at least as much equity as entrepreneurs with $z_1 = z^{**}$ and will choose to enter because they have both more equity and larger TFP than entrepreneurs with entrepreneurs with $z_1 = z^{**}$, who are indifferent. Conversely, no entrepreneur with TFP $z_1 < z^{**}$ will enter because they have lower TFP and less equity than those with $z_1 = z^{**}$.

We are now equipped to study the predictions of TFP in the presence of financial frictions.

Proposition 4. *Suppose Assumption 2 holds and there are financial frictions ($\lambda < \infty$). Consider an entrepreneur who operated a firm in the first period with TFP z_1, and who has the option to start a potential firm in period 2 with TFP z_2. If the persistence of TFP draws $\rho > 0$ is sufficiently large, both the 1st-SE and the 2nd-SE will have a larger expected TFP than non-serial entrepreneurs and the 2nd-SE will on average have a higher TFP than the 1st-SE.*

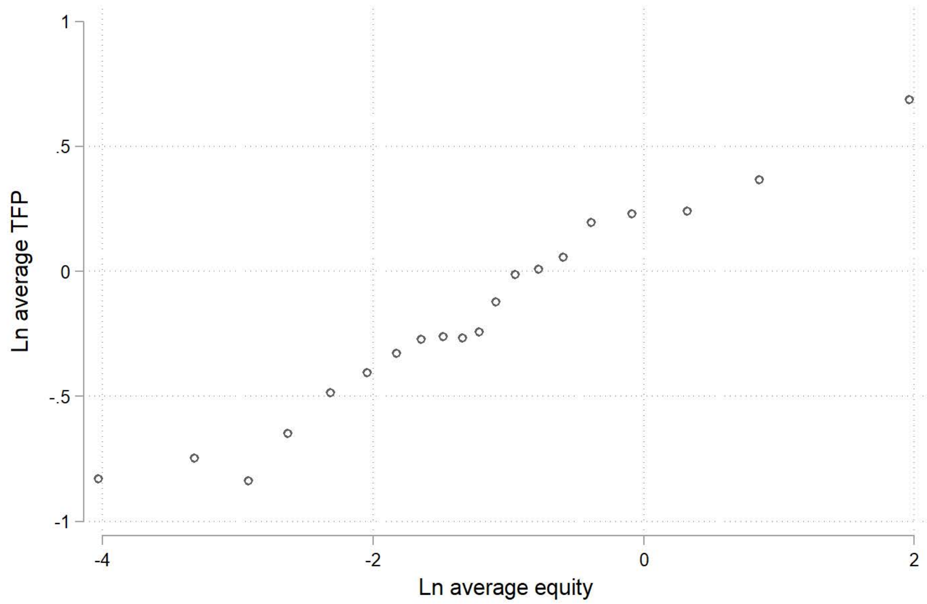
The proof is in the appendix.

We conclude that the predictions of Proposition 2 hold up in the presence of financial frictions provided that the persistence ρ is sufficiently large.[13]

[12] Drawing on the Inspection Data, we focus on new firms between the ages of one to four years. We drop firms in their initial year because of measurement error associated with the time of establishment during the year. For example, firms established in December would appear to have a very low TFP because value added is low even though capital and labor might be large.

[13] The predictions for TFP become ambiguous when ρ is sufficiently small. To see this, recall that the threshold function $Z(z_1, e_2)$ is monotone increasing in first-period TFP z_1. Therefore, when ρ is sufficiently small, the inequality (A-9) will be less likely to hold when z_1 increases. Lemma 1 then implies that if equity e_2 is held constant, the expected TFP of the 1st-SE firm will become *smaller* than that of non-serial firms.

Figure 5: Equity and TFP, Newly Established Non-Serial and 1st-SE Firms.



Notes: The figure plots the log average TFP and log average equity for non-serial and 1st-SE firms that are less than four years old in the Inspection Data. Based on their equity firms are divided into 20 ventiles, and the figure reports the averages for each ventile.

TFP for concurrent vs. non-concurrent firms. 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.

Corollary 2 implies that conditional on the TFP of the 1st-SE firm, the entrepreneur would enter with the second firm only if z_2 is sufficiently high (otherwise the entrepreneur would remain a non-SE). For intermediate levels of z_2 – larger than $Z(z_1, e)$ but sufficiently low that $z_1 \geq Z(z_2, e)$ – the entrepreneur would operate the two firms concurrently, while for sufficiently large levels of z_2 the entrepreneur would operate only the 2nd-SE firm (see also Figure 4). It follows that the 2nd-SE firm has a relatively low TFP when firms are operated concurrently and a relatively high TFP when they are operated non-concurrently.

The implications for TFP of the 1st-SE are the reverse: conditional on the TFP of the 2nd-SE firm (of a serial entrepreneur), the entrepreneur would operate the firms concurrently if z_1 is sufficiently large and non-concurrently if z_1 is sufficiently low. oIn other words, the more productive is the 1st-SE firm, the larger is the chance that the firms will be run concurrently with the 2nd-SE firm. This leads to our predictions about concurrent versus non-concurrent serial entrepreneurs, which we state in the following proposition.

Proposition 5. *TFP of 2nd-SE is lower for concurrently run SE firms than the 2nd-SE TFP 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.*

3.2.3 Non-skill Advantages

Our finding that persistence in TFP draws leads SE to be more productive than non-SEs rests on our maintained assumption that over and above their TFP draws, entrepreneurs face the same obstacles and trade-offs for becoming entrepreneurs. However, serial entrepreneurship might be driven by advantages enjoyed by some but not all potential entrepreneurs, leading them to start many firms. For example, some individuals might have better access to borrowing, i.e., a larger λ, or face a lower cost of a operating firm, i.e., a lower ν,

As an extension to our benchmark model, we now introduce non-skill advantages for some individuals and study the implications of allowing potential entrepreneurs to differ ex ante in their operating cost ν and/or borrowing limit λ. For simplicity, suppose the potential entrepreneurs are of two types – A and B. Agents of type A have a low ν and a large λ while type B have a high ν and a low λ. To study the effect of this heterogeneity in a transparent setting, we shut down the persistence channel by assuming that $\rho = 0$. Propositions 1 and 3 imply that entrepreneurs of type A have a lower TFP threshold both because of their lower ν and because of their higher λ. A lower threshold also makes them more likely to enter each period. It is straightforward to show that if their ν is sufficiently low and/or their λ is sufficiently high, the type-A agents will be over-represented among the serial entrepreneurs relative to their share among entrepreneurs who enter in the first period. The reason is that, conditional on TFP and equity, they are more likely to enter in the second period than the type-B entrepreneurs who started a firm in the first period. Moreover, since the type-A entrepreneurs have a lower TFP threshold and $\rho = 0$, the serial entrepreneurs will have *lower* TFP than non-SE.[14]

We state these results as a corollary.

Corollary 4. *If $\rho = 0$ and type-A entrepreneurs have a sufficiently low ν and a sufficiently high λ relative to type-B entrepreneurs, type-A entrepreneurs will be over-represented among serial entrepreneurs. Moreover, SE firms will on average have lower TFP than non-SE firms.*

We conclude that our model is sufficiently flexible to support various outcomes of TFP for SE relative to non-SE. The data will determine whether the persistent-skills channel or the non-skill advantage channel is more salient.

4 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 Section 3 are consistent with the empirical facts in China.

4.1 Theoretical Predictions Summarized

It is convenient to summarize the theoretical predictions of our model. Proposition 1 and Corollary 1 in Section 3.1 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.

[14] To see this, note that for any pair of the state variable (z_1, e_2), the threshold function Z is monotone increasing in the fixed operating cost ν and monotone decreasing in the collateral parameter λ. A lower threshold is associated with a higher probability of becoming a SE and lower realized TFP for those firms. Therefore, entrepreneurs who have a lower operating cost ν and/or are allowed to borrow more for a given equity (larger λ) would be more likely to become SE and would tend to have a lower TFP.

- *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 the equity, the smaller the increase in the debt-equity ratio with TFP.

Propositions 2 and 4 and Corollary 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*: If ρ is sufficiently large, and entrepreneurs have the same ν and λ, capital and TFP of 2nd-SE firms are larger than capital and TFP of 1st-SE firms and capital and TFP of 1st-SE firms are larger than capital and TFP of Non-SE firms.

- *Theoretical Prediction D2*: If $\rho = 0$ is sufficiently low and some potential entrepreneurs have sufficiently large non-skill advantages at operating firms (i.e., sufficiently low ν and sufficiently high λ) relative to the other entrepreneurs, then TFP and capital of Non-SE firms will be larger than TFP and capital of 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 E*: TFP of 1st-SE (2nd-SE) firms is higher (lower) for concurrently run 1st-SE (2nd-SE) firms than those run non-concurrently.

4.2 Measuring Firm TFP

The Inspection Data do not have all the information required to compute a firm's level of TFP directly.[15] However, we can use data on capital and value added to calculate a firm's TFP *relative* to the average TFP in a group of firms that face the same wage rate w.[16] 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[17] 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

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

[15] Before the calculation, we trim the inspection data by the bottom and top 1 percentile of assets. We also drop firms with zero assets and revenue.

[16] 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.

[17] Equation (A-1) in the Appendix.

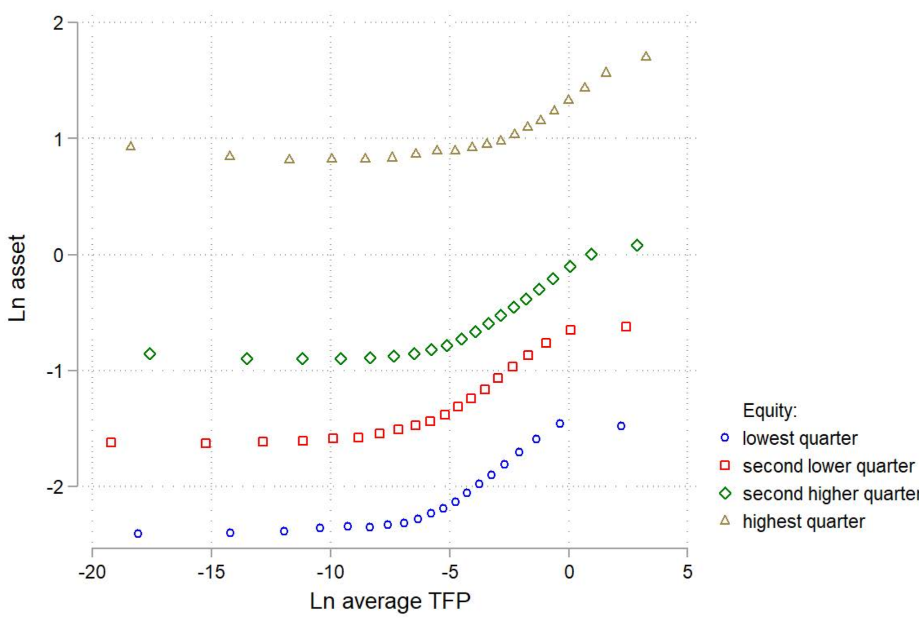
where ω_i is the relative weight in value added of each observation i. Then, the TFP of firm i relative to the average TFP $\bar{z}$ in a particular province-industry-year cell is:

$$\frac{z_i}{\bar{z}} = \frac{y_i^{\frac{1-\alpha\eta}{1-\eta}} k_i^{-\frac{(1-\alpha)\eta}{1-\eta}}}{\sum_i \omega_i y_i^{\frac{1-\alpha\eta}{1-\eta}} k_i^{-\frac{(1-\alpha)\eta}{1-\eta}}}. \tag{7}$$

This ratio can be computed using available data on firm i's value added y_i and capital k_i.[18]

4.3 Correlation of Assets and Debt-Equity Ratios with TFP

Figure 6: Capital and Relative TFP, Inspection Data, 2008-2012.



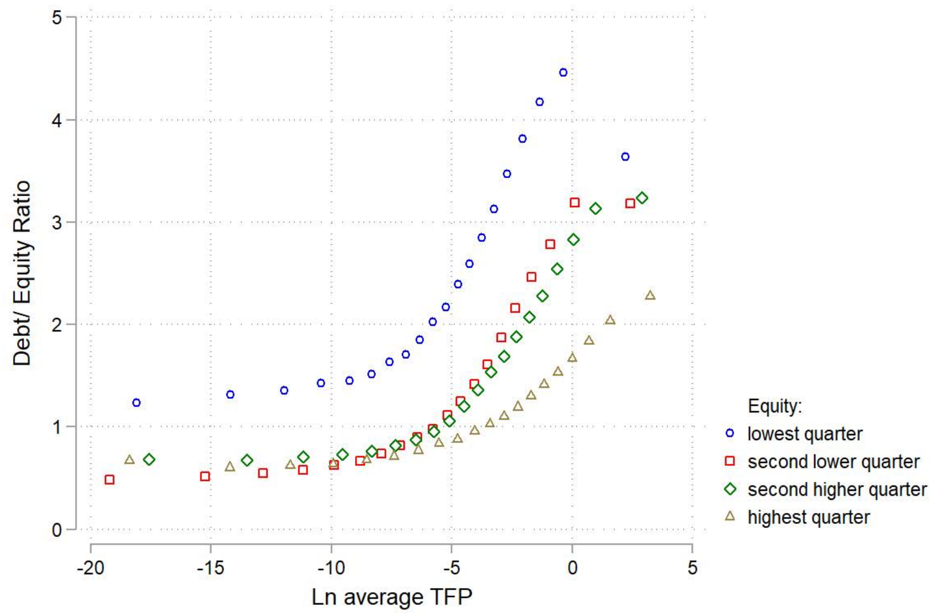
Notes: Authors' calculations from the Inspection Data. The figure shows the relationship between assets and TFP. Firms are sorted into four quarters according to their equity. For each equity quarter, firms are ranked on TFP and sorted into twenty ventiles. Each point in the figure plots log average TFP and log average assets for firms in the ventile. All variables are computed relative to their averages of all firms in the same province-industry-year cell.

Figures 6 and 7 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 quarters of equity (with the first quarter containing the 25% of firms with the lowest equity, etc.) Then the firms in each quarter are again sorted based on their TFP into twenty ventiles. For each such ventile we then calculate average TFP, assets, and debt-equity ratio and present these in scatter plots in Figures 6-7.

Figure 6 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 6 also shows that as we move

[18] We trim the bottom and top 1 percentile of computed TFP in following analysis.

Figure 7: Debt-Equity Ratio and Relative TFP, Inspection Data, 2008-2012.



Notes: Authors' calculations from the Inspection Data. The figure shows the relationship between the debt-equity ratios and TFP. Firms are sorted into four quarters according to their equity. For each equity quarter, firms are ranked on TFP and sorted into twenty ventiles. Each point in the figure plots log average TFP and average debt over average equity for firms in the ventile. All variables are computed relative to their averages of all firms in the same province-industry-year cell.

from lower to higher equity quarters the entire profile of assets shifts upwards. This is in line with Theoretical Prediction *B*.

Figure 7 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 quarter of equity. Moreover, as we move from lower to higher equity quarters, the entire debt-equity profile shifts downward and the slope with respect to TFP becomes flatter. These findings are consistent with Theoretical Prediction *C*.

4.4 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 Prediction *D* but no support for Prediction *D2*. 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. Second, 2nd-SE firms have higher registered capital, assets, equity, revenue, and TFP than 1st-SE firms. This is consistent with Theoretical Prediction *D* provided that ρ is sufficiently large.[19] Note also that columns (1) and (2) indicate that the results on the level of registered capital using the full sample of firms are similar to those on the smaller

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

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	0.04***	0.16***
2nd quarter of equity	1.09***	-1.30***
3rd quarter of equity	1.68***	-1.39***
4th quarter of equity	3.10***	-2.23***
TFP*2nd quarter of equity	-0.00***	-0.03***
TFP*3rd quarter of equity	-0.00***	-0.04***
TFP*4th quarter of equity	-0.01***	-0.10***
Age	0.06***	0.15***
Age squared	-0.00***	-0.00***
Observations	12,476,788	12,476,788
Adjusted R-squared	0.64	0.04

Notes: Authors' calculations from the Inspection Data. The table reports the relationship between assets and the debt-equity ratio and TFP. The results are computed for different quarters 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, Registry and Inspection Data, 2008-2012.

	Full Sample	Sample with Inspection Data				
	Log Registered Capital	Log Registered Capital	Log Assets	Log Equity	Log Revenue	Log Relative TFP
	(1)	(2)	(3)	(4)	(5)	(6)
1st SE	0.39***	0.35***	0.41***	0.36***	0.33***	0.11***
2nd-SE	0.69***	0.58***	0.68***	0.58***	0.53***	0.18***
Age	0.07***	0.10***	0.17***	0.12***	0.26***	0.41***
Age squared	-0.00***	-0.00***	-0.00***	-0.00***	-0.01***	-0.01***
Observations	34,458,350	12,476,788	12,476,788	12,476,788	12,476,788	12,476,788
Adjusted R-squared	0.05	0.06	0.11	0.08	0.08	0.03

Notes: Authors' calculations from the Registry and Inspection Data. 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.

sample of firms in the Inspection Data over the same 2008-2012 period.

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	-0.06***	-0.07***	0.23***	-0.16***
Age	0.37***	0.14***	0.62***	0.16***
Age square	-0.01***	-0.00***	-0.03***	-0.01***
Observations	2,254,408	2,254,408	1,826,093	1,826,093
Adjusted R-squared	0.03	0.08	0.02	0.04

Notes: Authors' calculations from the Inspection Data. 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.

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, 86.5%, are ran concurrently with the 1st-SE firm, while in 13.5% 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 6% lower TFP and 7% lower equity than those 1st-SE firms that are run concurrently with the 2nd-SE firm. On the other hand, Columns (3) and (4) show that 2nd-SE firms that are operated by entrepreneurs who have closed down their first firm (1st-SE) have a 23% higher TFP and 16% lower equity than those 2nd-SE firms that are run concurrently with the 1st-SE firm. These patterns are consistent with Theoretical Prediction E 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.

4.5 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

$$\tilde{R}_1 = \tilde{R}_2 \tag{8}$$

$$(1-\alpha)\,\eta\frac{y_i}{k_i} = (1-\alpha)\,\eta\frac{y_i}{k_i} \tag{9}$$

The theoretical prediction of equation (9) is that if a SE owns several (concurrently operated) firms in the same industry, or if she owns concurrently operated firms in industries with similar capital intensity $(1-\alpha)\,\eta$, then the capital-output ratios should be equalized across the SE's 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 0.28. 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 0.20. Third, when considering entrepreneurs with concurrent firms in industries with similar capital intensities, the correlation is 0.21. 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 (9) 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 0.19 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 in the total number of 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 fraction of firms operated by serial entrepreneurs over time. Table 3 documented the increased importance of SE firms over much of the 1995-2015 period in terms of number of firms and total registered capital. Since SE firms are larger and more productive, over time they have also contributed to a larger share of output.

5 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.

5.1 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. The unconditional share measures the actual distribution of new entrants. Overall, the unconditional distribution across sectors is similar among these types of firms. 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 entrepreneurs, 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: 72.1% 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 18.3% 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 to start their 2nd-SE firm in the same prefecture (81.8% vs 60.9%). 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.

5.2 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 on entrepreneurs who have operated a firm in the first period, and study their sectoral choice for the second firm. Namely, what determines the choice of

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

Industry	2005						2010					
	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

Notes: Authors' calculations from the Registry Data. For a particular SE group, the unconditional share of a sector in a given year, is the number of new established firms in that sector divided by the total number of all newly established firms. For a particular SE group, the 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.

Table 10: Geographical and Sectoral Location, Registry Data, 1995-2015.

3-digit Industry	Same	Similar	Distant	Same (%)	Similar (%)	Distant (%)	Total(%) (%)
Same Prefecture	421,404	608,156	1,452,195	12.25	17.68	42.21	72.14
Same Province	43,010	79,044	205,805	1.25	2.30	5.98	9.53
Different Province	71,931	153,351	405,138	2.09	4.46	11.78	18.33
Total(%)				15.59	24.43	59.97	100.00

Notes: Authors' calculations from the Registry Data. 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.

sector for the 2nd-SE? Moreover, how do serial entrepreneurs who switch sectors 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.

5.2.1 Learning Sector-Specific Abilities

We now assume that there are several sectors $s \in S = \{1, 2, ..., N\}$ in the economy. 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

Table 11: Geographical and Sectoral Location, by Local and Non-local SEs, Registry Data, 1995-2015.

First firm in birth place	Total	3-digit Industry	Same (%)	Similar (%)	Distant (%)	Total (%)
No	1,533,638	Same Prefecture	11.39	14.58	34.88	60.85
		Same Province	1.72	3.06	7.62	12.40
		Different Province	3.22	6.69	16.84	26.75
		Total(%)	16.33	24.33	59.34	
Yes	1,814,352	Same Prefecture	13.06	20.30	48.46	81.82
		Same Province	0.85	1.63	4.54	7.03
		Different Province	1.14	2.57	7.44	11.15
		Total(%)	15.05	24.51	60.44	

Notes: Authors' calculations from the Registry Data. 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.

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 (5), 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 complementarities, for example.[20] 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^- 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

$$z_2 = \begin{cases} \rho z_{1s} + \varepsilon & \text{if stay in same sector } s \\ \rho^+ \cdot z_{1s} + \bar{z} + \varepsilon & \text{if switch to similar sector } s^+ \in S^+ \\ \rho^- \cdot z_{1s} + \varepsilon & \text{if switch to distant sector } s^- \in S^- \end{cases} \qquad (10)$$

We assume that all sectors are ex-ante identical in the sense that the distribution of the TFP draw for the initial firm, z_{1s}, and the distribution of the innovation ε, are the same for all initial sectors $s \in S$.

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

Note that the choice of sector affects the mean of the distribution for the 2nd-period draw z_{2s} but has no effect on the dispersion around $E\{z_{2s}\}$, which is entirely determined by ε. Since profits are monotone increasing in z_{2s} for any level of financial friction λ, the optional choice of sector to sample a TFP draw for the firm in the 2nd period is determined by what maximizes $E\{z_{2s}\}$. This decision 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, $z_{1s} > \bar{\zeta}$, the entrepreneur remains in the same sector s. If z_{1s} is sufficiently low, $z_{1s} < \underline{\zeta}$, the entrepreneur switches to a distant sector $s^- \in S^-$. For intermediate values of TFP, $z_{1s} \in \left(\underline{\zeta}, \bar{\zeta}\right)$, the entrepreneur switches to a similar sector $s^+ \in S^+$. The entrepreneur is indifferent between sector s and S^+ (S^+ and S^-) when $z_{1s} = \bar{\zeta}$ ($z_{1s} = \underline{\zeta}$). The thresholds are defined as $\bar{\zeta} \equiv \bar{z}/\left(\rho - \rho^+\right) \geq 0$ and $\underline{\zeta} \equiv -\bar{z}/\left(\rho^+ - \rho^-\right) \leq 0$.*
- ***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 λ is sufficiently large, the same ranking also applies to the average TFP for the 2nd-SE firm.*

Proof. The optimal choice maximizes $E\{z_2\}$ 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

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

When $z_{1s} = \bar{\zeta}$ the entrepreneur 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

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

When $z_{1s} = \underline{\zeta}$ the entrepreneur is indifferent. Since $\bar{z} \geq 0$, it follows immediately that $\bar{\zeta} \geq 0 > \underline{\zeta}$. 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 $\bar{\zeta}$, the entrepreneur stays in the current sector, while the entrepreneur switches to a distant sector if initial TFP is below $\underline{\zeta}$ 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 was no complementary 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 λ is sufficiently large, the deterministic component must dominate, guaranteeing the same ranking of average TFP for the 2nd-SE firm as for the 1st-SE firm.

5.2.2 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 $s' \neq s$.[21] 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.[22]

Second, we assume that the entrepreneur obtains one (idiosyncratic) draw $z_{s'}$ for every sector $s' \in S^-$. The entrepreneur 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 in sector s has a stochastic sector-specific return to capital δ_s in addition to the regular production. The total output of the firm is therefore given by the sum $y_s + \delta_s k_s$, where $y_s = z_s^{1-\eta}\left(k_s^{1-\alpha} n_s^{\alpha}\right)^{\eta}$ is the regular deterministic idiosyncratic production (cf. equation (1)) with factor inputs k_s and n_s. Let W denote the realized final wealth for an entrepreneur with firms in sectors s and s' and equity e in the beginning of period 2. W is then given by

$$W = \Pi\left(z_s, z_{s'}, e\right) + \delta_s k_s + \delta_{s'} k_{s'},$$

where the function Π denotes the profits in the 2nd period of operating firms with TFP z_s and $z_{s'}$ and equity e. Thus, $\Pi\left(z_s, z_{s'}, e\right) = y_s + y_{s'} - (n_s + n_{s'})w - (k_s + k_{s'} - e)R - \nu(\mathbb{1}_1 + \mathbb{1}_2)$, where $\mathbb{1}_j$ is an indicator function taking the value 1 if and only if firm $j \in \{1, 2\}$ is in operation.

Recall that given the vector of realizations of TFP for potential 2nd-period firms, the variable Π is deterministic because factor allocations are made after observing TFP. However, the realizations of the sector-specific returns δ_s and $\delta_{s'}$ are observed *a*fter having made the sector choice and the factor allocations. Therefore, W is stochastic when sector and factor choices are made.

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

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

We assume that the returns δ_j have the same univariate 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 expected realization of δ_j to zero for all sectors.

For an entrepreneur who operates two firms concurrently, the expected utility is given by

$$E\{u(W)\} = a \cdot \Pi\left(z_s, z_{s'}, e\right) - 2b \cdot \left[Var(\delta_s) + Cov\left(\delta_s, \delta_{s'}\right)\right].$$

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 for potential firms* $\{z_{s'}\}_{s' \in S^-}$*. 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 $\tilde{s}$ will be chosen only if it 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. It follows that sector s' will be chosen more often than sector $\tilde{s}$. □

5.2.3 Upstream-Downstream Integration and Input-Output Complementarities

A natural extension of our simple multi-sector model in Section 5.2.2 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.[23] 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 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 because the theory is silent about which firm benefits from the linkages, be it the 1st-SE, 2nd-SE, or both.

5.3 Empirics: Determinants of Sectoral Choices

We start by summarizing the theoretical predictions regarding sector choice.

- *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.

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

- *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.

5.3.1 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. Altogether, we have observations on 292,549 entrepreneurs. For non-concurrent SE, we use the TFP of the 1st SE in their last year of operation, and the first year that 2nd SEs report, which is typically the year they are established. For concurrent SEs, we use information on 1st and 2nd firms for all years they both report. 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 on the persistence of TFP draws, summarized in equation (10) and 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	0.33***	0.24***	0.13***
Age of 1st-SE	0.31***	0.34***	0.29***
Age difference	0.31***	0.33***	0.29***
Observations	52,934	76,223	163,392
Adjusted R-squared	0.11	0.08	0.03

Notes: Authors' calculations from the Inspection Data. 1st- and 2nd-SE firms are identified from the Registry Data. 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 110% 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 18% and 25% 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	-0.18***	-0.25***	-0.25***
Distant Industry	-1.08***	-1.11***	-1.12***
Distant Industry * Covariance			0.37***
Age	0.34***	0.67***	0.67***
Age squared	-0.01***	-0.03***	-0.03***
Observations	292,549	292,549	292,549
Adjusted R-squared	0.03	0.03	0.03

Notes: Authors' calculations from the Inspection Data. 1st- and 2nd-SE firms are identified from the Registry Data. 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.

5.3.2 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.[24] We calculate average returns for each 3-digit industry and use the empirical realizations to estimate the covariance matrix of returns.

[24] We drop the financial crisis period.

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.[25]

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 from 1995-2015 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, 1995-2015.

	Excess Probability				
	(1)	(2)	(3)	(4)	(5)
Downstream Integrated	0.52***				0.47***
Upstream Integrated		0.57***			0.46***
Complementarity			0.51***		0.41***
Covariance				-0.03*	-0.11***
Observations	364,716	364,716	364,716	364,716	364,716
Adjusted R-squared	0.02	0.02	0.02	0.01	0.04

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.

[25] 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.[26] 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 0.37 therefore implies that increasing this variable (the covariance) by one standard deviation (of the cross-sectional dispersion in covariance) will increase TFP by 37%. This effect is significant, both from an economic and a statistical point of view.

6 Conclusion

This paper uses 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 examine these data through the lens of a model of serial entrepreneurship in which potential entrepreneurs face capital market frictions in the form of collateral constraints. Our model generates sharp predictions relating to the effect of endowments and abilities on the likelihood of both entrepreneurship and serial entrepreneurship, differences between serial and non-serial firms, and differences between the initial firm and subsequent firms of serial entrepreneurs. We also study migration patterns for serial entrepreneurs in terms of what sector they locate their 2nd-SE firm relative to the sector of their 1st-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 – the 2nd-SE firm being more productive than the 1st-SE firm – 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 sequentially. The choice of sector is informative about the process of firm creation. On the one hand, serial entrepreneurs who switch sectors are less productive, which we interpret as evidence for sector-specific learning about ability. On the other hand, for those who switch sector, the next-sector choice is influenced by risk diversification and sectoral linkages, hinting at the presence of other types of frictions in the economy.

In this paper, we assumed that frictions are the same across space. They may, in fact, differ, which has implications for selection into entrepreneurship (Brandt, Kambourov and Storesletten (2019)), and thus the properties of serial entrepreneurs. In future work, we plan to examine these differences. In addition, in this paper we analyze serial entrepreneurship through the lens of entrepreneurs who establish second firms as individual investors. Firm owners can also start second firms with investments through the enterprises they control.[27] In other contexts (Bena and Ortiz-Molina (2013)), these differences were key to explaining differences between new firms.

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

[27] If we expand the definition of serial entrepreneurs in the Registry Data to include also entrepreneurs who start a second firm through the first firm they own, then we will have 2,600,603 serial entrepreneurs in total, and among them, 300,400 started their second firms through investments by firms they established earlier.

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Online Appendix for

Serial Entrepreneurship in China

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A Proof of Proposition 1

Consider first an unconstrained entrepreneur. Assuming that $k < \lambda e$, the entrepreneur's problem is

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

The first-order conditions are given by

$$\begin{aligned}\alpha\eta y &= wn, && \text{(A-1)}\\ (1-\alpha)\eta y &= Rk, && \text{(A-2)}\end{aligned}$$

Plugging this back into the production function yields an expression for output in terms of z and equity. The optimal allocations follow directly from eq. (A-1)-(A-2) and are given by equation (A-3),

$$\begin{aligned}y^*(e,z,1) &= z\cdot\left(\frac{(1-\alpha)\eta}{R}\right)^{\frac{(1-\alpha)\eta}{1-\eta}}\left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}} && \text{(A-3)}\\ k^*(e,z,1) &= z\cdot\left(\frac{(1-\alpha)\eta}{R}\right)^{\frac{1-\alpha\eta}{1-\eta}}\left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}} \equiv zk^*\\ n^*(e,z,1) &= z\cdot\left(\frac{(1-\alpha)\eta}{R}\right)^{\frac{(1-\alpha)\eta}{1-\eta}}\left(\frac{\alpha\eta}{w}\right)^{\frac{1-\eta(1-\alpha)}{1-\eta}}\end{aligned}$$

and where profits are

$$\Pi(e,z,1) = z\cdot(1-\eta)\cdot\left(\frac{(1-\alpha)\eta}{R}\right)^{\frac{(1-\alpha)\eta}{1-\eta}}\left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}} + Re$$

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 $\Pi(z,e,1) - \nu \geq Re$ implies a cutoff z^* such that all potential entrepreneurs with $z \geq z^*$ will choose to operate firms, where z^* is given by

$$z^* \equiv \frac{v}{1-\eta}\left(\frac{(1-\alpha)\eta}{R}\right)^{-\frac{(1-\alpha)\eta}{1-\eta}}\left(\frac{\alpha\eta}{w}\right)^{-\frac{\alpha\eta}{1-\eta}} = \frac{\eta}{1-\eta}\frac{1-\alpha}{R}\frac{\nu}{k^*}$$

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 (since higher returns on deposits increase the alternative value of equity). The unconstrained entrepreneur will install a capital stock given by $k^*(e,z,1) = zk^*$ (see equation (A-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) $z \geq z^*$ and (2) $\lambda e \geq z \cdot k^*$. Namely, both TFP and equity must be sufficiently large. Moreover, it follows that the lower bound for equity for an unconstrained entrepreneur is $\underline{e} \equiv z^* k^* / \lambda = \nu (1-\alpha) \eta / [(1-\eta) \lambda R]$.

Next, consider a constrained entrepreneur who is constrained in terms of borrowing, i.e., $k = \lambda e$ and $b = (\lambda - 1) e$. This entrepreneur solves the problem

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

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

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

where the subscript c denotes "constrained."

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

$$\lambda e < zk^*.$$

Note that the return to equity for constrained entrepreneurs exceeds R.

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 $\Pi(e,z,0) - \nu \geq Re$. This condition implies a threshold function $z^*(e)$ given by

$$z^*(e) \geq \left(\frac{\nu + R\lambda e}{1-\alpha\eta}\right)^{\frac{1-\alpha\eta}{1-\eta}} (\lambda e)^{-\frac{(1-\alpha)\eta}{1-\eta}} \left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\eta}}.$$

Equity and better financial markets (larger λ) affects the threshold for constrained entrepreneurs in two opposing ways. On the one hand, a larger equity and/or a larger λ increase the value of the firm. This tends to reduce the threshold. On the other hand, a larger equity and/or a larger λ increase 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

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

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

A.1 Proof of Lemma 1

Lemma 1 amounts to proving that if $g(z)$ is monotone increasing in z then

$$E[z | z \geq a, G(z) + \epsilon \geq b] \geq E[z | z \geq a],$$

where Z is a stochastic variable and a and b are constants.

The main idea is to show that (1) adding the condition $G(z)+\epsilon \geq b$ 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 the unconditional pdf and cdf of z as $i(z)$ and $I(z)$, and the pdf and cdf of ϵ as $j(z)$ and $J(z)$. The pdf conditional on $z \geq a$ can then be expressed as

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

Then the pdf of z conditional on $z \geq a$ and $G(z) + \epsilon \geq b$ is

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

where $h(z) = 1 - J(b - G(z))$ is an increasing function of z because $G(z)$ is increasing in 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

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

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

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

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

$$E[z|F] = \int z dF(z) = \int z dG(y) < \int y dG(y) = \int z dG(z) = E[z|G].$$

QED

A.2 Proof of Proposition 3

The maintained assumption is that the entrepreneur entered and operated firm 1 in period 1. If $z_2 > z_1$, it will be strictly more profitable to operate firm 2 than firm 1. The entrepreneur will therefore enter and operate firm 2 regardless whether or not firm 1 is operated. It follows that $Z(z_1, e) \leq z_1$. Propostion 1 implies that firm 2 would not be operated if $z_2 < z^*$. From now on we focus on the case when $z^* \leq z_2 \leq z_1$.

Suppose first that $\lambda e \geq (z_2 + z_1) k^*$. Propostion 1 implies that it is better to operate each firm with capital $z_2 k^*$ and $z_1 k^*$, respectively, than depositing the equity earning rate R. Since equity is sufficient to fund both firms, this allocation is also feasible. This lower bound on z_2 is independent of e and z_1.

Suppose now that $\lambda e < (z_2 + z_1) k^*$. Propostion 1 then implies that if the entrepreneur is operating both firms then she will be constrained: $b = (\lambda - 1) e$. The optimal employment would be to allocate capital and labor so as to equate the marginal product of labor in each firm to the wage rate. 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 would be distributed across the firms so as to equalize the marginal product of capital across firms. This implies

$$(1-\alpha)\eta (z_2)^{1-\eta} \frac{\left(k_2^{1-\alpha} n_2^{\alpha}\right)^{\eta}}{k_2} = (1-\alpha)\eta (z_1)^{1-\eta} \frac{\left(k_1^{1-\alpha} n_1^{\alpha}\right)^{\eta}}{k_1}$$

which in turn implies $k_2 = \frac{z_2}{z_1} k_1$. Since we hypothesize $k_1 + k_2 = \lambda e$, it follows that $\lambda e = \left(\frac{z_2}{z_1} + 1\right) k_1$, implying

$$k_2 = \frac{z_2}{z_2 + z_1} \lambda e \qquad \text{and} \qquad k_1 = \frac{z_1}{z_2 + z_1} \lambda e.$$

Maintaining that $\lambda e \leq (z_2 + z_1) k^*$, we now consider two cases.

Suppose first that equity is sufficiently large that the entrepreneur is unconstrained when operating one firm, i.e., $\lambda e \geq z_1 k^*$ so $\lambda e \in [z_1 k^*, (z_2 + z_1) k^*)$. The entrepreneur would then operate two firms if and only if

$$\Pi\left(\frac{z_2}{z_2 + z_1}\lambda e, z_2; 0\right) + \Pi\left(\frac{z_1}{z_2 + z_1}\lambda e, z_1; 0\right) - 2\nu \geq \Pi(z_1; 1) + Re - \nu, \tag{A-5}$$

where the function $\Pi(k, z; 0)$ denotes profits net of the operating cost ν from a constrained entrepreneur with equity e operating a firm with capital $k = \lambda e$ and TFP z,

$$\Pi(\lambda e, z, 0) = (1 - \alpha\eta) z^{\frac{1-\eta}{1-\alpha\eta}} (\lambda e)^{\frac{(1-\alpha)\eta}{1-\alpha\eta}} \left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\alpha\eta}} - R(\lambda - 1) e.$$

Moreover, the function $\Pi(z; 1)$ denotes profits net of the operating cost ν from an unconstrained entrepreneur operating a firm with TFP z,

$$\Pi(z; 1) \equiv z \cdot (1 - \eta) \cdot \left(\frac{(1-\alpha)\eta}{R}\right)^{\frac{(1-\alpha)\eta}{1-\eta}} \left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}}.$$

Simple algebra establishes that the condition (A-5) is equivalent to the following lower bound on z_2,

$$\begin{aligned} z_2 \quad &\geq \quad Z(z_1, e) \equiv \left(z_1 \cdot \frac{1-\eta}{1-\alpha\eta}\left(\frac{(1-\alpha)\eta}{R}\right)^{\frac{(1-\alpha)\eta}{1-\eta}} \left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}} + \frac{R\lambda e + \nu}{1-\alpha\eta}\right)^{\frac{1-\alpha\eta}{1-\eta}} (\lambda e)^{-\frac{(1-\alpha)\eta}{1-\eta}} \left(\frac{\alpha\eta}{w}\right)^{-\frac{\alpha\eta}{1-\eta}} \quad \text{(A-6)} \\ &= \quad \left(1 + \frac{1-\eta}{1-\alpha\eta}\left(\frac{zk^*}{\lambda e} - 1\right) + \frac{(1-\alpha)\eta}{1-\alpha\eta}\frac{1}{\lambda e}\frac{v}{R}\right)^{\frac{1-\alpha\eta}{1-\eta}} \frac{\lambda e}{k^*} - z \end{aligned}$$

Simple algebra establishes that

$$\frac{\partial Z(z,e)}{\partial z} = \left(1 + \frac{1-\eta}{1-\alpha\eta}\left(\frac{zk^*}{\lambda e} - 1\right) + \frac{1-\eta}{1-\alpha\eta}\frac{z^* k^*}{\lambda e}\right)^{\frac{1-\alpha\eta}{1-\eta}-1} - 1 > 0,$$

which is positive given the maintained assumption that $\lambda e \leq z_1 k^*$. This implies that the lower bound $Z(z_1, e)$ is increasing in z_1 whenever $\lambda e \in [z_1 k^*, (z_2 + z_1) k^*)$.

In terms of equity, simple algebra establishes that

$$k^* = \left(\frac{(1-\alpha)\eta}{R}\right)^{\frac{1-\alpha\eta}{1-\eta}} \left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}}$$

$$\begin{aligned}\frac{\partial Z}{\partial e} &= -\left(z_1 k^* - \lambda e + \frac{(1-\alpha)\eta}{1-\eta}\frac{\nu}{R}\right) \\ &\quad \cdot \frac{R\lambda}{1-\alpha\eta}\left(\frac{1-\eta}{1-\alpha\eta}\frac{Rk^*}{(1-\alpha)\eta}z_1 + \frac{R\lambda e + \nu}{1-\alpha\eta}\right)^{\frac{1-\alpha\eta}{1-\eta}-1} (\lambda e)^{-\frac{1-\alpha\eta}{1-\eta}} \left(\frac{\alpha\eta}{w}\right)^{-\frac{\alpha\eta}{1-\eta}} \\ &< 0,\end{aligned}$$

where the inequality follows from the maintained assumption that $z_1 k^* \geq \lambda e$. This implies that the lower bound $Z(z_1, e)$ is falling in e whenever $\lambda e \in [z_1 k^*, (z_2 + z_1) k^*)$.

Finally, consider the case when equity is sufficiently small that the entrepreneur would be constrained even when operating one firm, i.e., $\lambda e < z_1 k^*$. In this case, the entrepreneur would operate two firms if

$$\Pi\left(\frac{z_2}{z_2 + z_1}\lambda e, z_1; 0\right) + \Pi\left(\frac{z_1}{z_2 + z_1}e, z_1; 0\right) - 2\nu \geq \Pi(e, z_1; 0) - \nu. \quad \text{(A-7)}$$

Standard algebra establishes that the condition (A-7) is equivalent to the lower bound $z_2 \geq Z(z_1, e)$, where

$$Z(z_1, e) \equiv \left((z_1)^{\frac{1-\eta}{1-\alpha\eta}} + \left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\alpha\eta}} \frac{\nu}{1-\alpha\eta}(\lambda e)^{-\frac{(1-\alpha)\eta}{1-\alpha\eta}}\right)^{\frac{1-\alpha\eta}{1-\eta}} - z_1. \quad \text{(A-8)}$$

It is immediate that $Z(z_1, e)$ is monotone increasing in z_1 and monotone falling in e in this range. This completes the proof of Proposition 3.

A.3 Proof of Proposition 4

From Proposition 3 the condition for choosing to operate firm 2 in period 2 is

$$\rho z_1 + \varepsilon - Z(z_1, e_2) \geq 0, \quad \text{(A-9)}$$

where Z is monotone increasing in z_1. By taking the partial differential of the functions $\underline{Z}$ and $\bar{Z}$ with respect to z_1 it is straightforward to show that $\underline{Z}$ is convex in z_1 while $\bar{Z}$ is concave in z_1,

$$\begin{aligned}\frac{\partial^2 \bar{Z}}{\partial z^2} &= -X\left(1 + \left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\alpha\eta}} \frac{\nu}{1-\alpha\eta}(\lambda e)^{-\frac{(1-\alpha)\eta}{1-\alpha\eta}} (z)^{-\frac{1-\eta}{1-\alpha\eta}}\right)^{\frac{(1-\alpha)\eta}{1-\eta}-1} (\lambda e)^{-\frac{(1-\alpha)\eta}{1-\alpha\eta}} (z)^{-\frac{1-\eta}{1-\alpha\eta}-1} < 0 \\ \frac{\partial^2 \underline{Z}}{\partial z^2} &= \frac{(1-\alpha)\eta}{1-\alpha\eta}\frac{k^*}{\lambda e}\left(\frac{1-\eta}{1-\alpha\eta}\frac{zk^*}{\lambda e} + \frac{R\lambda e + \nu}{1-\alpha\eta}\frac{1-\alpha}{R}\frac{\eta}{\lambda e}\right)^{\frac{(1-\alpha)\eta}{1-\eta}-1} > 0.\end{aligned}$$

where $X = \nu (1-\alpha) \eta / (1-\alpha\eta)^2 [w/(\alpha\eta)]^{\alpha\eta/(1-\alpha\eta)} > 0$ is a constant. Since $Z(z,e)$ is convex in z for $z < \lambda e/k^*$ and concave in z for $z \geq \lambda e/k^*$, the largest value of $\partial Z(z,e)/\partial z$ occurs for $z = \lambda e/k^*$. It follows that $\partial Z(z,e)/\partial z$ is bounded from above by the following expression,

$$\frac{\partial Z(z,e)}{\partial z}\Big|_{z=\lambda e/k^*} = \left(1 + \frac{1-\eta}{1-\alpha\eta}\frac{z^*}{z}\right)^{\frac{(1-\alpha)\eta}{1-\eta}} - 1 < \left(1 + \frac{1-\eta}{1-\alpha\eta}\right)^{\frac{(1-\alpha)\eta}{1-\eta}} - 1,$$

where the last inequality follows from the maintained assumption that $z_1 = \lambda e/k^* \geq z^*$. Recall now that equity $e_2 = \Pi(z_1, e_1)$ is given by the accumulated equity after operating the 1st-SE firm for one period. Since profits are monotone increasing in TFP, Assumption 2 guarantees that e_2 is monotone increasing in z_1. Equity e_2 therefore mitigates the degree to which Z is increasing in z_1. Therefore, the inequality (A-10) provides an upper bound for the derivative $dZ(z_1, \Pi(z_1, e_1))/dz_1$. It follows that if ρ is sufficiently large, the expression $\rho z_1 + \varepsilon - Z(z_1, e_2)$ is monotone increasing in z_1. Lemma 1 therefore applies and implies that

$$E\{z_1 | z_1 \geq z^{**} \text{ and } \rho * z_1 + \varepsilon - Z(z_1, \Pi(z_1, e_1)) \geq 0\} \geq E\{z_1 | z_1 \geq z^{**}\},$$

which establishes that the expected TFP of 1st-SE firms will exceed the expected TFP of non-serial entrepreneurs. Finally, following the proof of Proposition 2, a sufficiently large ρ guarantees that the expected TFP of the 2nd-SE firm will exceed the expected TFP of the 1st-SE firm.

B Tables

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

Year	Non-SE	1st-SE	2nd-SE
2008	30.48%	32.59%	30.73%
2009	33.10%	35.17%	33.03%
2010	35.07%	36.97%	34.11%
2011	37.84%	39.87%	35.92%
2012	39.60%	41.53%	37.42%

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

Year	Number of Firms
2008	1,641,828
2009	2,001,297
2010	2,411,502
2011	2,966,918
2012	3,455,243
Total	12,476,788

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	10.38	56.13	2.80	7.34	0.94	16.89	15.90	10.14
1996	11.48	54.26	2.83	8.78	0.99	16.39	16.74	11.61
1997	12.62	52.14	2.97	10.28	1.12	16.30	17.18	13.26
1998	13.83	49.79	3.18	12.01	1.15	16.02	17.84	15.20
1999	15.58	48.26	3.26	13.09	1.10	16.77	17.53	16.35
2000	17.43	45.61	3.39	14.48	1.09	17.70	17.72	17.87
2001	19.33	42.87	3.63	16.21	1.13	17.90	18.26	19.84
2002	21.51	40.67	3.78	17.70	1.26	18.02	18.57	21.48
2003	25.21	37.62	3.94	18.88	1.17	20.19	18.21	22.82
2004	28.37	35.49	4.29	20.50	1.21	19.28	19.22	24.79
2005	31.52	34.21	4.52	22.06	1.31	18.40	19.51	26.58
2006	34.93	33.02	4.93	23.13	1.34	17.86	19.72	28.06
2007	40.74	34.11	5.02	22.80	1.30	17.01	19.75	27.83
2008	45.09	33.17	5.26	23.26	1.38	16.84	20.09	28.53
2009	51.07	31.40	5.47	24.41	1.40	16.72	20.60	29.88
2010	59.47	29.12	5.73	25.96	1.42	16.58	21.19	31.69
2011	69.15	27.09	5.82	27.58	1.37	16.28	21.86	33.39
2012	78.53	25.72	5.98	28.21	1.33	16.29	22.47	34.20
2013	91.35	25.04	6.13	28.93	1.31	15.70	22.87	35.07
2014	114.76	21.95	7.50	31.69	1.79	14.70	22.37	39.19
2015	137.33	19.81	9.16	33.14	1.97	13.70	22.21	42.30