Serial Entrepreneurship in China*

Loren Brandt[†] Ruochen Dai[‡] Gueorgui Kambourov[§]
Kjetil Storesletten[¶] Xiaobo Zhang[‖]

December 2024

Abstract

This paper studies entrepreneurship and firm creation through the lens of serial entrepreneurs – entrepreneurs who establish more than one firm. Using data covering the universe of Chinese firms, we document key facts about serial and non-serial entrepreneurs and develop a theory rationalizing how their behavior is shaped by ability, endowments, and capital market frictions. Serial entrepreneurs have higher average productivity and lower return on capital than non-serial entrepreneurs. However, this premium conceals significant heterogeneity, with a majority of serial entrepreneurs underperforming relative to non-serial entrepreneurs. We link these differences to capital market frictions that favor some, but not all, entrepreneurs.

JEL Classification: D22, D24, E22, E44, L25, L26, O11, O14, O16, O40, O53, P25, R12, D21

Keywords: Serial Entrepreneurship; Entrepreneurship; Capital Distortions; Industry Choice

*We thank Hui Chen, Tim Lee, Ernest Liu, Yikai Wang, and seminar participants at CAF Development Bank of Latin America, Bank of Canada, BI Norwegian Business School, Erasmus University Rotterdam, European University Institute, University of Surrey, Peking University, Queen's University, University of Essex, University of Nottingham, University of Wisconsin, IIES, Stockholm School of Economics, Sveriges Riksbank, the NBER Chinese Economy Working Group, VEAMS Macroeconomics Seminar Series, the 2nd Workshop on Labor Markets and Macroeconomic Outcomes (LAEF, UCSB), the 4th Bristol Macroeconomic Workshop, the 8th International Conference on Transition and Economic Development (TED) in China, the 2019 Conference of the Asian Bureau of Finance and Economic Research, the 2019 Bank of Canada-Tsinghua University Conference, the 2020 Growth and Institutions Workshop at Tsinghua University, the 2022 Current Advances in Macroeconomics and Financial Markets at the UK Campus of Peking University HSBC Business School, the 6th HKUST and Jinan Joint Workshop on Macroeconomics, the 2023 CCER Summer Institute, and Oslo Macro Group. Brandt and Kambourov gratefully acknowledge the support from the Social Sciences and Humanities Research Council of Canada. Brandt also thanks the support from the Noranda Chair for International Trade and Economics. Dai and Zhang thank the support from China National Science Foundation (project number 71874008,72192844, and 72203252) .

[†]University of Toronto, Department of Economics, 150 St. George St., Toronto, Ontario M5S 3G7, Canada. E-mail: brandt@chass.utoronto.ca.

[‡]Central University of Finance and Economics, Shahe, Changping District, Beijing, China. E-mail: dairuochenpku@gmail.com.

[§]University of Toronto, Department of Economics, 150 St. George St., Toronto, Ontario M5S 3G7, Canada. E-mail: g.kambourov@utoronto.ca.

[¶]University of Minnesota, Department of Economics, 1925 Fourth Street S, Minneapolis, MN 55455, USA. E-mail: kjetil.storesletten@gmail.com.

[‖]Peking University, Guanghua School of Management, No.5 Yiheyuan Road, Haidian District, Beijing, China. E-mail: x.zhang@gsm.pku.edu.cn.

1 Introduction

The creation of new productive firms is an important engine of growth, especially in emerging economies. While most entrepreneurs start only a single firm during their lifetime, some start and operate a series of firms. This paper studies entrepreneurship and the creation of new firms in China through the lens of these serial entrepreneurs (SEs) and their differences with entrepreneurs who only start a single firm, or non-serial entrepreneurs (Non-SEs). These differences are informative about the underlying frictions and dynamics of entrepreneurship and more generally, the environment facing potential entrepreneurs.

In principle, serial entrepreneurs could be selected because of highly persistent skills, i.e., they are individuals good at identifying new business opportunities (Holmes and Schmitz, 1995). Alternatively, their advantage may lie in better access to scarce factors or connections, which help them secure finance and overcome barriers to doing business. If serial entrepreneurship is driven by persistent skills, we expect them to be better than average; if driven by non-skill advantages, we expect them to have lower productivity and to be associated with resource misallocation. Thus, the performance of SEs in terms of total factor productivity (TFP) and assets relative to Non-SEs is revealing of the driving forces of entrepreneurship as well as potential frictions entrepreneurs face.

Studying serial entrepreneurs is often constrained by data availability. 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 (Registry Data) and measure their performance over the shorter window between 2008-2012 (Inspection Data).

To guide our empirical assessment, 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 relationship between firm debt, equity and TFP in our data substantiates the presence of these constraints in China.

The relative productivity of SEs in the model 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 the entrepreneurs' access to credit (i.e., non-skill advantages at starting firms). If skills are sufficiently persistent, SE firms are on average more productive than non-serial firms, and the second SE firm is more productive than the first SE firm. However, if this persistence is sufficiently low and some entrepreneurs have large non-skill advantages, serial entrepreneurs have lower TFP than non-serial entrepreneurs.

Our empirical evidence is in line with the persistent-skills force dominating: serial entrepreneurs' firms are significantly more productive than non-serial firms in the same (2 digit) industry and the 2nd-SE firm is more productive than the 1st-SE firm. Relative to their peers, the 1st- and 2nd-SE firms are 9% and 18% more productive, respectively. Thus, on average, the evidence for China points toward entrepreneurs becoming SEs for efficiency reasons. However, this behavior conceals substantial heterogeneity among SEs in their productivity that is related to their industry choices.

To study these linkages, we extend our model to incorporate the choice of industry across firms established by a single serial entrepreneur. We focus on a mechanism of learning about industry-specific comparative advantage: if an entrepreneur is relatively successful (unsuccessful) at operating a firm in a particular industry, then a future firm started in the same industry by the same entrepreneur can also be expected to be relatively successful (unsuccessful). This learning induces entrepreneurs to stay in the same industry if the TFP of the first firm is large and switch industry if it is sufficiently low (Jovanovic, 1979).

This threshold behavior interacts with potential heterogeneity in non-skill advantages. Assume that some entrepreneurs are "favored" by having easier access to borrowing. These favored entrepreneurs should have a lower TFP threshold for entry because their preferential access to finance allows them to recover the fixed operating cost at a lower level of TFP. They should also install more capital in the firms they operate, conditional on TFP. Favored entrepreneurs are therefore negatively selected on TFP and positively selected on capital relative to their non-favored counterparts. Thus, favored entrepreneurs should be over-represented among the industry switchers relative to their actual share in the population, which motivates using switching behavior as an indicator for favored entrepreneurs. We find that switchers have, on the one hand, significantly lower TFP and, on the other hand, more capital than stayers and non-serial entrepreneurs. The fact that switchers have lower TFP than non-serial entrepreneurs implies that the entire SE productivity premium is driven by stayers.

Finally, in the presence of financial constraints, our analysis has implications for the decision of serial entrepreneurs to operate their firm concurrently or non-currently, i.e., close the old firm when establishing the new firm. Our theory predicts that entrepreneurs with smaller endowments (equity) should close the first firm when the second firm is substantially more productive because of the higher opportunity costs of capital associated with keeping the first firm in operation. This prediction is borne out in the Chinese data.

We consider two additional motives for the choice of industry for the 2nd SE firm: diversification of industry-specific risk and gains from complementarities between firms operating in related industries. To study diversification, we assume there are industry-specific returns to capital, which creates a hedging motive and preference for industries with a low covariance in returns. As a result, an entrepreneur requires a risk premium in the form of higher productivity to start a second firm in the same industry as the first firm. Empirically, we find that entrepreneurs' industry choices are consistent with a diversification motive: industries with a lower covariance (of return to capital) with the industry of the first firm are chosen more frequently. Moreover, the firms in the industries with low covariance (with the first industry) have lower TFP on average. In addition, conditional on switching industries, entrepreneurs are more likely to choose industries with strong input-output linkages and industries that share the same downstream and/or upstream links.

Our paper contributes to the growing literature that recognizes that entrepreneurship is a "serial" activity. Recent studies document that serial entrepreneurship is common in the US and other countries and highlight the relative importance of entrepreneurial "learning by doing" and ability in understanding serial entrepreneurship.[1] In each case, authors find that serial entrepreneurs are more successful than non-serial entrepreneurs measured in terms of either size (sales), firm longevity, or productivity, which they attribute to the ability of these entrepreneurs and/or faster learning.[2] In common with much of the literature, we find that SEs are on average better. However, this premium conceals significant heterogeneity, with an important subset of serial entrepreneurs underperforming relative to non-SEs, which we link to distortions that favors some, but not all entrepreneurs.

We also contribute to the broader literature on entrepreneurship (e.g., Quadrini (2000), Cagetti and De Nardi (2006), and Tan (2018)) 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 and financial constraints (Evans and Jovanovic (1989)), which may prevent individuals from starting new firms and 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.

Finally, in the context of China our study identifies a mix of dynamism and distortion, a

[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), Rocha, Carneiro and Amorim Varum (2015), and Felix, Karmakar and Sedlacek (2021) for Portugal; Shaw and Sørensen (2019) for Denmark; Carbonara, Tran and Santarelli (2020) for Vietnam.

[2]From an empirical point of view, our paper is related to Rocha et al. (2015), Lafontaine and Shaw (2016), Shaw and Sørensen (2019), Shaw and Sørensen (2022), and Felix et al. (2021), who leverage panel data of entrepreneurs for several industrialized countries, including Portugal, US, and Denmark.

more general feature of the Chinese economy. We show that dynamism is manifested in the presence of highly productive serial entrepreneurs while distortions are betrayed by favored individuals and financial frictions. In the literature, the contrast is typically in terms of differences between the state and non-state sector (Song, Storesletten and Zilibotti (2011); Hsieh and Song (2015), Lardy (2019)). Entry by private firms has also been singled out for its important contribution to productivity growth (Brandt, Van Biesebroeck and Zhang (2012)). We find that even within the private sector there are stark differences among serial entrepreneurs in their productivity and size. We link this to preferential access to finance and favoritism. Given the weight of serial entrepreneurs in the Chinese economy, the costs of these distortions in the aggregate are likely significant.

The rest of the paper is organized as follows. Section 2 describes our data and provides an introductory discussion of entrepreneurship and serial entrepreneurship in China. Section 3 lays out a stylized model of serial entrepreneurship. Section 4 confronts the theoretical predictions with our Chinese data on serial entrepreneurship while Section 5 studies two additional motives for the industry choice of the firms of serial entrepreneurs: diversification of industry-specific risk and gains from complementarities between firms operating in related industries. 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 behavior 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 provides a regularly updated record of all firms that have operated in China since 1949. We have access to a single snapshot of the Registry for the end of 2015, thus providing information on all firms that have ever operated in China since 1949 through 2015.[3]

For each firm in the Registry, we have information on their year of establishment, exit date (if applicable), primary 4-digit industry, location, registered capital (in nominal terms), and investors in the firm and their share. Registered capital is total capital contributed by all investors in the firm and represents a notion of firm's equity.[4] The firm investors are

[3]The data for later years 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. As explained more fully below, most of our analysis uses data through 2012.

[4]A small percentage of unincorporated firms such as township and village enterprises (TVEs) do not have

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. We supplement data from the Registry in 2015 with information collected by SAIC on changes in the registered capital of firms.[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 firms operating in 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.
- *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.

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. In the analysis that follows, we focus on the post-1995 time period.

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, total taxes, and equity (computed as assets minus liabilities). 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

registered capital. We retain these firms in our sample 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.

[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.

registry system, and replaced by an annual self-reporting system. For quality reasons, we restrict our use to 2008-2012.[7]

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.

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

Year	Based on largest shareholder							Unreported
	Total	Unregistered	Individual			Enterprise		
			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

[7] Appendix Tables A-1 and A-2 provide more information on the number of firms and the reporting ratio in the Inspection Data.

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, each increasing by more than a factor of 30 between 1995 and 2015. 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.

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.

The structure of the dataset implies that we cannot reconstruct the entire ownership history of each firm since its establishment. 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.

2.4 Serial Entrepreneurs in the Business Registry of China

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

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.

2.4.1 Definitions

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

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.[8]

2.4.2 Empirical Patterns

SE firms. Table 3 highlights the fact that SE firms are a quantitatively significant part of the Chinese economy − they represent about one-third of all firms and hold almost half of all the registered capital. As shown in column (2), the fraction of SE firms increased from 30.6% in 1995 to 33.9% in 2005.[9] 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.

Columns (5) and (6) in Table 3 reveal that the average registered capital in SE firms is about two times larger than in Non-SE firms. The fact that SE firms are larger in terms of capital is central for our analysis, and raises the following question: Are they larger because they are more productive in terms of TFP or because they have easier access to finance?

Entry and Exit of SE and Non-SE firms. 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 Appendix Table A-4.[10] 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.[11] 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.

[8]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

[9]The fraction recedes to 28.2% in 2015. 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.

[10]As pointed out above, 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.

[11]The entry rate is new firms in the current period as a share of all firms in the previous period. The exit rate is the number of firms that exit in the current period as a share of all firms in the current period.

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.

Concurrent vs. non-concurrent SE firms. If the 1st-SE firm is closed down simultaneously with the start of the 2nd-SE firm (or before the 2nd-SE firm is started), we then classify both firms as *non-concurrent* during all of their years of operation in the Inspection Data (2008-2012).[12] Alternatively, if the 1st-SE firm is closed down after the start of the 2nd-SE firm (or continues to operate), we then classify both firms as *concurrent* during all of their years of operation. An implication of this procedure is that in the analysis of concurrent versus non-current firms, we need to exclude all pairs of 1st- and 2nd-SE firms where the 2nd-SE firm is started after 2012. Since we do not have Inspection data after 2012, we do not know whether 2nd-SE firms started after 2012 operate concurrently or non-concurrently

[12]Note that this implies that we therefore classify firms for which the last year of operation of the 1st-SE firm coincides with the first year of observation of the 2nd-SE firm as non-concurrent.

with the 1st-SE firm.

By this definition, 47.5% of SE firms are operated concurrently.

Industrial distribution of entrants. Table 4 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 across industries for new entrants. In order to control for the underlying distribution of firms across industries, 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 industry relative to the existing industry distribution of firms.

Wholesale and Retail Trade, Manufacturing, and Business Services dominate with relatively small differences overall between non-serial and serial entrepreneurs, and between 1st and 2nd firms of SEs in the breakdown. Serial entrepreneurs are slightly more likely to enter Business Services, R&D, and Real Estate compared to non-serial entrepreneurs, three industries that represent a fifth of all firms.

Industry and locational switching of SEs. In Table 5, we examine changes by serial entrepreneurs in the industry and location of their 1st and 2nd firms. Only one-third of serial entrepreneurs start their second firm in the same industry, with two-thirds changing to a different industry.[13] In contrast, a majority (72.3%) start their second firm in the same prefecture as their first firm.

Table 5: Geographical and Industry Location, Registry Data, 1995-2015.

	Stayers	Switchers	Stayers (%)	Switchers (%)	Total (%)
Same prefecture	822,215	1,595,585	24.58	47.70	72.27
Different prefecture	277,224	650,288	8.29	19.44	27.73
Total (%)			32.87	67.13	100.00

Notes: Authors' calculations from the Registry Data. Stayers are SE whose I-O industry code of the 1st-SE and the 2nd-SE are same. Switchers are SE whose I-O industry code of the 1st-SE and the 2nd-SE are different.

[13] Industry is defined using the classification in the Chinese 2007 Input-Output table, which has 135 categories. For manufacturing, this reflects activities between the 2-digit and 3-digit SIC level, and for services, activities at the two-digit SIC level. We use the industry breakdown from the I-O table for consistency with later analysis that leverages the I-O table to estimate upstream and downstream linkages.

Table 4: 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 an industry in a given year, is the number of new established firms in that industry divided by the total number of all newly established firms. For a particular SE group, the conditional share of each industry is the ratio of unconditional share divided by the fraction of a given industry in the stock of firms one year before.

3 A Model of Entrepreneurship

We now lay out a two-period model of entrepreneurship. Section 3.1 analyzes the decision to start a firm in the first period. Section 3.2 studies the choices in the second period when the entrepreneur may choose to start a second firm and become a serial entepreneur. Motivated by the evidence in Table 3 that serial entrepreneurs start firms with more capital, our analysis focuses on two key factors that affect serial entrepreneurship and the performance of serial entrepreneurs relative to non-serial entrepreneurs: (i) persistence in entrepreneurial skills; and (ii) heterogeneity in access to finance where some entrepreneurs face less constraints. Sections 3.1-3.2 abstract from industry choice. In Section 3.3, we extend the model to incorporate the choice of industry across firms established by a single entrepreneur, focusing on the role of learning about industry-specific comparative advantage.

3.1 Choices in the First Period

The economy is populated by a fixed set of (potential) entrepreneurs who may choose to operate firms.[14] Firms produce a homogeneous 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. This has to be paid every period. For simplicity we abstract from capital depreciation and capital adjustment costs.

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 $1 - 1/\lambda$ of installed capital, where $\lambda \geq 1$. This constrains 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. Note that the first-period problem is entirely static: it is optimal to operate a firm if and only if the first-period profits are positive. The entrepreneur therefore decides to operate the firm if the TFP z draw is higher than a threshold value $z^*(e)$ which is weakly decreasing in the entrepreneur's equity e. Conditional on having chosen to operate, the firm's objective is then given by

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

An entrepreneur is either constrained, thus investing all his/her equity in the firm and 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 entry decision and 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,*

[14] In 77% of the firms in our sample, the largest shareholder is also the the firm's Legal Representative − the key person that has the legal authority to interact with Chinese officials, execute the powers and duties of the company, and bear the legal responsibility for the actions of the firm. Therefore, the largest investors are actively involved in the management and operation of their firms.

$z \geq z^*(e)$, 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

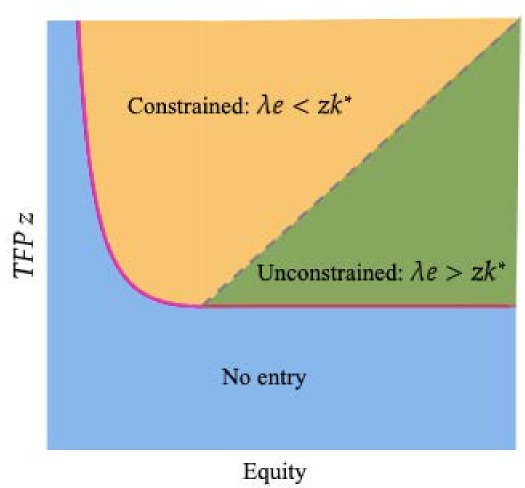
$$\begin{aligned} k^* &\equiv \left(\frac{(1-\alpha)\eta}{R}\right)^{\frac{1-\alpha\eta}{1-\eta}} \left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}} \\ z^* &\equiv \frac{\eta}{1-\eta} \frac{1-\alpha}{R} \frac{\nu}{k^*}. \end{aligned}$$

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

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

Proof. The proof is in Appendix B.1. □

Figure 1: Entry Decision.

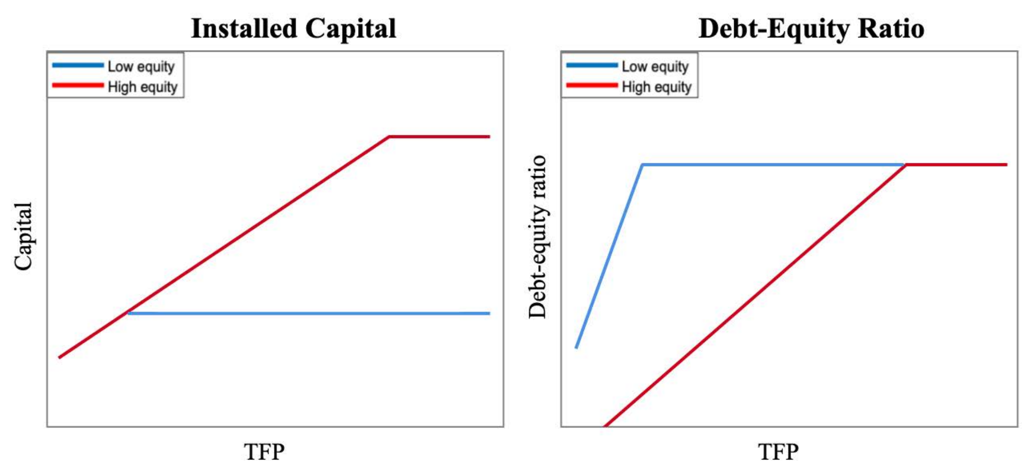


Notes: The figure shows the entry decision for an entrepreneur with equity e and the option to run a firm with TFP z.

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.

Proposition 1 implies the following theoretical predictions, in the presence of financial frictions, about the empirical relationship between equity, capital, debt, and TFP of firms: (i) capital is monotone increasing in equity, (ii) capital is monotone increasing in TFP, and (iii) the debt-equity ratio is monotone increasing in TFP, monotone decreasing in equity, and when equity is larger the debt-equity ratio increases less steeply in TFP. These patterns are illustrated in Figure 2.

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.

3.2 Choices in the Second Period: Becoming a Serial Entrepreneur

Consider now the entrepreneur's choices in the second period. Entrepreneurs consume at the end of the second period, so all potential profits from the first period are saved for the second period. 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. Recall that the entrepreneur can move capital and workers between firms at no cost and that entrepreneurial effort is not a rival input in production.

We analyze separately the two key factors that may affect the performance of serial entrepreneurs: (i) persistence in entrepreneurial skills, and (ii) heterogeneity in access to finance.

3.2.1 Persistence in Entrepreneurial Skills

We capture the persistence in entrepreneurial skills across firms started by an entrepreneur i by allowing the TFP of potential firms drawn in the first and second period to be related via an AR(1) process,

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

where the parameter $\rho \in [0, 1]$ captures the autocorrelation of an entrepreneur's 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.

No Financial Frictions. To develop the intuition for our results, we initially analyze an environment without any financial constraints, i.e., when $\lambda \to \infty$. From Proposition 1, the optimal decision for the entrepreneur will be to open a firm in the second period if and only if $z_2 \geq z^*$. The following proposition characterizes the average TFP for serial versus non-serial entrepreneurs when there are no financial frictions.

Proposition 2. *Suppose there are no financial frictions ($\lambda \to \infty$). Then,*

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.*

2. *If ρ is sufficiently large, the 2nd-SE will on average have a higher TFP than the 1st-SE.*

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

Proof. The proof is in Appendix B.2. □

When the draws are positively correlated, the TFP for the firms of an entrepreneur who obtains two draws in succession above the common threshold z^* must first-order stochastic dominate the TFP for firms of entrepreneurs who obtained one draw above and one below the threshold. If ρ is sufficiently large, the left tail of the realized distribution of ε is truncated from below. The reason is that the entrepreneur would enter with the 2nd firm if and only if $z_2 = \rho z_1 + \varepsilon \geq z^*$. Given z_1, this condition imposes a lower bound on ε that will be realized. If $\rho = 1$, the expected *potential* TFP for the 2nd firm is $z_2 = z_1 + E(\varepsilon) = z_1$. Because the entrepreneur would operate the firm 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 firms must have an expected TFP larger than z_1. Finally, when TFP draws are i.i.d. over time ($\rho = 0$), and potential entrepreneurs are otherwise ex-ante identical, there is no information in being a SE. Therefore, SE and non-SE firms must have the same expected TFP.

Financial Frictions. Consider now the choices for entrepreneurs who face financial frictions in the form of a collateral constraint on borrowing ($\lambda < \infty$). Proposition 3 characterizes the 2nd-period entry decisions for an entrepreneur who operated a firm in the first period.

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

$$\begin{aligned} \bar{Z}(z_1, e) &= \left(1 + \frac{1-\eta}{1-\alpha\eta}\left(\frac{z_1 k^*}{\lambda e} - 1\right) + \frac{(1-\alpha)\eta}{1-\alpha\eta}\frac{1}{\lambda e}\frac{v}{R}\right)^{\frac{1-\alpha\eta}{1-\eta}} \frac{\lambda e}{k^*} - z_1 \\ \underline{Z}(z_1, e) &= \left((z_1)^{\frac{1-\eta}{1-\alpha\eta}} + \left(\frac{w}{\alpha\eta}\right)^{\frac{\alpha\eta}{1-\alpha\eta}} \frac{\nu}{1-\alpha\eta}(\lambda e)^{-\frac{(1-\alpha)\eta}{1-\alpha\eta}}\right)^{\frac{1-\alpha\eta}{1-\eta}} - z_1. \end{aligned}$$

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

Proof. The proof is in Appendix B.3. □

The TFP threshold for entry of the 2nd firm is now a function $Z(z_1, e)$ of both the TFP of the existing firm, z_1, and equity e. Naturally, the threshold is falling in e because more equity allows the firm to invest in capital closer to the optimal firm size. Moreover, the threshold is increasing in z_1 because a larger productivity of the first firm increases the opportunity cost of equity associated with opening a second firm. To see this, recall that investments are assumed to be fully reversible so the entrepreneur would equate the marginal product of capital across firms if they operate both firms concurrently. 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.

The following corollary characterizes the debt and installed capital in each SE firm.[15] 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 the fixed cost of operation must be paid every period and capital is fully reversible.

Corollary 1. *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*

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

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

The total debt of the entrepreneur is given by

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

Corollary 1 characterizes the allocation of capital and debt for each firm of a serial entrepreneur. Both capital and the debt-equity ratio are increasing in the TFP of each firm and capital (in each firm) is increasing in equity.

Financial frictions complicate the predictions of TFP for serial versus non-serial entrepreneurs since the level of equity now matters for the TFP thresholds $z^*(e)$ and $Z(z_1, e)$. Our earlier proof of Proposition 2 relied on all potential entrepreneurs having the same TFP threshold $z^* \in \mathbb{R}$ for starting firms. When equity is correlated with the TFP draws, pre-

[15] The proof of Corollary 1 follows directly from the proof of Proposition 3.

dictions about the relative TFP of SE and non-SE firms become ambiguous. In particular, if equity and TFP are 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 obtain sharp predictions about TFP, we must impose some restrictions on the distribution of initial equity and the initial TFP draw z_1. For simplicity, we focus on a sufficient condition, namely that TFP and initial equity are positively related. We state this as a formal assumption.

Assumption 1. *Assume that initial equity is monotone increasing in the initial TFP draw z_1 in the first period.*

Assumption 1 guarantees that the entry condition for the 1st-SE, i.e., that z_1 exceeds the TFP threshold function $z^*(e)$, can be replaced by the condition $z^{**} \geq z^*(e)$, where $z^{**} \geq z^*$ and $z^{**} \in \mathbb{R}$. Namely, there exists a TFP level 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 1, 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 $z_1 = z^{**}$, who are indifferent. Conversely, no entrepreneur with TFP $z_1 < z^{**}$ will enter because they have lower TFP and less equity than those with $z_1 = z^{**}$. With a common entry threshold for TFP z^{**}, we can use the same proof strategy as for Proposition 2 to show that SEs are more productive than non-SEs if ρ is sufficiently large.

Empirical support for Assumption 1 is provided by the bin scatter plot of equity against TFP for newly established firms reported in Appendix Figure A-1. We can now state the main prediction about TFP in the presence of financial frictions.

Proposition 4. *Suppose there are financial frictions ($\lambda < \infty$) and that Assumption 1 holds. 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 ρ 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 firm will on average have a higher TFP than the 1st-SE firm.*

Proof. The proof is in Appendix B.4. □

In summary, the predictions of Proposition 2 hold up in the presence of financial frictions provided that the persistence ρ is sufficiently large and Assumption 1 holds.

3.2.2 Heterogeneity in Access to Finance

Having analyzed the role of persistence in skills for serial entrepreneurship, we now turn to the role of heterogeneity in access to finance. A large literature on China's economy has emphasized that there are large differences across firms in the extent of the financial frictions they face (see, e.g., Hsieh and Klenow (2009) and Song et al. (2011)). Entrepreneurs may therefore differ ex ante in their access to borrowing through the tightness of their borrowing constraint. To model this possibility, assume that potential entrepreneurs are of two types, A and B, and that type B individuals (favored) have a more relaxed collateral constraint than type A individuals (non-favored): $\lambda_B > \lambda_A$. There are no other differences between favored and non-favored individuals. In particular, both groups have the same distribution of (potential) TFP.

To focus on the effect of this heterogeneity we eliminate any role for persistence by assuming that $\rho = 0$. Propositions 1 and 3 imply that entrepreneurs of type B have a lower TFP threshold because they have easier access to borrowing (higher λ_B). A lower TFP threshold makes them more likely to enter each period. As a result, the favored (type-B) individuals will be over-represented among the serial entrepreneurs relative to their share in the population of entrepreneurs who enter in the first period. Since the favored entrepreneurs have a lower TFP threshold and $\rho = 0$, serial entrepreneurs will on average have *lower* TFP than non-SEs.[16] However, if λ_B is sufficiently large, the favored entrepreneurs will have more capital, conditional on TFP.

We state these results in the following proposition.

Proposition 5. *If $\rho = 0$ and favored entrepreneurs have a higher λ relative to non-favored entrepreneurs, the favored entrepreneurs will be over-represented among SEs. SE firms will then on average have lower TFP than non-SE firms. Moreover, SE firms will have a larger capital stock conditional on TFP.*

Persistence and heterogeneity support contrasting outcomes for the TFP of SE firms relative to non-SE firms. The data will determine which force is dominant.

3.2.3 Operating SE Firms Concurrently or Non-concurrently

A critical decision of serial entrepreneurs is whether to operate their firms concurrently or to close the first firm when starting the second. Our model is well suited to study this decision,

[16] To see this, note that for any state variable (z_1, e_2), the threshold function Z is 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 are allowed to borrow more for a given equity (larger λ), would be more likely to become SEs and would tend to have a lower TFP.

which is revealing of the financial frictions facing entrepreneurs.

Consider the case when it is optimal for the entrepreneur to start the second firm (and become a serial entrepreneur). Recall that both the 1st-SE and 2nd-SE firm must pay the fixed operating cost ν if they operate in the second period. Moreover, if the two firms operate concurrently, the marginal product of capital will be equated across firms. Since the optimal size of a firm is increasing in its TFP, it follows that the opportunity cost of equity associated with operating the 1st-SE in the second period is increasing in the TFP of the 2nd-SE. Therefore, if equity is sufficiently scarce and the 2nd-SE firm is sufficiently productive, it is optimal to close the 1st-SE firm and allocate all funds to the most productive firm. This effect is stronger the less equity the entrepreneur has in the beginning of period 2.[17]

The optimal choice, which follows from Proposition 3, is characterized in the following proposition.[18]

Proposition 6. *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. 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 follows immediately as a necessary and sufficient condition for concurrent operation. □

3.3 Learning Industry-Specific Abilities

So far, we have abstracted from the industry choice of serial entrepreneurs. Slightly more than two-thirds of all serial entrepreneurs switch industries. As we shall see, this decision is informative about the factors driving serial entrepreneurship. To incorporate industry choice into our analysis, we assume that there are several industries $s \in S = \{1, 2, ..., N\}$ in the economy. Moreover, an entrepreneur's ability differs across industries. Following Jovanovic (1979), the decision to enter an industry is made before observing the ability. When entering an initial industry s, the potential entrepreneur obtains an initial TFP draw

[17] A similar effect is present if the initial firm is very productive, in which case the opportunity cost of equity would be determined by a potential and less productive 2nd-SE firm. However, if a potential second firm is not sufficiently productive, it would not get started and the entrepreneur would be recorded as a non-serial entrepreneur.

[18] This is further illustrated in Appendix B.5.

z_{1s}. A firm established in a particular industry must remain in that industry. After the first period, the entrepreneur is free to start a second firm (2nd-SE) in any industry $s' \in S$.

We assume that the persistence of TFP across firms is higher for firms in the same industry than for different industries.[19] In particular, if the entrepreneur chooses to make a TFP draw in the same industry s as the first firm, the persistence of TFP is ρ, while for a TFP draw in a different industry $s' \neq s$, the persistence is $\underline{\rho}$, where $0 < \underline{\rho} < \rho$. Therefore,

$$z_2 = \begin{cases} \rho z_{1s} + (1-\rho)\bar{z} + \varepsilon & \text{if stays in same industry } s \\ \underline{\rho} z_{1s} + (1-\underline{\rho})\bar{z} + \varepsilon & \text{if switches to different industry } s' \in S \backslash s. \end{cases} \tag{5}$$

Moreover, we set $\bar{z} \equiv E\{z_1\}$ to ensure that the expected TFP of *potential* draws of z_2 is the same for switchers and stayers. Thus, any difference in realized outcomes must be due to selection into staying or switching.

All industries are ex-ante identical, with the same distributions for z_1 and ε. The optimal industry choice after the first period is now straightforward: the entrepreneur stays in the same industry as the first firm if and only if the TFP of the 1st-SE firm z_{1s} is larger than the switching threshold $\bar{z}$. The reason is that the entrepreneur prefers high persistence – which she can obtain by staying in the same industry – if and only if the initial draw z_1 is above the average first-period draw, $E\{z_1\}$. This threshold behavior in industry choice induces positive selection for the entrepreneurs who remain in the same industry and negative selection for those who search for potential firms in different industries. Therefore, TFP for serial entrepreneurs locating two firms in the same industry will be larger than TFP for switchers. This captures the spirit of the Jovanovic (1979) learning model. We summarize this decision in the following proposition.

Proposition 7. *Consider an entrepreneur who operated a firm in industry s with TFP z_{1s} in the first period.*

- ***Part A: Industry choice**. If TFP of the 1st-SE firm is above a switching threshold $z_{1s} \geq \bar{z} = E\{z_1\}$, the entrepreneur remains in the same industry s. Otherwise, the entrepreneur switches to a different industry $s' \neq s$.*

- ***Part B: TFP**. Average TFP is higher for entrepreneurs who stay in the same industry than for those who switch industries. This holds true for both the 1st-SE and the 2nd-SE firms.*

[19]In a previous version of this paper we generalized this process to allow for an intermediate group of industries, dividing industries into "same," "similar," and "distant." All the qualitative properties go through with the current simpler setup.

Proof. Remaining in the industry implies a larger z_{2s} for all realizations of ε if and only if $z_{1s} > E\{z_1\}$. Moreover, z_{2s} is invariant to ε if $z_{1s} = E\{z_1\}$. This proves Part A. Part B then follows from $\rho > \underline{\rho} > 0$, and z_{1s} being strictly larger for entrepreneurs who stay in the initial industry. □

4 Empirical Analysis

Our model generates empirical predictions relating to: (i) the relationship between productivity, debt and equity (Corollary 1); (ii) the performance of serial versus non-serial entrepreneurs (Propositions 4 and 5) and concurrent versus non-concurrent SE firms (Proposition 6); and (iii) productivity and the decision of serial entrepreneurs to switch industries (Proposition 7). We examine each in turn.

4.1 Measuring Firm TFP

We measure firm TFP relative to other firms in the same 2-digit industry, province, and year. This requires data on value added, capital, and labor. We use firm revenue and firm assets from the Inspection Data as measures of value added and capital, respectively.[20] However, the Inspection Data do not have information on labor input. To overcome this shortcoming we assume that all firms in the same 2-digit industry, province, and year cell pay workers the same wage rate w. Assuming competitive labor markets, firm optimization equates the marginal product of labor across firms. From the firm's first-order condition, labor input can be expressed as $n_i = y_i \alpha\eta / w$. Combining this expression with the production function in equation (1), TFP of firm i relative to the revenue-weighted average TFP $E\{z\}$ in a particular province-industry-year cell can be expressed as

$$\frac{z_i}{E\{z\}} = \frac{y_i^{\frac{1-\alpha\eta}{1-\eta}} k_i^{-\frac{(1-\alpha)\eta}{1-\eta}}}{\sum_j \omega_j y_j^{\frac{1-\alpha\eta}{1-\eta}} k_j^{-\frac{(1-\alpha)\eta}{1-\eta}}}, \tag{6}$$

where the weight ω_j is the relative revenue of firm j in the industry-province-year cell. We assume a return to scale of $\eta = 0.85$ and set the industry-specific labor income share $\alpha\eta$ equal to those used in Hsieh and Klenow (2009).[21] Before computing TFP, we trim the

[20] Revenue is an appropriate proxy for value added provided that all firms in the same industry-province-year cell have the same Cobb-Douglas production over labor, capital, and intermediate inputs.

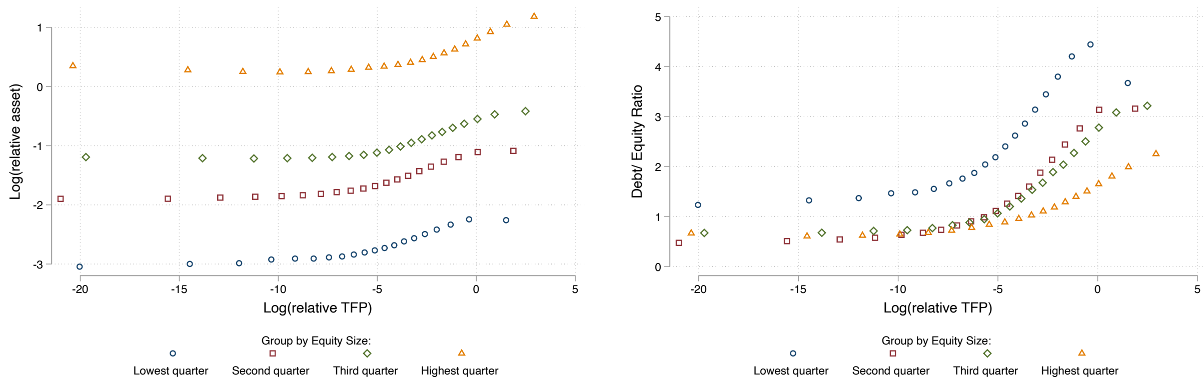
[21] In Appendix D we discuss methods for computing the labor share from Chinese data − the Chinese 2007 Input-Output Tables and the 2008 Chinese Enterprise Census Data − and argue that U.S. labor shares are informative about labor elasticities in Chinese data while being arguably less subject to measurement issues.

Inspection Data by dropping the bottom and top 1 percentile of assets. We also drop firms with zero assets and revenue. Finally, when reporting the facts on TFP, we drop the bottom and top 1 percentiles of computed TFP.

4.2 Productivity, Debt and Equity

Using the Inspection Data for 2008-2012, we first divide our sample of firms into four quartiles of equity (with the first quartile containing the 25% of firms with the lowest equity, etc.) Next, we sort firms in each quartile on the basis of their TFP into twenty ventiles. For each ventile we calculate average TFP, assets, and debt-equity ratio and present these in scatter plots.[22]

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



(a) Capital and TFP | (b) Debt-Equity Ratio and TFP

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

The left panel in Figure 3 and column (1) in Appendix Table A-5 show that firms with higher TFP have more assets and are thus larger. This increase is much more pronounced for firms with TFP above the median than for firms below the median. Assets are also increasing in equity, conditional on TFP. The left panel in Figure 3 verifies that the entire profile of assets shifts upwards as we move from lower to higher equity quartiles. Finally, the debt-equity ratio is increasing in TFP and decreasing in equity. Further, the larger the equity, the smaller the increase in the debt-equity ratio with TFP. The right panel in Figure 3 and column (2) in Appendix Table A-5 verifies that these patterns hold in the data. The

[22] All variables are computed relative to that variable's average for firms in the relevant province-industry-year cell. Appendix 4.1 provides details on the procedure.

debt-equity profile is increasing with TFP within each quartile of equity, and as we move from lower to higher equity quartiles, the entire debt-equity profile shifts downward and the slope with respect to TFP becomes flatter.

These patterns are consistent with the relationship among equity, capital, debt, and TFP, in the presence of financial frictions − discussed in Proposition 1 and illustrated in Figure 2 − indicating that financial frictions are a quantitatively important feature of the environment facing entrepreneurs.

4.3 TFP of Serial Entrepreneur Firms

4.3.1 Serial versus Non-serial Firms

Our key predictions relating to the performance of serial versus non-serial entrepreneurs were provided by Propositions 4 and 5. Table 6 uses data from the 2008-2012 Inspection Data to show the levels of TFP, assets, revenue, and equity of 1st-SE and 2nd-SE firms relative to Non-SE firms. All variables, except age, are computed relative to their averages over all firms in the same province-industry-year cell. We find that SE are more productive and have larger firms. Compared to their Non-SE counterparts, 1st and 2nd SE firms are 9% and 18% more productive, and in terms of assets, are 40% and 66% larger. Among the serial firms, 2nd-SE firms also have a higher TFP and more assets, revenue, and equity than 1st-SE firms.[23]

On average, the evidence is in line with the persistent-productivity view of Proposition 4 and not with the favored-entrepreneurs view of Proposition 5. The higher productivity of SE firms suggests that a positive correlation of TFP draws for entrepreneurs is quantitatively much more important than any heterogeneity in the tightness of the financial constraint. Furthermore, the higher productivity of the 2nd-SE firms relative to the 1st-SE firms indicates high persistence ρ in the TFP draws, as required in Proposition 4. Thus, the evidence favors the view that entrepreneurs are serial for efficiency reasons: productivity is persistent across firms started by the same entrepreneur and better entrepreneurs start more firms.

4.3.2 Concurrent versus Non-concurrent SE Firms

About half of the 2nd-SE firms are run concurrently with the 1st-SE firm, while in the other half of the cases the 1st-SE firm is closed when operating the 2nd-SE firm. In Table 7 we consider the TFP and equity of 1st-SE and 2nd-SE firms, depending on whether they are run concurrently or not, relative to Non-SE firms. We find that SE firms that are operated

[23] In a contemporaneous paper Shaw and Sørensen (2022) document that similar properties hold for SEs in Denmark.

Table 6: Performance of Firms, Registry and Inspection Data, 2008-2012.

	Sample with Inspection Data					Full Sample
	Log TFP	Log Assets	Log Revenue	Log Equity	Log Registered Capital	
	(1)	(2)	(3)	(4)	(5)	(6)
1st SE	0.09***	0.40***	0.32***	0.35***	0.34***	0.37***
2nd+ SE	0.18***	0.66***	0.52***	0.57***	0.57***	0.66***
Age	0.42***	0.17***	0.26***	0.12***	0.10***	0.07***
Age square	-0.01***	-0.00***	-0.01***	-0.00***	-0.00***	-0.00***
Observations	12,476,788	12,476,788	12,476,788	12,476,788	12,476,788	34,458,350
Adjusted R-squared	0.03	0.11	0.08	0.08	0.06	0.04

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.

concurrently differ systematically from SE firms that are operated non-concurrently. First, Table 7 shows that 1st-SE firms that are closed down when the 2nd-SE firm is started have a 49% lower TFP and 6% lower equity than those 1st-SE firms that are run concurrently with the 2nd-SE firm.[24] This finding is in line with the predictions of Proposition 6 that a relatively poor productivity draw for the 1st-SE firm, as well as less equity, makes it more likely to be run non-concurrently with the 2nd-SE firm. Second, 2nd-SE firms that are operated by entrepreneurs who closed down their first firm (1st-SE) have an 13% higher TFP and 20% lower equity than those 2nd-SE firms that are run concurrently with the 1st-SE firm. This finding is also in line with the predictions of Proposition 6 − a relatively good productivity draw for the 2nd-SE firm, as well as more equity, makes it more likely that the firms are run concurrently. We also interpret this as evidence that firms face financial constraints.

4.4 Learning and Industry Choices

How are productivity and industry choice related? We first document that the persistence of TFP shocks is larger for serial firms started in the same industry than for serial firms started in different industries. Recall that this is the key assumption in Proposition 7. Altogether, we have observations on 292,549 serial entrepreneurs. For non-concurrent SEs, we use the TFP of the 1st-SE firm in its last year of operation and the first year that 2nd-SE firm reports. For concurrent SE firms, we use information on 1st- and 2nd-SE firms for all years

[24]For TFP, for example, the difference for non-concurrent 1st SEs is given by subtracting the estimate in column (2) from the estimate in column (1), i.e., -0.21 - 0.28 = -0.49.

Table 7: TFP and Equity of Concurrent vs Non-concurrent SE Firms, Inspection Data, 2008-2012.

	Log TFP		Log Equity	
	Non-concurrent SE	Concurrent SE	Non-concurrent SE	Concurrent SE
	(1)	(2)	(3)	(4)
1st SE	-0.21***	0.28***	0.43***	0.49***
2nd+ SE	0.29***	0.16***	0.47***	0.67***
Age	0.41***	0.40***	0.12***	0.12***
Age square	-0.01***	-0.01***	-0.00***	-0.00***
Observations	9,749,158	10,116,156	9,749,158	10,116,156
Adjusted R-squared	0.03	0.03	0.06	0.08

Notes: Authors' calculations from the Inspection Data. The table compares the TFP and equity of concurrent and non-concurrent 1st-SE and 2nd-SE firms, relative to Non-SE. TFP and equity are computed relative to the averages of all firms in the same province-industry-year cell. *** − statistically significant at the 1% level.

they both report. Table 8 shows that the persistence in TFP shocks is two-times higher for serial firms in the same 2-digit industries than for serial firms that are in different 2-digit industries. This confirms that the assumption on the persistence of TFP draws, summarized in equation (5) and underlying Proposition 7, is supported in the data.[25]

Table 8: Persistence in TFPs for 1st- and 2nd-SE Firms, at Entrepreneur Level.

	Log 2nd-SE TFP	
	Stayers	Switchers
	(1)	(2)
Log 1st-SE TFP	0.29***	0.14***
Age of 1st-SE	0.34***	0.30***
Age difference	0.34***	0.29***
Observations	103,896	188,653
Adjusted R-squared	0.10	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. All observations are SE who operate the 1st- and 2nd-SE firms for at least one year from 2008 to 2012. TFP is computed relative to the average of all firms in the same province-industry-year cell. Stayers are SE whose I-O industry code of the 1st-SE and the 2nd-SE are same. Switchers are SE whose I-O industry code of the 1st-SE and the 2nd-SE are different. *** − statistically significant at the 1% level.

Consider now the implications from Proposition 7 regarding the ranking of TFP for industry stayers versus switchers. Table 9 shows that these predictions are born out: the

[25]Estimating a version of Table 8 separately for concurrent and non-concurrent entrepreneurs shows the same results for both groups: a persistence of 0.30 for stayers and 0.14 for switchers.

TFPs of both 1st- and 2nd-SE firms are significantly higher when both firms are in the same 2-digit industry than when they are in different industries. In particular, the 1st-SE and 2nd-SE firms of industry stayers have respectively 49% and 70% higher TFP than non-serial firms. On the other hand, the 1st-SE and 2nd-SE firms of industry switchers have respectively 9% and 11% lower TFP than non-serial firms.

Table 9: Performance of Serial Entrepreneurs: Industry Switchers vs. Stayers.

	Log TFP	Log Assets	Log Revenue	Log Equity	Log Registered Capital
	(1)	(2)	(3)	(4)	(5)
1st-SE Stayers	0.49***	0.35***	0.35***	0.29***	0.27***
1st-SE Switchers	-0.09***	0.42***	0.30***	0.38***	0.37***
2nd-SE Stayers	0.70***	0.61***	0.59***	0.51***	0.49***
2nd-SE Switchers	-0.11***	0.69***	0.48***	0.60***	0.61***
Age	0.42***	0.17***	0.26***	0.12***	0.10***
Age square	-0.01***	-0.00***	-0.01***	-0.00***	-0.00***
Observations	12,476,788	12,476,788	12,476,788	12,476,788	12,476,788
Adjusted R-squared	0.03	0.11	0.08	0.08	0.06

Notes: Authors' calculations from the Registry and Inspection Data. The table compares the financial performance of 1st-SE and 2nd-SE firms of the stayers and switchers, relative to Non-SE firms. Stayers are SE whose the IO industry of the 2nd-SE is same as that of the 1st-SE. Switchers are SE whose I-O industry code of the 1st-SE and the 2nd-SE are different. 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.

Since serial entrepreneurs who switch industries are actually less productive than non-serial entrepreneurs, the entire productivity premium of serial entrepreneurs must be a product of those who locate the 2nd-SE firm in the same 2-digit industry. Why, then, are the switchers willing to open the second firm? One possibility is that these entrepreneurs are largely favored individuals with non-skill advantages in the form of preferential access to borrowing. Recall from Proposition 5 that easier access to credit lowers the entry threshold, lowers TFP, and (conditional on TFP) increases the capital stock. Moreover, according to the learning hypothesis (Proposition 7) entrepreneurs with a low initial TFP are more likely to switch industry. It follows that favored individuals should be overrepresented among switchers. This insight suggests that industry switching can be used as a proxy for favored individuals.[26] The preponderance of favored individuals among switchers will in turn be a force for lower TFP and larger capital stock among switchers. In particular, switchers will have more capital than stayers, relative to their TFP. If the advantage is sufficiently

[26]We provide a more rigorous discussion of this in Appendix C.

large, the switchers could end up having larger average capital than the stayers, even if their average TFP is lower.

The results in Table 9 are consistent with this interpretation. The estimates in columns (2), (4), and (5) show that serial entrepreneurs who locate firms in distant industries have more assets, more equity, and more registered capital than their more productive peers who locate SE firms in the same (two-digit) industry. For example, the estimates in column (2) show that switchers – serial entrepreneurs who locate firms in different industries – have at least 7% more capital in the 1st- and 2nd-SE firms relative to stayers (i.e., serial entrepreneurs who locate firms in the same industry). This might seem surprising given that switchers have substantially lower TFP than stayers and should – if all entrepreneurs face the same cost of capital – install substantially less capital. However, as discussed above, the presence of favored entrepreneurs can rationalize why switchers have more capital even though their TFP is lower.

The evidence in Table 9 raises a puzzle for our simple theory of industry choice and TFP for serial entrepreneurs, namely, the growth in TFP between the 1st-SE and 2nd-SE firm should be *larger* for switchers than for stayers.[27] A simple extension of our theory of favored entrepreneurs can rationalize the empirical observation that switchers have lower growth in TFP between the 1st-SE and the 2nd-SE firms than stayers. Assume that the advantage of the favored entrepreneurs in access to credit increases over time. This implies that their entry threshold is lower for the 2nd-SE firm than for the 1st-SE firm. Clearly, if this improvement in credit access is sufficiently large, the positive selection associated with entry for the 2nd-SE firm should be smaller. Namely, the entrepreneur will choose to enter for a larger set of bad realizations of ε. If this effect is sufficiently large, it can counteract the positive expected TFP growth between the 1st-SE and 2nd-SE firms for switchers.

5 Additional Motives for Industry Choice

The analysis so far focused on learning as the main mechanism for industry choice. We now explore several additional motives for the industry choice of the 2nd-SE firm − risk

[27] The reason is as follows. Note first that as long as $\rho \leq 1$, both stayers and switchers experiences (weakly) regression toward the switching threshold $\bar{z}$ for the expected value $E\{z_{2,s'} \mid z_{1,s}\}$. Second, since an entrepreneur staying in the same industry has $z_{1s} \geq \bar{z}$, she has $z_{1s} \geq E\{z_{2,s} \mid z_{1,s}\}$. In contrast, a switcher has $z_{1s} < \bar{z}$, implying that $z_{1s} < E\{z_{2,s'} \mid z_{1,s}\}$. Recall that selection into entry for the 2nd-SE firm will imply that the realized 2nd-SE TFP will be larger than the expected one conditional on entry (i.e., $E\{z_{2,s'} \mid z_{1,s}, \text{entry}\} \geq E\{z_{2,s'} \mid z_{1,s}\}$.) However, if the interest rate advantage of the favored entrepreneurs is not too large, this positive selection effect will be larger for switchers because they have a lower expected TFP and, hence, will choose to not enter for a larger set of bad realizations of ε. TFP growth between 1st-SE and 2nd-SE would therefore be larger for switchers than for stayers.

diversification and complementarities through input-output linkages. Even though the model of serial entrepreneurship developed in the previous sections does not incorporate these two margins, they are both empirically relevant in understanding the industry choices of serial entrepreneurs and the TFPs of their 1st- and 2nd-SE firms.

5.1 Diversification of Risk

We start by studying the role of risk diversification for the industry choice of the 2nd-SE firm We illustrate this motive with the aid of a simple portfolio choice model. To simplify the exposition, we focus on entrepreneurs who started and operated a firm in industry s in the first period and who have decided to solicit TFP draws for potential firms in a new industry $s' \neq s$.

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 $a > 0$ and $b > 0$.[28] Second, we assume that the entrepreneur obtains one (idiosyncratic) draw $z_{s'}$ for every industry $s' \in S \backslash s$. 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 industry s has a stochastic industry-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 industries 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.

Note 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 industry-specific returns δ_s and $\delta_{s'}$ are observed $a$fter having made

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

the industry choice and the factor allocations. Therefore, W is stochastic when industry and factor choices are made.

We assume that the returns δ_j have the same univariate distribution for all industries, although the covariance with initial industry, $Cov(\delta_{s'}, \delta_s)$, can differ across industries. Without loss of generality, we normalize the expected realization of δ_j to zero for all industries.

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 industry-specific returns to capital. We state the main predictions of this section in the following proposition (the proof is in the appendix).

Proposition 8. *Consider the problem for an entrepreneur who has an existing firm in industry s and a set of idiosyncratic draws for potential firms $\{z_{s'}\}_{s' \in S \backslash s}$. The probability that the entrepreneur chooses industry s' is falling in the covariance $Cov(\delta_{s'}, \delta_s)$. Moreover, conditional on choosing industry s', the average TFP of the 2nd-SE firm is increasing in $Cov(\delta_{s'}, \delta_s)$.*

Proof. The proof is in Appendix B.6. □

Empirical Evidence on Diversification. The diversification theory requires that we measure the returns on firms in each industry, and the joint distribution (the variance-covariance matrix) of these returns. We focus on firms that are run concurrently one year after the establishment of the 2nd-SE because the entrepreneur would achieve risk diversification only when both firms are in operation. We construct an empirical measure of the return on capital in industry 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.[29] We calculate average returns for each 2-digit industry and use the empirical realizations to estimate the covariance matrix of returns.

Table 10 regresses TFP on observables for concurrently run firms with the omitted category being SE firms in the same 2-digit industry. Columns (1) and (2) convey the same message as the one in column (1) in Table 9 − SE firms in distant industries have significantly lower TFP than SE firms in the same industry. The third column of Table 10 adds the

[29] We drop the financial crisis period.

covariance between returns in the industries of the 1st-SE and 2nd-SE firms as a control variable for 2nd-SE firm TFP. The table shows that the TFP of the 2nd-SE firm is increasing in the covariance. This result confirms that entrepreneurs require a risk premium for choosing industries with more positive correlation with the entrepreneur's initial industry. 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 0.20 therefore implies that increasing this variable (the covariance) by one standard deviation (of the cross-sectional dispersion in covariance) will increase TFP by 20%. This effect is significant, both from an economic and a statistical point of view. This result is robust to including all SE firms in the regression, including firms that are not run concurrently.

Table 10: Risk Diversification and TFP for 1st- and 2nd-SE Firms, at Entrepreneur Level.

	log 1st-SE TFP (1)	log 2nd-SE TFP (2)	log 2nd-SE TFP (3)
Switchers	-0.50***	-0.67***	-0.67***
Switchers×Covariance	–	–	0.20***
Age	0.06***	0.72***	0.72***
Age squared	-0.00***	-0.03***	-0.03***
Observations	255,262	255,262	255,262
Adjusted R-squared	0.00	0.03	0.03

Notes: Authors' calculations from the Inspection Data. 1st- and 2nd-SE firms are identified from the Registry Data. All observations are SE who operate the 1st- and 2nd-SE firms concurrently for at least one year from 2008 to 2012. Switchers are SE whose I-O industry code of the 1st-SE and the 2nd-SE are different. 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 industries. This variable is standardized to have mean zero and a standard deviation of one. *** – statistically significant at the 1% level.

5.2 Upstream-Downstream Integration and Input-Output Complementarities

A natural extension of our simple multi-industry model in Section 5.1 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.[30] This implies that an entrepreneur with a firm in industry s has a comparative advantage of operating in industries that trade with firms in industry s.

If the only difference across potential industries s' is the strength of their linkages with industry s, then industries 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.

Measuring upstream and downstream integration. We measure the downstream and upstream industry 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.

Measuring input and output complementarities. 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.

Measuring the excess probability of industry choice. In order to study the quantitative importance of the measures described above in determining the industry choice of a 2nd-SE firm, we construct an excess probability measure: the normalized probability of starting the 2nd-SE firm in industry j, given that the 1st-SE firm is in industry 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

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

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.

Empirical Evidence on the Role of Linkages. We close this section by studying how industry linkages and diversification motives shape the probability of industry choice for the 2nd-SE firm conditional on the location of the 1st-SE. Table 11 reports the results of a regression of the excess probability measure on our measure of covariance, downstream and upstream integration, and complementarity.[31] In the regression, we control for the industry 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 an industry that is upstream integrated, downstream integrated, and complementary with the industry of their 1st-SE firm. These results confirm that entrepreneurs should be more likely to choose integrated industries. Moreover, Table 11 confirms the prediction of Proposition 8 that switchers should be more likely to choose industries that are negatively correlated with the initial industry (see the Covariance row, where this variable is defined as in Table 10).

Table 11: Industry Choice: Diversification, 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 industry 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 industry of the 1st-SE.

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. We highlight

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

two key factors potentially driving serial entrepreneurship: persistence in entrepreneurial skills and learning, and preferential access to finance or other scarce inputs. These drivers have sharply different implications for the outcomes of serial entrepreneurs relative to their non-serial counterparts.

We find that serial entrepreneurs in China are better than non-serial entrepreneurs. We interpret this as evidence that persistence and learning create positive selection of serial entrepreneurs. Serial entrepreneurs who start their firms in the same two-digit industry enjoy fifty percent higher productivity than non-serial firms in the same industries. In principle, serial entrepreneurs who switch industries should also be better, albeit not as good as those who remain in the same industry. We find that the productivity of switchers is lower than stayers, but surprisingly, significantly lower than non-serial firms. While frictions upstream and downstream may be contributing to the lower productivity of switchers, the most likely explanation for the negative selection of these entrepreneurs into serial entrepreneurship is preferential access to finance.

How do we explain these diametrically opposite forces shaping entrepreneurial behavior? In this paper, we assume that frictions are the same across space as well as industries. They may, in fact, differ, which has implications for selection into entrepreneurship (Brandt, Kambourov and Storesletten (forthcoming)), and thus the properties of serial entrepreneurs. In future work, we plan to examine these differences.

Finally, 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.[32] In other contexts (Bena and Ortiz-Molina (2013)), these differences were key to explaining differences between new firms.

[32]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

Loren Brandt, Ruochen Dai, Gueorgui Kambourov,
Kjetil Storesletten, Xiaobo Zhang

A Tables and Figures

Table A-1: 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

Notes: Authors' calculations from the Inspection Data.

Table A-2: 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%

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

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

Notes: Authors' calculations from the Registry Data.

Table A-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

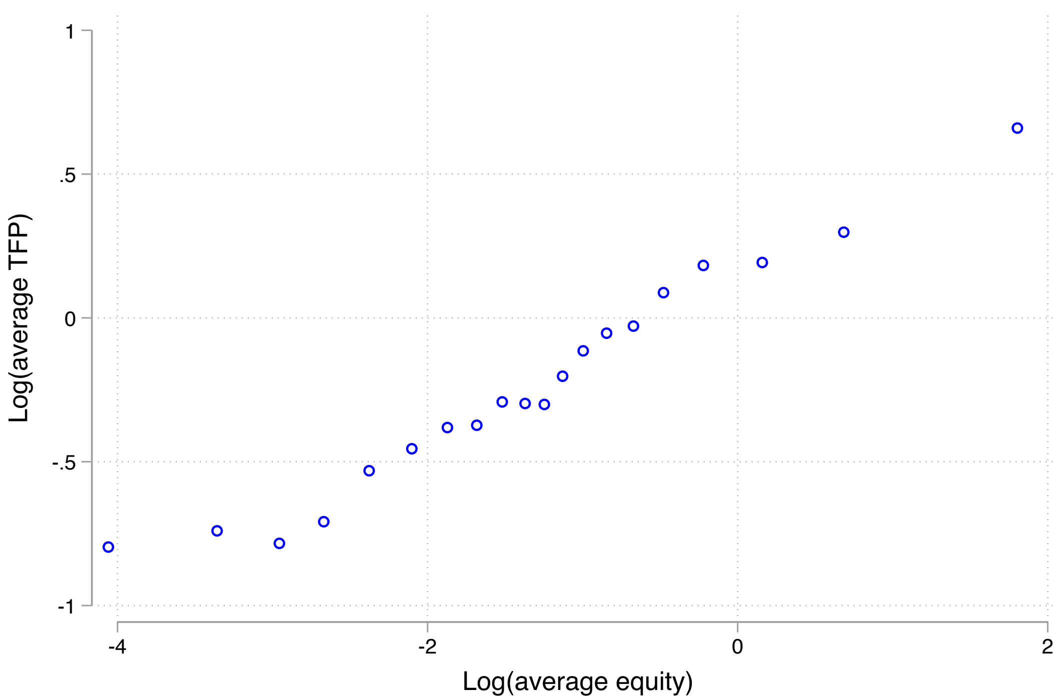
Notes: Authors' calculations from the Registry Data. Survival measures the number of firms in a given year while New and Exit denote the number of new and exiting firms in a given year, respectively.

Table A-5: 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	1.07***	-1.32***
3rd quarter of equity	1.65***	-1.41***
4th quarter of equity	3.04***	-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 square	-0.00***	-0.00***
Observations	12,476,788	12,476,681
Adjusted R-squared	0.63	0.03

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.

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



Notes: The figure reports a bin scatter plot of 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. Data source: Inspection Data.

B Theoretical Results

B.1 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

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

$$(1-\alpha)\eta y = Rk, \tag{B-2}$$

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. (B-1)-(B-2) and are given by equation (B-3),

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

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 (B-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 (B-1), applies, while equation (B-2) becomes an inequality, $R\lambda e < (1-\alpha)\,\eta y$. For constrained entrepreneurs the optimal allocations are given by equation (B-4),

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

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

$$\lambda e < z k^*.$$

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 $e = e^*$.

B.2 Proof of Proposition 2

The proof that SE firms have higher TFP than non-SE firms (part 1 of Proposition 2) relies on the following lemma for conditional expectations.

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

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

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

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 the key result of Part 1 that 1st-SE firms will on average have higher TFP than non-serial firms provided that $\rho > 0$. A similar argument establishes also that 2nd-SE firms are on average more productive than non-serial firms when $\rho > 0$. To see this, note that Lemma 1 also implies that $E[z_2|z_2 \geq b, z_2 \geq a - \epsilon/\rho] \geq E[z_2|z_2 \geq b]$, where $\tilde{\varepsilon} \equiv -\varepsilon/\rho$ is a stochastic variable and $z_1 = z_2/\rho - \varepsilon/\rho = z_2/\rho + \tilde{\varepsilon}$.

- **Proof of Lemma 1.** Proving 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

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

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

$$E[z|F] = \int zdF(z) = \int zdG(y) < \int ydG(y) = \int zdG(z) = E[z|G].$$

QED

B.3 Optimal allocations under financial frictions

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

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

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 (B-5) is equivalent to the following lower bound on z_2,

$$z_2 \geq Z(z_1,e) \equiv \left(z_1 \cdot \frac{1-\eta}{1-\alpha\eta}\left(\frac{(1-\alpha)\eta}{R}\right)^{\frac{(1-\alpha)\eta}{1-\eta}} \left(\frac{\alpha\eta}{w}\right)^{\frac{\alpha\eta}{1-\eta}} + \frac{R\lambda e+\nu}{1-\alpha\eta}\right)^{\frac{1-\alpha\eta}{1-\eta}} (\lambda e)^{-\frac{(1-\alpha)\eta}{1-\eta}} \left(\frac{\alpha\eta}{w}\right)^{-\frac{\alpha\eta}{1-\eta}} \quad \text{(B-6)}$$

$$= \left(1+\frac{1-\eta}{1-\alpha\eta}\left(\frac{zk^*}{\lambda e}-1\right)+\frac{(1-\alpha)\eta}{1-\alpha\eta}\frac{1}{\lambda e}\frac{v}{R}\right)^{\frac{1-\alpha\eta}{1-\eta}} \frac{\lambda e}{k^*} - z$$

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

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

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

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

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.

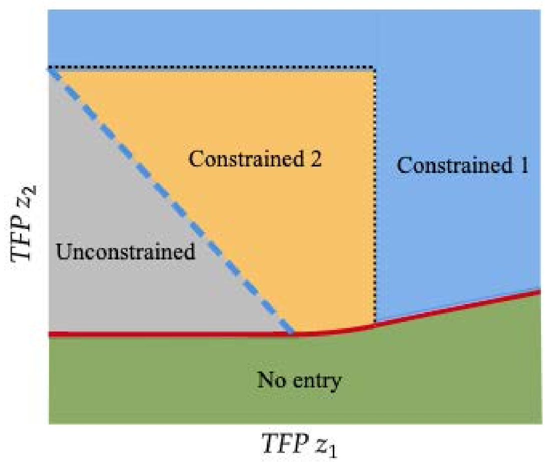
QED

Figure B-1 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").[33] 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.

Figure B-1: 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.

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.[34] 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 $Z(z_1, e) \leq z_1$.

[33]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, $\lambda e = (z_1 + z_2)k^*$.

[34]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.

B.4 Proof of Proposition 4

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

$$\rho z_1 + \varepsilon - Z(z_1, e_2) \geq 0, \tag{B-9}$$

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 1 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 (B-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

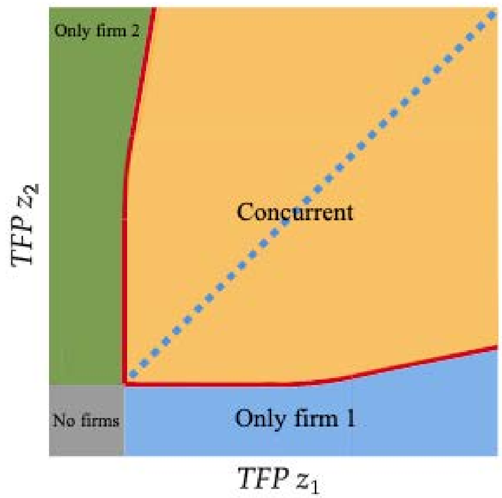
$$E\{z_1 | z_1 \geq z^{**} \text{ and } \rho * z_1 + \varepsilon - Z(z_1, \Pi(z_1, e_1)) \geq 0\} \geq E\{z_1 | z_1 \geq z^{**}\},$$

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.5 Concurrent versus Non-concurrent SE Firms

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 B-2 illustrates this aspect of Proposition 6. 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 B-2: 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".

B.6 Proof of Proposition 8

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 $\tilde{s}$.

C Favored and Non-Favored Entrepreneurs with Sector Learning

Consider an extension of our learning model where favored entrepreneurs (i.e., individuals who possess non-skill advantages) coexist with non-favored entrepreneurs. For ease of exposition, assume that the advantage of the favored entrepreneurs takes the form that they do not face strict collateral constraints (i.e., very large λ). Since favored entrepreneurs can borrow more, they have a lower TFP threshold z^* than the non-favored entrepreneurs: $z^*_{nf}(e) \geq z^*_f(e)$.

A key implication of this setting is that favored individuals will be more preponderant among the sector switchers than among the stayers. To understand this result, note that there are no differences between the favored and the non-favored in their second-period decision rule on switching sectors because all entrepreneurs have the same switching threshold $\bar{z}$. Consider the case when $\bar{z} > z^*_f(e)$, which is necessary to observe some entrepreneurs switch sector in equilibrium. Otherwise, all entrants would have TFP above the switching threshold and would choose to remain in their initial sector. In this case, favored entrepreneurs would be more over-represented among the switchers than among the stayers. Since favored entrepreneurs have a lower TFP threshold for entry than the non-favored ones (i.e., $z^*_f(e) \leq z^*_{nf}(e)$), the favored should be proportionally represented among entrepreneurs who choose to enter for sufficiently high realizations of z and over-represented for low realizations of z. This holds true for any level of equity e. It follows that the preponderance of favored entrepreneurs should be larger for TFP levels below the switching threshold $\bar{z}$ than for TFP levels above this threshold.

This result allows us to use sector switching as a proxy for favored individuals.

An implication of this result is that the presence of favored individuals will be a force for lower TFP and larger capital stock among switchers. In particular, switchers will have more capital than stayers, relative to their TFP. If the advantage is sufficiently large, the switchers could end up having larger average capital than the stayers, even if their average TFP is lower.

We summarize these insights in the following corollary.

Corollary 2. *Favored entrepreneurs are over-represented among entrepreneurs who switch and locate the 1st-SE and 2nd-SE in different sectors. Switchers therefore have more capital relative to their TFP than stayers. If the favored entrepreneurs enjoy sufficiently large advantages in terms of borrowing, switchers could have larger average capital stocks than stayers.*

In this section we have focused on easier access to borrowing (i.e., a larger λ) as the source of favoritism. The effects of favoritism would be quantitatively stronger a lower cost of borrowing (i.e., a lower interest rate).

D Industry-Specific Labor Income Shares

Following much of the literature on firm-level productivity measurements in China (including for example Brandt et al. (2012), Hsieh and Klenow (2009), and Bai, Hsieh and Qian (2006)), our preferred approach when estimating firm-level TFP is to use sector-specific labor-income shares from the U.S. The values for sector-specific labor-income shares that we get from the U.S. are reported in column 1 of Table D-1.

Unfortunately, it is not possible to estimate sector-specific labor-income shares using the Inspection Data, which our analysis is based on. The reason is that these data do not include information on labor and wages. We estimate the labor-income share from Chinese data in two ways for each sector j – as a pure labor-income share $\phi_{1,j}$ and as an elasticity $\phi_{2,j}$.

We measure the share parameter $\phi_{1,j}$ as the ratio of aggregate labor income to aggregate value added in industry j. We rely on data from the Chinese 2007 Input-Output table to measure the labor compensation and value added for each sector. The Chinese 2007 Input-Output table also includes each industries' use of labor, capital depreciation, surplus, and paid-in tax. We aggregate data at the 3-digit industry level up to a 1-digit industry level, and use this to calculate the labor share ratio of 1-digit industries. When aggregating up to the 1-digit level, the weight for each 3-digit industry is the number of firms from the 2008 census data.

We measure the parameters $\phi_{2,j}$ as the elasticity of value added to a change in labor input in industry j. Formally, we estimate $\phi_{2,j}$ running the following OLS regression using data from the 2008 Chinese Enterprise Census Data.

$$\ln y_{i,j} = (0.85 - \alpha_j) \ln(k_{i,j}) + \alpha_j \ln(n_{i,j}) + \varepsilon_{i,j} \tag{D-1}$$

where $y_{i,j}$ is value added for firm i in industry j, $k_{i,j}$ is capital, and $n_{i,j}$ is the labor input. The decreasing returns to scale parameter of 0.85 is taken from Restuccia and Rogerson (2008).

Table D-1 reports the results. We have two main findings. First, the measured labor share estimates are positively correlated with the corresponding shares for U.S. industries, with a correlation of about 0.3. We conclude that the U.S. labor shares are informative about labor elasticities in Chinese data.

Second, we observe that for the largest industries (i.e., Wholesale and Retail, Manufacturing, and Leasing and Business Services), the estimated labor shares using Chinese data are low compared to their U.S. counterparts (see columns 2 and 3 of Table D-1). Manufacturing is a point in case, where the estimates for China are around 0.33. This compares to 0.514 for the U.S. It seems unreasonable to us that China should have a substantially lower aggregate labor share in manufacturing than the U.S. This could be due to the fact that firm-level data probably does not include all labor compensation because contributions through pension plans etc. might be ignored (this issue is relevant also when estimating labor shares in U.S. data). Further, Chinese data are also likely to contain mismeasurements of labor compensation due to some firms reporting costs of hired temporary workers as "intermediary inputs" rather than as part of the labor cost. Finally, the measured production parameters might be biased because of sector-specific distortions, including subsidies or taxes (see for example Hsieh and Klenow (2009) and Brandt et al. (forthcoming)).

Therefore, we find it reasonable to rely on U.S. labor-income shares when estimating firm-level TFP. The reason is that these measurement issues are arguably much smaller in the U.S.

Table D-1: Labor Share Estimation

1-digit industry	ϕ_j^{US}	$\phi_{1,j}$	$\phi_{2,j}$
	(1)	(2)	(3)
Mining	0.264	0.352	0.254
Manufacturing	0.514	0.324	0.338
Utilities	0.269	0.254	0.377
Construction	0.641	0.510	0.454
Wholesale and Retail	0.533	0.242	0.233
Transportation	0.623	0.271	0.420
Catering	0.580	0.276	0.613
IT	0.399	0.230	0.328
Finance	0.238	0.260	0.551
Real Estate	0.238	0.109	0.316
Leasing and Business Service	0.714	0.552	0.488
R&D	0.387	0.537	0.387
Public Facilities	0.387	0.384	0.453
Resident Service	0.387	0.679	0.379
Education	0.387	0.663	0.380
Health	0.580	0.509	0.398
Culture	0.580	0.820	0.451
Social Organization	0.413	0.887	0.314
International Organization	0.413	–	0.451
$CORR(\phi_j, \phi_j^{US})$	–	0.266	0.306

Notes: ϕ_j^{US} is from BEA. $\phi_{1,j}$ is from the Chinese Input-Output Table 2007, $\phi_{2,j}$ is estimated based on the Chinese Enterprise Census Data 2008.