ISIGrowth

INNOVATION-FUELLED, SUSTAINABLE, INCLUSIVE GROWTH

Working Paper

Persistent High-Growth Firms in China's Manufacturing

Daniele Moschella
Scuola Superiore Sant'Anna

Federico Tamagni
Scuola Superiore Sant'Anna

Xiaodan Yu
Scuola Superiore Sant'Anna

04/2017 March

This project has received funding from the European Union Horizon 2020 Research and Innovation action under grant agreement No 649186

Persistent high-growth firms in China's manufacturing*

Daniele Moschella, Federico Tamagni, and Xiaodan Yu†

Scuola Superiore Sant'Anna, Pisa, Italy

Abstract

This article investigates the characteristics of high-growth (HG) firms in Chinese manufacturing, and further explores the effects of firm characteristics on persistence of high-growth. We employ a multi-dimensional definition of HG firms that simultaneously accounts for growth of sales and employment. Exploiting a representative panel covering the period of the China's miracle, we find that HG firms outperform other firms, showing higher productivity, higher profitability, larger investment intensity, higher sales from product innovation, lower interest expenses and lower leverage. HG firms are also relatively young, larger in size, more often exporters and more concentrated in non-State-controlled companies. However, regression analysis suggests that none of the indicators of structural characteristics and performance considered above displays any statistical association with the ability to persistently replicate high-growth over time. The results speak against the long-run effectiveness of policies supporting the creation and backing of high-growth firms.

JEL codes: D22, D24, L26

Keywords: Entrepreneurship, Firm growth, High-growth firms, Persistent high-growth firms

*We thank Giovanni Dosi and Jiasu Lei for helping with the study and giving insightful suggestions. We thank participants to the International Workshop & Small Business Economics Special Issue on Entrepreneurship in China, Beijing, October 2016. We thank Zoltan Acs, Haifeng Qian, Jiangyong Lu and Canfei He for their insightful suggestions. We gratefully acknowledge the support by the European Union Horizon 2020 Research and Innovation programme under grant agreement No. 649186 - ISIGrowth. Daniele Moschella received financial support by the Italian Ministry of Education, University, and Research under the SIR Programme (project code RBSI14JAFW). The usual disclaimer applies.

†Main author for correspondence: Xiaodan Yu, Scuola Superiore San'Anna, Pisa, Italy. Postal address: Institute of Economics, Scuola Superiore Sant'Anna, Piazza Martiri 33, 56127, Pisa, Italy, E-mail: xiaodan.yu@santannapisa.it

1. Introduction

The Chinese economy has been slowing down to a 6.9% in GDP growth rate in 2015, after three-decades-long of impressive economic growth and catching-up (real GDP growth averaged 10% yearly). Meanwhile the State Council of China tried to boost sustained economic growth and job creation through embracing "mass entrepreneurship and innovation."[1] Given the macroeconomic conditions and the promotion of industrial policies for entrepreneurship, a small group of firms with extraordinary high growth performance, so-called "gazelles", might be of particular interest to Chinese policy makers, practitioners and entrepreneurs, as gazelles are often perceived as important drivers of economic dynamism, diffusion of innovation, and job creation. In this perspective, understanding the factors distinguishing *persistent* high-growth firms – which are likely to capture the dynamism of true "entrepreneurship"– from 'one-hit wonders' might help to facilitate policy measures in sustaining the Chinese economic catching-up in the long-run. Indeed, the entrepreneurial efforts to seize big business opportunities (i.e., to generate high-growth) and to achieve that constantly over time, through accumulation of knowledge and capabilities, are not an easy task, and they are particularly challenging for developing countries (Cimoli et al., 2009). In this work, we exploit a large representative panel of China manufacturing firms over the period of the "China miracle" before the global crisis (1999-2007) to explore the differences in structural characteristics and performances between high-growth and other firms, and try to identify the most relevant firm's idiosyncratic characteristics affecting persistence of high-growth.

The vast empirical literature on high-growth firms and gazelles has so far focused on the determinants of high-growth performance, especially in terms of demography (firm size and age) and innovation (see Coad and Hölzl, 2012; Audretsch et al., 2014, for surveys). But we know much less about the relations between high-growth and firms' highly heterogenous entrepreneurial orientations as revealed (and measured in this study) by their structural characteristics. Even less attention is devoted to investigate the determinants of the persistence of high-growth, as indeed there is even a debate on the very existence of persistently high-growing firms (Hölzl, 2014; Daunfeldt and Halvarsson, 2015). One exception is the recent study by Bianchini et al. (2017) on Italian, Spanish, French and UK firms, who find that the few firms showing persistent high-growth patterns do not systematically differ from "simple" high-growth firms in terms of crucial dimensions of structural characteristics and performance, such as efficiency, profitability, financial

[1] For industrial policies of the State Council of China, see http://english.gov.cn/makersAndInnovations/.

conditions and innovativeness. Guarascio and Tamagni (2016) show, on a long-in-time panel of Spanish firms, that persistence of high-growth is not affected by persistence in innovation either.

This article poses a similar question in the context of Chinese manufacturing. We look at a large set of firm attributes as potentially relevant for high-growth and high-growth persistence. Besides demographic attributes (size, age and sector of activity) that are usually associated with high-growth, we also investigate the role of productivity, profitability, investment, innovation performance and financial conditions, as these are indeed the candidate drivers suggested by diverse theories of firm growth, drawing from models of firm-industry dynamics and capability-based view of the firms. We also compare the dynamics of high-growth across firms under state vs. non-state ownership, and control for export status, since these specific factors are especially relevant in the context of the Chinese transition towards a market-based economy.

In order to provide a multidimensional assessment of the growth process occurring within firms (Delmar et al., 2003; Hölzl, 2014), our definition of high-growth firms encompasses both employment and sales growth. We identify high-growth firms as those firms in the top 20% of the three-years average growth rates distribution in terms of at least one of the two growth measures. We explore basic descriptive statistics and non-parametric analysis to unravel whether high-growth firms display distributional differences from other firms along the set of key structural characteristics. Next, we construct econometric models to investigate whether firm attributes contribute to the probability that high-growth firms replicate their high-growth status over time. The different specifications are first estimated on the whole sample, but we also present specific analysis of the distinctive patterns that may arise across young vs. old firms, across larger firms vs. small firms or SMEs, and between state-controlled vs. non state-controlled firms.

The years under analysis define the period of the extraordinary materialization of the "China miracle", before the slow down experienced in more recent years in the wake of the great recession. That phase of un precedent expansion was indeed boosted by reforms and direct policies undertaken by the Chinese authorities favoring the development of virtuous dynamism in the economy, supporting new entrepreneurship and private firms, although within the boundaries of a state-managed economy. As such, that period provides a intriguing test bed for studying the characteristics and the determinants of high-growth and high-growth persistence.

In section 2, we offer a more detailed review of the literature on high-growth firms and their persistence. In Section 3 we sketch an overview of entrepreneurship and high-growth firms in the context of China. Section 4 describes the data, the definition of high-growth firms and the main variables. Section 5 discusses

the distinctive characteristics of high-growth firms vis a vis other firms. Section 6 and Section 7 report the analysis of the influence of firm characteristics upon the probability to persistently remain high-growth, respectively on the entire sample, and dissecting the specific role of age, size and state-control. Section 8 concludes.

2. High-growth, persistence of high-growth and firm characteristics: a literature review

One of the most robust empirical regularities in industrial dynamics is that the distribution of firm growth rates is fat-tailed (Stanley et al., 1996; Bottazzi and Secchi, 2006; see Coad, 2009 for surveys). The fat-tail behavior in the upper tail of the growth rate distribution is intriguing, as it indicates a relatively high probability of extreme high-growth events that provide a disproportionately large contribution to industrial dynamics. Achieving high *sales* growth rates is often considered as one of the most important factors in entrepreneurial orientation (Covin et al., 2006), while high *employment* growth is crucial for job creation for policy makers (Birch and Medoff, 1994; Davidsson and Henrekson, 2002; Acs and Mueller, 2008; Henrekson and Johansson, 2010; Acs et al., 2011; Coad et al., 2014).

In understanding the nature and characteristics of such high-growth episodes, the meta-analysis by Henrekson and Johansson (2010) identifies the established stylized facts that high-growth firms tend to be younger, smaller and ubiquitous in all industries. Henrekson and Johansson (2010) also emphasize that small size gazelles can be over-represented, but larger gazelles are also important job contributors in absolute terms. Also, it appears that newness or young age are even more important factors, as also confirmed in the study by Haltiwanger et al. (2013) on business startups and young business. Acs et al. (2011), on the contrary, finds that the average high impact firm is around 25 years old when it makes a significant contribution to the economy.

Beyond the mere demographic characterization in terms of size or age, however, the literature devotes increasing, and perhaps disproportionate attention to innovation performance of high-growth firms. A number of empirical works (see, among others Coad and Rao, 2008; Hölzl, 2009; Stam and Wennberg, 2009; Segarra and Teruel, 2014; Bianchini et al., 2016; Coad et al., 2016) relates high-growth to a number of indicators of innovative activity at the firm level, such as R&D expenditures, patenting behavior, and other factors, for instance product vs. process innovation, usually elicited in innovation surveys such as

the European CIS (but see Goedhuys and Sleuwaegen, 2010, on Sub-Saharan Africa). Empirical results from quantile regressions have shown that innovation has a limited impact on the sales growth rates of the average firm, whereas innovative efforts are much more relevant for the growth records of the fastest-growing firms in the top quantiles of firm growth rates distributions (see Audretsch et al., 2014, for an exhaustive survey). Investment in innovative machinery and equipment is also related to acquisition of embodied innovative technology, and in particular, technological learning (Freeman et al., 1982; Yu et al., 2015).

Against this background, beyond innovativeness and demography, we know very little about the role played in high-growth dynamics by the other structural characteristics and performances that we consider in this study, that is productivity, profitability, investment, financial conditions, export status, and public vs. private ownership structure (see Coad and Hölzl, 2012, for a survey).

In terms of the association between productivity and fast-growing firms, Du and Temouri (2015) find, for the UK, that firms in both manufacturing and services sectors are more likely to become high-growth firms when they exhibit higher productivity growth. Bianchini et al. (2017) show that high-growth firms are more efficient in Italy and Spain, while Daunfeldt et al. (2010) detect an insignificant or even negative association between productivity growth and high-growth for Swedish firms.[2]

There have been very few empirical works devoted to investigate the relationship between profitability and high-growth performance (exceptions are Coad et al., 2011; Bianchini et al., 2017), while there is some more widespread evidence that shows a negligible effect of profitability on firm growth (Coad, 2007; see Yu et al., 2015, on China manufacturing). Internal profits and cash flow have a central importance in the literature on financial constraints to investment and growth, at least since the seminal study in Fazzari et al. (1988). In fact, a large literature reports that internal finance and credit rationing provides critical constraints to growth, especially for young and small enterprises (for reviews, see Oliveira and Fortunato, 2006; Bottazzi et al., 2014). However, only few exceptions look for the existence of financial constraints to high-growth. Bianchini et al. (2017) find that high-growth firms have a larger debt-to-asset ratio (leverage), that may be indeed interpreted as a signal of past ability to access credit, but limiting future further accumulation of debt burden.

From the internationalization and trade perspective, many high-growth firms' strategies are globally

[2]This finding can be interpreted as a 'Penrose effect', according to which the challenges in terms of managerial capabilities and absorptive capacity form the key binding constraints limiting firm growth (Penrose, 1959).

oriented, and this is associated with export behaviour (Robson and Bennett, 2000). In addition, there is evidence that firms under different ownership structures display different growth patterns. For example, Beck et al. (2005) find that growth rates of government-owned firms are lower while foreign firms tend to display high-growth. Based on meta analysis, Bellak (2004) suggests that the growth rates of domestic and foreign firms are not significantly different.

Finally, the influence of structural characteristics on high-growth is particularly overlooked in those few empirical works on less developed countries. Indeed, the attention is mostly focused to address the constraining effects of under-developed public infrastructure, financial, legal and institutional obstacles on firm growth and high-growth (Beck et al., 2005; Goedhuys and Sleuwaegen, 2010).

The lack of systematic explorations of the links between high-growth and crucial indicators of firm structure and performance, beyond innovativeness, is particularly unfortunate and to some extent puzzling. It may even be driven by a too large theoretical consensus, since indeed practically all modern theories of firm growth and firm-industry dynamics point to the wide heterogeneities in productivity and profitability, mediated by financial conditions and innovation capacity (see Dosi et al., 2007) as the obvious determinants of extraordinary growth record. This applies to neoclassical models of equilibrium dynamics (as in Jovanovic, 1982; Hopenhayn, 1992; Ericson and Pakes, 1995; Luttmer, 2007; Clementi and Hopenhayn, 2006), as well to frameworks featuring evolutionary disequilibrium (as, among others, in Nelson and Winter, 1982; Winter, 1984; Silverberg et al., 1988; Dosi et al., 1995; Metcalfe, 1998; Winter et al., 2003; Bottazzi et al., 2001). The managerial literature also share a similar intuition, taking even stronger implications for long-run growth of firms. In fact, the notion of "dynamic capabilities", developed within the capability-based view of the firm predicts that the accumulation of firms' heterogenous organizational and technological capabilities is key to continuously sustain the comparative advantages over time, thus explaining the origins of persistent high-growth (Teece and Pisano, 1994; Teece et al., 1997; Dosi et al., 2001; Pisano, 2015). Eventually, such a large agreement on the underlying causes of growth and persistence of competitive advantage may have contributed to discard the empirical verification of the factors that make some firms able to achieve extraordinary growth.

Given the limited attention to the determinants of high-growth, it perhaps comes with no surprise that we know even less about the determinants of high-growth persistence, that is about the factors that make some firms not only able outperform the others, but also to do it persistently over time. Some studies even dispute that persistence in high-growth itself exists in the data, echoing theories of firm growth as

essentially stemming from luck (Barney, 1997). Hölzl (2014) and Daunfeldt and Halvarsson (2015) show that high-growth firms are "one-hit wonders" that do not replicate their high-growth over time, while other studies (Delmar et al., 2003; Capasso et al., 2014) show that persistent outperformers and "super relative growers" coexist with "bouncing firms" and "erratic one-shot growers". To our knowledge at least, Bianchini et al. (2017) and Guarascio and Tamagni (2016) are the only works addressing whether persistently high-growth firms differ in terms of structural characteristics, as compared to firms that display short-lived "spurts" of high-growth. The answer in both studies is largely negative: in the first study, persistent high-growth firms (in Italy, Spain, France and the UK) do not differ from "simple" high-growth firms along none of the dimensions considered (efficiency, profitability, financial conditions and innovativeness), whereas the second study shows that high-growth persistence is not affected by persistence in innovation either, in a long-in-time panel of Spanish firms.

3. The Chinese context

The extraordinary performance of the Chinese economy, especially over the period that we consider in this study, has obviously attracted attention of scholars and policy makers. Increasing availability of micro-data at the firm level allowed for a characterization of the key features of industrial dynamics in this country, highlighting the role of virtuous transformation and learning of domestic firms, the differential contribution of state-owned vs. private firms, also regarding access to finance and the role of innovation in survival and growth of Chinese firms (see Yu et al., 2015; Guariglia et al., 2011; Zhang and Mohnen, 2013).

However, high-growth dynamics has not yet received attention. Most of existing literature frames the dynamism of the Chinese economy around the concept of entrepreneurship, as those creations and newness initiated by Chinese citizens or domestic firms over the last 15-20 years, and the socio-political transformations that sustained them (Yang and Li, 2008; Li, 2013). The development of entrepreneurship in China went to three phases (Li, 2013), characterized by the emergence and prominent role of different types of new firms: the first stage (1978-1992) sees the birth and flourishing of township-and-village enterprises, and the initial appearance of private firms; the second stage (1992-2000) features the rapid growth of non-public firms, promoted by the first signals of political acceptance of the private property (the Deng Xiaoping's 'South Tour' in 1992) and the related constitutional amendment in 1999; in the third stage (2000-present), increasing supportive and encouraging policies have been issued to channel private

investment, promote small and medium enterprises and to protect private property. A number of studies on Chinese entrepreneurship extensively focus on the association between the phases of entrepreneurial development and liberalization policies, such as the removal of institutional barriers to private ownership, or the easing the access to key resources (finance, labour and technology) for private firms and SMEs (Chang and MacMillan, 1991; Li and Matlay, 2006).

In fact, among the three types of entrepreneurship that usually coexist within developing countries – subsistence, catch-up and frontier entrepreneurship (see Hobday and Perini, 2009; Huang, 2010) –, the vast majority of Chinese entrepreneurs are of the catch-up type. They usually engage in replicative activities, copying and producing at competitive costs innovations introduced by others, as it is the case, for instance, with Wanxiang (an automobile supplier) and Geely (the firm that just acquired Volvo). They considerably contribute to the economy through market expansion (within existing area) and job creation, although they introduce breakthroughs in science and technology at a much lower pace than frontier entrepreneurship firms do.

The prevalence of catch-up firms warns against the potentially misleading implications that may arise from an exclusive focus on start-ups and small firms. As argued by Hobday and Perini (2009), there is a spread mis-conception of the function of new and dynamic firms in catching-up economies: their primary role is to enable technology transfer, learning, and incremental innovation, rather than to trigger 'Schumpeterian dynamics' driving to new product development or radical technical, which is instead the main role of entrepreneurship in advance economies. And, indeed, the evidence on successful firm-level growth from China and other Asian countries shows that large, SMEs, and multinational corporations all play a role in entrepreneurial progress. In this sense, a study of the drivers of high-growth and its persistence could be more revealing than usual focus on small, innovative start-ups.

To conclude, Chinese manufacturing represents an almost ideal testbed for understanding the questions: What are the contributions of firm's structural characteristics to the persistence of high-growth, grounded upon the general background of the rapid catching-up of Chinese economy ? Indeed, the "China miracle" entailed a major process of increasing returns through learning and accumulation of knowledge and technological capabilities based on firms that are highly heterogenous, in terms of all the dimensions of firm performance and characteristics that we analyse in this study (Yu et al., 2015; Yu et al., 2015).

4. Data and variables

Sources and sample

This work draws upon firm-level data collected by the Chinese National Bureau of Statistics (NBS). It is a largely used database (see, among others, Hu et al., 2005; Fu and Gong, 2011; Yu et al., 2015) which includes all industrial firms with sales above 5 million RMB (around $US 600,000) covering the period 1998-2007.[3] Each firm is assigned to a sector according to the 4-digit Chinese Industry Classification (CIC) system, that closely matches the Standard Industrial Classification (SIC) employed by the U.S. Bureau of Census.[4]

In the following analysis, we focus on manufacturing firms only. First, we apply a few cleaning procedures to the original set of data in order to eliminate visible recording errors (see Table A.1). The final version of the database is the same used in Yu et al. (2015), where it is referred to as "China Micro Manufacturing" (CMM). [5] Then, we create a balanced panel that includes all continuing incumbents during the period, consisting of 22,988 manufacturing firms. In this dataset, therefore, we will compare high-growth-and-surviving firms against other-and-surviving firms, as defined in the following.

Definition of high-growth firms

The literature offers a number of different definitions of an high-growth firm, not always comparable one to the other. The existing identification criteria differ in terms of the different proxies of size used to measure firm growth rates, in terms of the time span over which an high-growth event is considered (yearly growth vs. average growth over some consecutive years), and distinguishing whether absolute vs. relative extraordinary growth should be taken as the basis to define high-growing firms. In absence of a commonly accepted definition, we identify the group of high-growth (HG) firms as follows. First, we create three non-overlapping periods: period 1 (1999-2001), period 2 (2002-2004) and period 3 (2005-2007).[6] Second, we

[3] According to NBS definition, industry definition includes mining, manufacturing and public utilities.

[4] In 2003, the classification system was revised: some sectors were further disaggregated, while others were merged together. To make the industry codes comparable over time, we adopted the harmonized classification proposed in Brandt et al. (2012).

[5] We applied the following cleaning procedure. We dropped firms with negative output, value-added, sales, original value of fixed assets, cost of labour; and also firms with a number of employees less than 8, since below that threshold they operate under another legal system (Brandt et al., 2012).

[6] We discard the first year, 1998, in order to have periods of the same length.

compute the within-period average growth rate for each firm: $g_{i,1} = (s_{i,01} - s_{i,98})/3$, $g_{i,2} = (s_{i,04} - s_{i,01})/3$ and $g_{i,3} = (s_{i,07} - s_{i,04})/3$, where firm size $S_{i,t}$ is measured as either sales or number of employees, and $s_{i,t} = log(S_{i,t}) - \frac{\sum_{i \in j} log(S_{i,t})}{N}$ such that $s_{i,t}$ is the normalized firm size by 2-digit sectoral mean over the N firms active in sector j at year t.[7] Finally, in each period, we assign to the high-growth (HG) group all firms falling into the top 20% of the period-average growth rates distribution (pooling all sectors), in terms of *at least* one of the two growth measures.

By considering both sales and employment growth in the definition of the HG group we provide a multidimensional characterization of the growth processes of firms, accounting at the same time for different size proxies employed in the literature and reflecting the idea that no single "best" indicator of size exists, with each alternative proxy measuring different aspects of the firm growth process. Indeed, sales measures success on the market, while employment proxies for size in terms of established capacity. Further, by considering annualized average growth over 3 years we account for the well known fact that growth is quite unstable over time, so that a single big jump in size in one year does not seem enough to characterize firms that indeed consistently outperform the others. This choice is indeed standard in the literature, although the time window considered to measure average growth spans from 3 to 6 years, depending on the study and data available. Finally, our definition implicitly defines HG firms in terms of their relative growth. We prefer this approach over absolute growth since relative changes allow an equal treatment of small and medium-large firms, whereas big absolute changes would bias the HG group to disproportionately include larger firms.

Table 1 shows the total number of observations, the number of HG observations and the percentage share of HG observations in each 2-digit sector. Overall, we identify 31% of observations as belonging to HG firms. Notice that this implies that sales and employment growth are indeed correlated to some extent. Indeed, with our definition, we expect to have from 20% to 40% of HG firms in each period, where the lower bound corresponds to perfect cross-correlation between employment growth and sales growth, whereas the upper bound corresponds to non correlations between the two growth measures. The high-growth firms account for an increasing share of value added in the panel during the period (32.4% during 1999-2001, 37.7% during 2002-2004, and 44.7% during 2005-2007).

With our definition of an HG firm, given the time span available in the data, we end-up with three

[7] The normalization implicitly removes sector-specific common trends, such as inflation and business cycle effects in sectoral demand.

CIC	Sector	All	HG	% of HG
13	Processing of food from agricultural products	2830	927	32.8
14	Foodstuff	1537	489	31.8
15	Manuf. of beverages	1175	365	31.1
16	Manuf. of tobacco	150	38	25.3
17	Manuf. of textile	5061	1586	31.3
18	Manuf. of textile wearing apparel, footwear, cand caps	3401	1160	34.1
19	Manuf. of leather, fur, feather and related products	1675	506	30.2
20	Processing of timber, manufacture of wood, bamboo, etc.	722	252	34.9
21	Manuf. of furniture	523	170	32.5
22	Manuf. of paper and paper products	2143	650	30.3
23	Printing, reproduction of recording media	1677	396	23.6
24	Manuf. of articles for culture, education and sport activity	1183	417	35.2
25	Processing of petroleum, coking, processing of nuclear fuel	474	145	30.6
26	Manuf. of raw chemical materials and chemical products	5602	1584	28.3
27	Manuf. of medicines	2056	576	28.0
28	Manuf. of chemical fibers	309	122	39.5
29	Manuf. of rubber	960	305	31.8
30	Manuf. of plastics	3112	998	32.1
31	Manuf. of non-metallic mineral products	6284	1882	29.9
32	Smelting and pressing of ferrous metals	1128	361	32.0
33	Smelting and pressing of non-ferrous metals	1004	325	32.4
34	Manuf. of metal products	3384	1061	31.4
35	Manuf. of general purpose machinery	5743	1716	29.9
36	Manuf. of special purpose machinery	2946	948	32.2
37	Manuf. of transport equipment	3966	1226	30.9
39	Manuf. of electrical machinery and equipment	4725	1563	33.1
40	Manuf. of communication equipment, computers etc.	2682	948	35.3
41	Manuf. of measuring instruments and machinery for cultural activity	1212	366	30.2
42	Manuf. of artwork and other manufacturing	1300	445	34.2
	Total	68964	21527	31.2

Table 1: Total number of observations in the panel and observations identified as high-growth by 2-digit sectors (number and percentage shares).

		$period+1$		
		$HG=0$	$HG=1$	Total
$period$	$HG=0$	22901 (72.1%)	8860 (27.9%)	31761 (100.0%)
	$HG=1$	8636 (60.8%)	5579 (39.2%)	14215 (100.0%)
	Total	31537 (68.6%)	14439 (31.4%)	45976 (100.0%)

Table 2: Transitions in-and-out high-growth status in two consecutive periods: number of observations and transition probabilities in parentheses.

different measurement of high-growth status for each firm over time. Such HG status can indeed vary over the three subperiods, and this is crucial for our purposes since our main research question concerns to the identification of those firm characteristics that associate with the ability to remain in the HG group persistently over time. Transition probabilities in Table 2 give an idea of the degree of persistence in HG status in two consecutive periods (pooling over the three subperiods identified in the data). We do find some persistence: around 39% of the HG firms do not change their status in the the next period, whereas firms that are not HG at time t, have around 28% probability to become HG firms in period $t+1$.

Firm characteristics

The set of firm attributes that we consider as candidate distinctive features of HG firms and persistence in HG status includes a number of indicators of structural and demographic firm characteristics suggested in the theoretical and empirical literature on firm growth and HG firms. As in Bianchini et al. (2017), we derive from theoretical models of firm-industry dynamics the notion that productivity, innovation, profitability, investment behavior, and financial conditions allowing to access external resources represent the key dimensions of firm structural performance underlying growth dynamics. Further, we also consider age and size of the firms, since the literature on HG firms has repeatedly underlined that much of the entrepreneurial dynamics leading to extraordinary growth records do occur among small and young firms. Finally, we also look at two firm-characteristics that may be of particular importance in the context of Chinese industrial development, namely whether a firm is engaged in exporting and whether she is state-owned or private.

We measure firm productivity as the ratio of real value added (at constant prices) over the number of employees. In what follows, we will denote with PROD the log of such measure. We proxy for profitability

via a variation of the return on sales (ROS) index, defined as gross operating margins over total output.[8] We define firm's investment intensity (INV) as the ratio of real investment to real value added, where real investment at time t is the difference of firm's real capital stock between time t and $t-1$, and the time series of real capital stock is computed following Brandt et al. (2012), who applies a standard perpetual inventory method, with a 9% rate of depreciation. We use the percentage share of output due to new products introduced in each year as our proxy for product innovation (NEWPROD).[9] Financial conditions of firms are taken into account through two indicators: a flow measure of the capacity to meet financial obligations in a given year, computed as the ratio between interest expenses and total sales (IE), and a standard measure of leverage (LEV), computed as the ratio between total debt and total assets.[10] Firm age (AGE) is computed using information on firm's foundation year, and we proxy for firm size (SIZE) through the (log) number of employees. Since all of these variables are continuous variables, in order to input a value for each of the three subperiods defined by the definition of HG status, we take the within-period average over the three years defining each period.

Information about exporting behavior and state-ownership is recorded via two binary variables that we construct for each subperiod as follows. The export status dummy (EXP) takes value one if the firm exports in at least one year within each three-year subperiod, and zero otherwise. We recover firm's ownership status based on its registration capital, and define a dummy for state-ownership (STATE) that takes value one if the firm is under state-control in at least two years within each three-year subperiod, and zero otherwise.[11]

Table 3 provides basic descriptive statistics across the three periods (cf. columns labeled as "All"). Looking at the mean, we detect a clear trend in some of the variables. In particular, the average (log)

[8] Gross margins are essentially equivalent to an EBIDTA index, taking the difference between value added and cost of labour (total wages plus social security). Output is used in place of sales in the denominator, in compliance with the NBS methodology to compute value added as the difference between output and material inputs.

[9] "New products" are defined, according to NBS, as products adopting new technology and/or new design, or products that have been significantly improved over existing ones with respect to their structure, materials and/ or process technics. Hence, these "new products" are new to the enterprise but not necessarily new to the market.

[10] According to Chinese accounting rule, interest expenses is a net measure, which equals gross interest expenses minus interest revenues, and can thus take negative values.

[11] There are five types of registration capital: state, collective, legal person, individual, Hong-Kong Macao and Taiwan, and foreign. "State-control" indicates both State-absolute-control, i.e., the State capital share is greater than or equal to 50%, and State-relative-control, i.e., State capital share is less than 50% but it is greater than the other shareholders or the relative State-controlling status is regulated by the contract.

productivity increased from 3.609 (period 1) to 4.133 (period 2), reflecting the well known productivity growth in Chinese manufacturing over the period. Similarly, we observe a mild increase in the average innovative activity of the firms (the share of output due to new products increased from 4% to 5.6%) and also an increasing share of private or mixed ownership firms (the percentage of State-controlled firms decreases over time from 20% to about 14%). The two financial indicators, IE and LEV, display decreasing patterns, suggesting a general improvement in firms financial conditions. As expected, the average age and size of firms in our balanced panel tend to increase during the period. Finally, notice that almost half of the firms in our sample are exporters, and about 17-20% are state-owned.

5. Comparing HG and other firms

In Table 3 we also provide a first descriptive assessment of the differences between high-growth (columns labeled as $HG = 1$) and other firms ($HG = 0$) along all the proxies of firm characteristics. On average, across the three periods, HG firms display higher labour productivity, higher profitability, higher investment intensity, lower interest expenses as a percentage of sales, and lower leverage. HG firms are also younger and larger both in terms of sales and in terms of employment (except for period 1). Less marked differences are observed concerning the innovative activity, with the group of other firms performing slightly better in period 1 and 2. Finally, we observe a lower share of State-controlled firms and a higher share of exporters within the HG group.

The standard deviations in Table 3 also reveal a large and persistent heterogeneities in all the dimensions of firms' 'identity cards'. To complete the descriptive picture, we thus compare the entire distributions of firm characteristics between the two groups. Figure 1 to 8 show the kernel estimates of the empirical densities of our focal variables across HG and other firms, across the three periods. The support of the productivity distribution of HG firms is shifted to the right with respect to non-HG firms, especially in the right tail across comparatively more productive firms (Figure 1), and the same pattern appears to hold also for profitability and investment intensity, even if with some variation over time (Figures 2 and 3). Profitability distributions, in particular, seem to almost overlap during the first period, whereas in the last period the HG distribution move to the right. Concerning our proxy for innovative propensity (i.e., the share of new products in total output, in Figure 4), a clearcut difference emerges between the first two periods, in which the two distributions almost overlap, and the last period, in which the distribution

	Pool			Period 1			Period 2			Period 3		
	All	$HG=0$	$HG=1$	All	$HG=0$	$HG=1$	All	$HG=0$	$HG=1$	All	$HG=0$	$HG=1$
HG	0.312			0.308			0.310			0.318		
	(0.463)			(0.462)			(0.463)			(0.466)		
Gr sales	0.104	0.020	0.287	0.114	0.029	0.305	0.108	0.029	0.282	0.090	0.004	0.275
	(0.223)	(0.169)	(0.217)	(0.226)	(0.162)	(0.231)	(0.217)	(0.173)	(0.201)	(0.225)	(0.171)	(0.216)
Gr emp	0.008	−0.055	0.145	0.022	−0.043	0.167	0.008	−0.054	0.146	−0.007	−0.067	0.121
	(0.176)	(0.131)	(0.185)	(0.178)	(0.125)	(0.194)	(0.177)	(0.133)	(0.183)	(0.172)	(0.134)	(0.174)
PROD	3.863	3.753	4.106	3.609	3.526	3.796	3.848	3.752	4.063	4.133	3.986	4.449
	(0.966)	(0.939)	(0.979)	(0.922)	(0.902)	(0.938)	(0.932)	(0.918)	(0.926)	(0.971)	(0.940)	(0.961)
ROS	0.190	0.184	0.203	0.186	0.182	0.197	0.194	0.188	0.208	0.190	0.183	0.205
	(0.395)	(0.258)	(0.595)	(0.122)	(0.119)	(0.127)	(0.343)	(0.406)	(0.109)	(0.580)	(0.141)	(1.007)
INV	−0.035	−0.080	0.066	0.014	−0.049	0.156	−0.068	−0.075	−0.053	−0.050	−0.118	0.096
	(5.767)	(2.491)	(9.636)	(2.089)	(2.391)	(1.139)	(9.446)	(2.329)	(16.607)	(2.484)	(2.738)	(1.815)
NEWPROD	0.046	0.046	0.047	0.040	0.041	0.037	0.044	0.045	0.042	0.056	0.053	0.063
	(0.144)	(0.142)	(0.148)	(0.133)	(0.133)	(0.133)	(0.139)	(0.140)	(0.138)	(0.158)	(0.153)	(0.169)
IE	0.014	0.015	0.012	0.019	0.021	0.015	0.013	0.014	0.011	0.011	0.011	0.009
	(0.026)	(0.025)	(0.027)	(0.033)	(0.031)	(0.035)	(0.024)	(0.022)	(0.027)	(0.019)	(0.020)	(0.016)
LEV	0.580	0.584	0.571	0.589	0.593	0.580	0.579	0.582	0.570	0.572	0.577	0.562
	(0.256)	(0.263)	(0.238)	(0.244)	(0.248)	(0.235)	(0.256)	(0.265)	(0.233)	(0.267)	(0.276)	(0.246)
AGE	18	19	15	15	17	10	18	19	14	21	21	19
	(14)	(15)	(12)	(14)	(15)	(10)	(14)	(15)	(11)	(14)	(15)	(12)
Sales	177087	151085	234387	99177	95088	108350	159385	141560	199052	272700	217519	391003
	(1197168)	(1079842)	(1420288)	(560776)	(574356)	(528970)	(966009)	(975489)	(943428)	(1742581)	(1491192)	(2181613)
Emp	533	529	543	516	561	417	527	518	547	555	506	660
	(1874)	(1933)	(1737)	(1951)	(2205)	(1194)	(1718)	(1842)	(1406)	(1943)	(1716)	(2354)
EXP	0.470	0.454	0.504	0.472	0.452	0.515	0.451	0.436	0.485	0.486	0.474	0.512
	(0.499)	(0.498)	(0.500)	(0.499)	(0.498)	(0.500)	(0.498)	(0.496)	(0.500)	(0.500)	(0.499)	(0.500)
STATE	0.172	0.199	0.111	0.200	0.236	0.120	0.173	0.202	0.109	0.142	0.160	0.104
	(0.377)	(0.399)	(0.314)	(0.400)	(0.424)	(0.325)	(0.378)	(0.401)	(0.312)	(0.349)	(0.366)	(0.305)

Table 3: Mean and standard deviations (in parentheses) of the following variables: high-growth status dummy (HG), taking value one if firm is high-growth; sales growth (Gr sales); employment growth (Gr emp); productivity (PROD) computed as the log of value added over number of employees; return on sales (ROS), computed as gross operating margins over output; investment intensity (INV), computed as real investment over real value added; share of output due to new products (NEWPROD); the ratio of interest expenses to sales (IE); firm leverage (LEV) computed as the ratio of total debt over total assets; Sales at current price (unit 1000 RMB); number of employees (Emp); a dummy variable for firms' export status (EXP), taking value one if firm exports; and a dummy variable indicating State-control status (STATE).

of HG firms lies clearly above the distribution describing the other firms. A common pattern appear to characterize the empirical distributions of financial indicators (in Figures 5 and 6): HG and other firms display mild differences in the lower-tails, while non-HG firms display fatter upper tails, suggesting that they are more likely to pay comparatively high interest expenses (to sales) and to suffer from high debt-to-asset ratios. In terms of demographic characteristics, we HG firms tend to be younger in all periods, and comparatively smaller only in the initial period (see Figure 7 and 8).

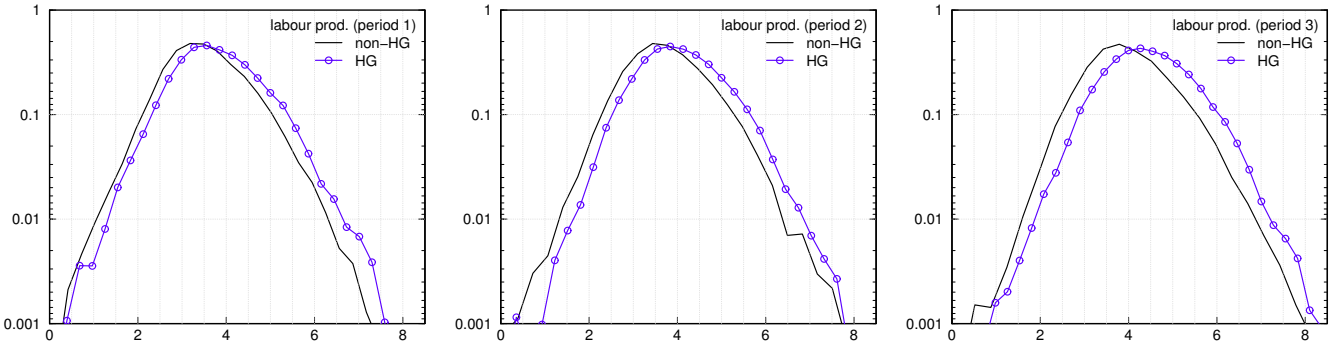

Figure 1: Kernel densities of (log-) labour productivity for HG and non-HG firms, in three periods 1999-2001, 2002-04 and 2005-07.

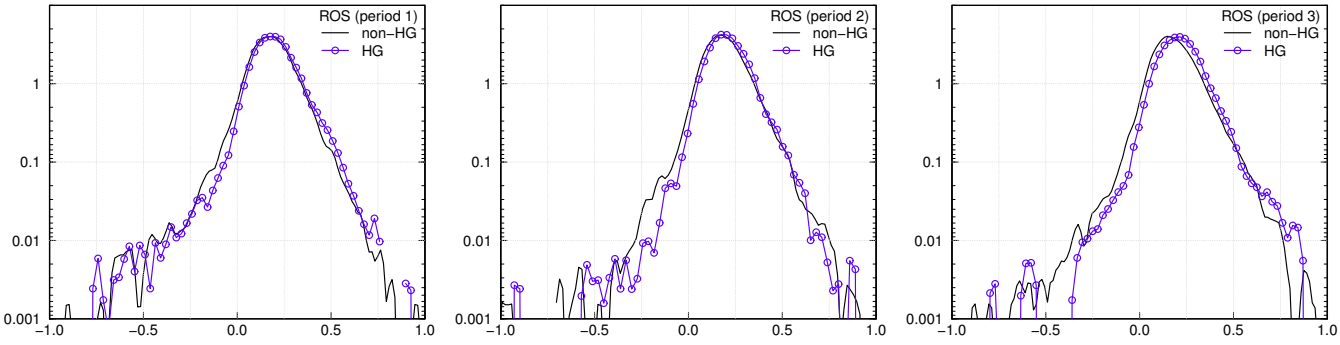

Figure 2: Kernel densities of profitability (Return on Sales) for HG and non-HG firms, in three periods 1999-2001, 2002-04 and 2005-07.

To corroborate the graphical inspection of the graphs, we provide a formal test of distributional equality between the densities estimated for HG and other firms, resorting to the Fligner and Policello (1981) test of stochastic equality (hereafter, FP). The test assesses which of the two distributions dominates over the other by measuring whether, if one randomly selects a firm from the HG group and a firm from the other firms, the former has a probability greater than 0.5 of having a greater value of a given firm attribute.

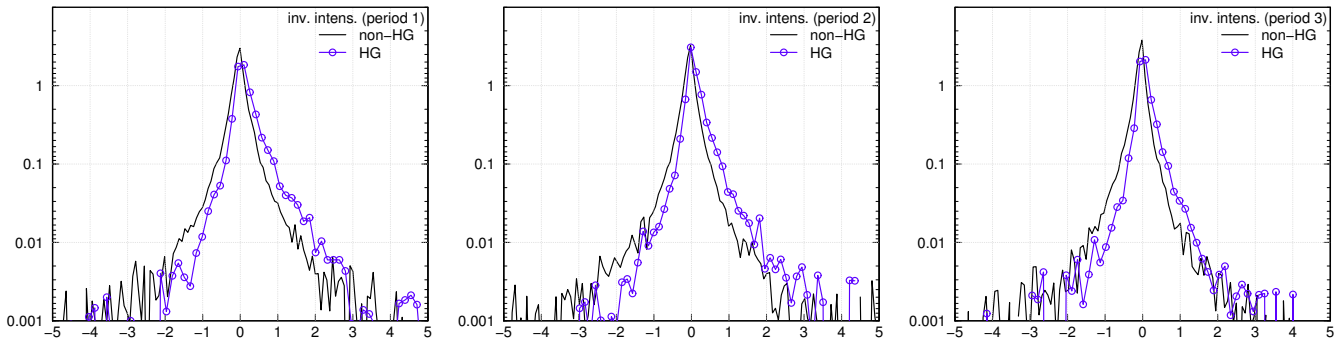

Figure 3: Kernel densities of investment intensity for HG and non-HG firms, in three periods 1999-2001, 2002-04 and 2005-07.

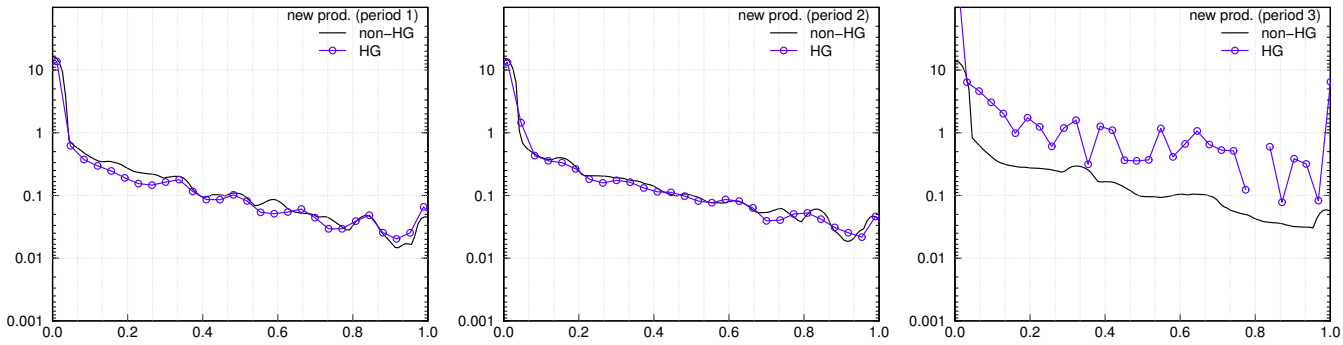

Figure 4: Kernel densities of share of new products in total output for HG and non-HG firms, in three periods 1999-2001, 2002-04 and 2005-07.

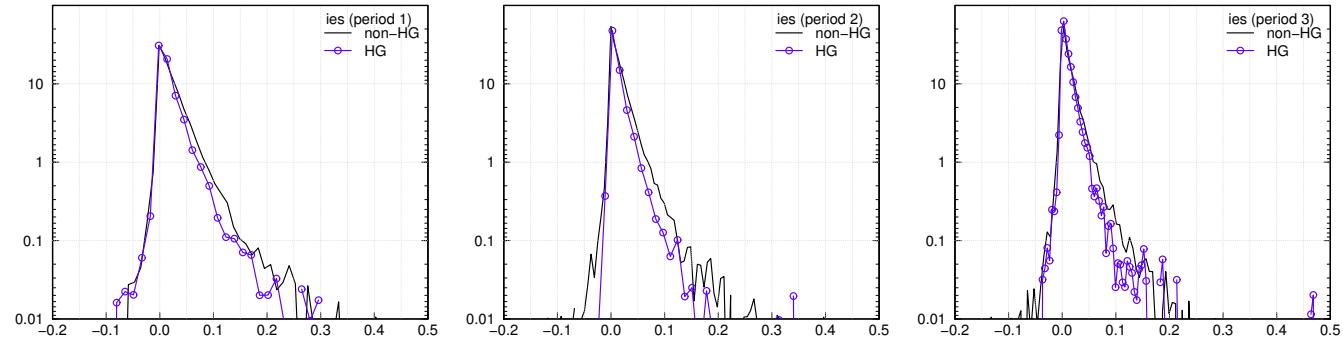

Figure 5: Kernel densities of interest expenditure (to sales ratio) for HG and non-HG firms, in three periods 1999-2001, 2002-04 and 2005-07.

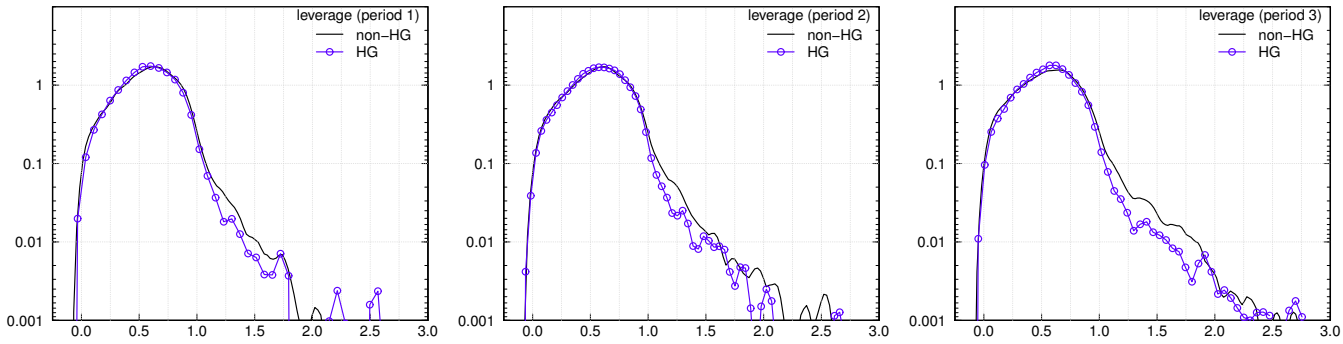

Figure 6: Kernel densities of leverage (total debt to total assets ratio) for HG and non-HG firms, in three periods 1999-2001, 2002-04 and 2005-07.

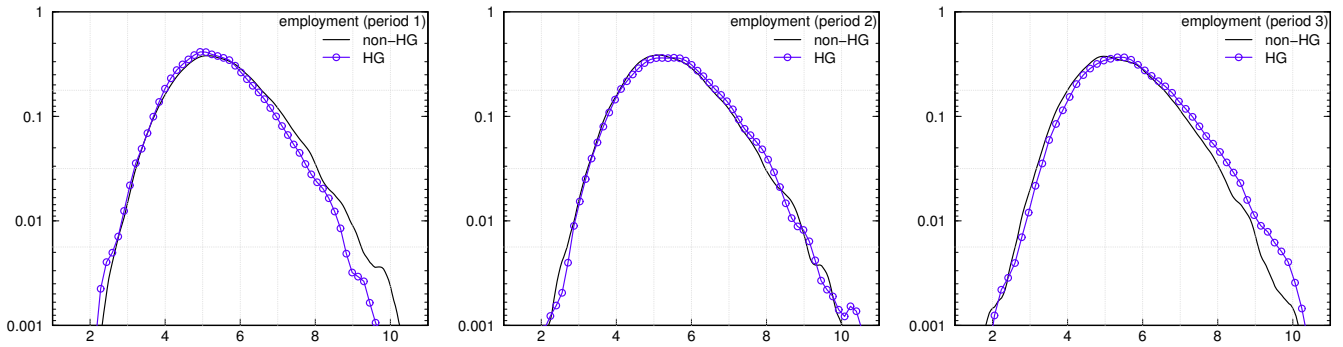

Figure 7: Kernel densities of (log) employment for HG and non-HG firms, in three periods 1999-2001, 2002-04 and 2005-07.

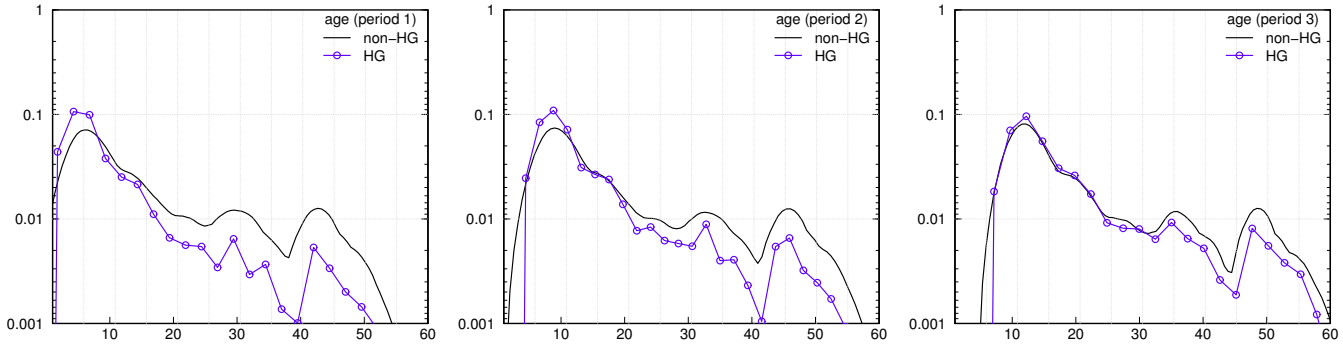

Figure 8: Kernel densities of age for HG and non-HG firms, in three periods 1999-2001, 2002-04 and 2005-07.

Period	Number of Obs. $HG=0$	Number of Obs. $HG=1$	PROD	ROS	INV	NEWPROD	IE	LEV	EMP	AGE
Pool	47394	21570	-46.18**	−25.80**	−79.67**	0.30	14.98**	5.90**	−4.32**	42.33**
1999-2001	15909	7079	-21.18**	−9.88**	−43.45**	3.71**	15.30**	4.18**	8.65**	40.26**
2002-2004	15818	7170	-24.65**	−12.01**	−46.91**	1.44	9.00**	2.33	−5.55**	25.91**
2005-2007	15667	7321	-36.78**	−22.65**	−49.22**	−4.37**	0.73	3.49**	−10.30**	11.68**

Table 4: Two-sample Fligner-Policello robust rank order test, both on pooled data and by sub-periods. FP statistics and observations are reported. Non-HG firms as the benchmark group: a positive and significant FP statistic means that non-HG firms dominate; a negative and significant FP statistic means that HG firms dominate. Asterisks denote significance levels (*: p<1%; **: p<0.1%).

Table 4 reports the results. We take the group of non-HG firms as the reference category, so that a positive and statistically significant FP statistic indicates that non-HG firms dominates HG firms with respect to the considered firm attribute, while HG firms dominates over other firms when the FP statistic is negative and significant. The tests tend to confirm the conclusions drawn from the graphical analysis. In particular: (a) HG firms dominate in terms of productivity, profitability, investment intensity and size. (b) Conversely, non-HG firms dominate in terms of interest expenses, leverage and age. (c) Results on the share of sales due to product innovation are less clearcut: HG firms outperform non-HG firms only in the last period.

6. Firm characteristics and persistence of high-growth

From the previous descriptive analysis, HG firms appear to differ from other firms along several characteristics. We now turn to address the key question of our paper: how do firm characteristics associate with the ability of HG firms to replicate their high-growth performance over time? Or, in other words, are there some firm-specific attributes that distinguish persistent high-growth from simple high-growth? Our primary focus in this Section is on the role played by indicators of structural characteristics and performance (productivity, profitability, innovative propensity, investment behavior and financial conditions), which the recent paper by Bianchini et al. (2017) has challenged as peculiar drivers of persistence of high-growth. Then, in the next Section, we will devote specific focus on dissecting the role of age, size and state vs. private ownership.

Our baseline empirical model is the following multivariate regression that describes the probability to remain in the HG group over time

$$Pr(HG_{i,p} = 1|HG_{i,p-1}, X_{i,p-1}, Controls_{i,p-1}) = \alpha + \beta_0 HG_{i,p-1} + \beta_1 X_{i,p-1} + \beta_2 (X_{i,p-1} \times HG_{i,p-1}) + Controls_{i,p-1} + \varepsilon_{i,p} \quad (1)$$

The dependent variable $HG_{i,p}$ is the binary variable indicating if firm i is high-growth in period p, and $HG_{i,p-1}$ is the high-growth status of firm i in period $p-1$. The matrix of focal explanatory variables $X_{i,p-1}$ includes the proxies of structural firm characteristics and performance: $PROD$, ROS, INV, $NEWPROD$, IE and LEV (as their period-averages), which also enter interacted with lagged HG status. The matrix $Controls_{i,p-1}$ is a set of variables that we consider as controls in the first place, including AGE, $SIZE$ (as log of employment), and the EXP and $STATE$ dummies.

Our primary interest lies into the coefficient vector β_2 on the interaction $X_{i,p-1} \times HG_{i,p-1}$. This measures the *additional* contribution of lagged firm attributes in $X_{i,p-1}$ to the probability to be in the HG group in period p for firms that already are HG in previous period p-1. That is, β_2 capture the influence of each variable on persistence in high-growth. The coefficient vector β_1 measures the association between lagged firm characteristics and the probability to be in the HG group in period p for the "control group" of firms that are not HG firms in period $p-1$ (HG_{p-1}=0).[12] We test several specifications of Equation (1) where the set of focal firm attributes enter one at a time and altogether. Since we are not interested in obtaining fitted probabilities, we estimate all the specifications as a linear probability model, via OLS.

Results are shown in Table 5. We start presenting the "univariate specifications" where only one firm characteristic and its interaction with lagged HG status are included (see columns 1-6). We find that productivity is associated with an increased probability of high-growth status, and the association is even larger for firms that remain high-growth in two consecutive periods (column 1). Profitability alone does not play an important role in explaining high-growth of non-persistent high-growers, but it is positively associated with the persistence of high-growth (column 2). Firm's product innovation increases the probability that a non-HG firm becomes HG, but there is no additional contribution of product innovation to the persistence of HG firms (column 4). The same holds concerning interest expenses over sales (column 5). Finally we do not detect any statistically significant association between HG status or persistence of HG status for both investment intensity and leverage (columns 3 and 6). Also notice that the coefficients

[12]The coefficient β_0 measures persistence of HG status for firms with all firm attributes in X set to zero, and they are as such not particularly informative.

on the control variables are very significant in every specification of the model. Younger and smaller firms tend to have more chances to be high-growth, and the same holds for exporters and firms that are not under direct state-control.

We next move (in column 7) to the estimates of the "full model", where all structural characteristics and their corresponding interactions with lagged high-growth status enter at the same time. We take this specification as the more reliable since we can control for the good deal of omitted variable bias affecting the "univariate" specifications. The results convey a remarkably different picture, indeed, especially regarding the relevance of firms characteristics to sustain persistence of high-growth. We confirm that lagged productivity and interest expenses (over sales) stand out as key features that distinguish firms that switch from non-HG to HG status over time, while at the same time HG firms suffer from comparatively lower profitability. However, and more interestingly, none of the key structural firm characteristics displays a statistically significant association with the ability to persistently remain in the HG group. Indeed, the estimated interaction coefficients are all statistically equal to zero.

7. Dissecting the role of age, size and state-ownership

The analyses of the previous section suggest that persistently high-growing firms do not seem to differ from "simple" high-growth firms along standard proxies of industrial and structural performance. A major question remains to be answered pertaining to the role of demographic characteristics. Entrepreneurship and industrial economics literature have repeatedly provided theoretical and empirical support to the peculiar dynamism of and the constraints faced by young and small firms, and the specific context of the Chinese economy suggests the distinction between state vs. private ownership as a further dimension that can be crucial to identify the origins of extraordinary growth and its persistence. Our data confirmed the expectation that HG firms tend to be younger, smaller and private. We conclude our analysis by exploring whether persistence of high-growth itself depends from age, size and ownership type, and we ask if the relations between firm characteristics and persistence of high-growth display specific patterns across firms of different age, size and ownership structure.

Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)
HG_{p-1}	0.0320	0.0545***	0.0948***	0.0952***	0.0979***	0.1098***	0.0532*
	(0.0202)	(0.0098)	(0.0049)	(0.0051)	(0.0055)	(0.0125)	(0.0257)
$PROD_{p-1}$	0.0305***						0.0340***
	(0.0030)						(0.0032)
$PROD_{p-1} \times HG_{p-1}$	0.0142**						0.0098
	(0.0052)						(0.0061)
ROS_{p-1}		0.0047					-0.0143*
		(0.0203)					(0.0066)
$ROS_{p-1} \times HG_{p-1}$		0.1979***					0.0318
		(0.0427)					(0.0434)
INV_{p-1}			-0.0011				-0.0006
			(0.0012)				(0.0013)
$INV_{p-1} \times HG_{p-1}$			0.0014				0.0008
			(0.0012)				(0.0013)
$NEWPROD_{p-1}$				0.0614**			0.0270
				(0.0193)			(0.0194)
$NEWPROD_{p-1} \times HG_{p-1}$				-0.0128			-0.0170
				(0.0355)			(0.0357)
IE_{p-1}					0.3456***		0.5047***
					(0.0983)		(0.1092)
$IE_{p-1} \times HG_{p-1}$					-0.1633		-0.2071
					(0.1659)		(0.1866)
LEV_{p-1}						-0.0033	0.0034
						(0.0098)	(0.0105)
$LEV_{p-1} \times HG_{p-1}$						-0.0260	-0.0108
						(0.0199)	(0.0209)
AGE_{p-1}	-0.0017***	-0.0020***	-0.0020***	-0.0020***	-0.0020***	-0.0020***	-0.0018***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
$SIZE_{p-1}$	-0.0316***	-0.0360***	-0.0362***	-0.0370***	-0.0369***	-0.0362***	-0.0327***
	(0.0023)	(0.0023)	(0.0023)	(0.0023)	(0.0023)	(0.0023)	(0.0023)
EXP_{p-1}	0.0072	0.0137**	0.0121*	0.0106*	0.0133**	0.0116*	0.0079
	(0.0049)	(0.0049)	(0.0049)	(0.0049)	(0.0049)	(0.0049)	(0.0050)
$STATE_{p-1}$	-0.0473***	-0.0490***	-0.0494***	-0.0515***	-0.0512***	-0.0491***	-0.0509***
	(0.0059)	(0.0059)	(0.0059)	(0.0059)	(0.0059)	(0.0059)	(0.0059)
Constant	0.3627***	0.5110***	0.5143***	0.5194***	0.5131***	0.5162***	0.3484***
	(0.0203)	(0.0157)	(0.0150)	(0.0151)	(0.0150)	(0.0160)	(0.0222)
Observations	45976	45976	45976	45976	45976	45976	45976
R2	0.0377	0.0342	0.0334	0.0336	0.0337	0.0334	0.0386

Table 5: Linear probability (OLS) estimates of Equation 1. All specification include 2-digit sectoral fixed effects. Robust standard errors in parentheses: asterisks denote significance levels (***: p<1%; **: p<5%; *: p<10%).

7.1. Young vs. old firms

Table 6 presents a series of variation of our baseline regression in Equation 1 where we explore the role of firm age. In column 1 we add an explicit interaction between lagged HG status and firm age. Next, we split the sample according to age, defining each firm as young if she is less than 10 years old in the last year of the sample (2007), and as an old firm otherwise.[13] Young firms account for 3.48% of total observations, and we exploit this variation in two ways. In column 2 we interact lagged HG status with a dummy identifying young firms, while in columns 3 and 4 we report results of split-sample estimates of Equation 1 by young and old firms.

The different specifications convey a consistent picture. On the one hand, we confirm that HG firms tend to be younger than non-HG firms (negative coefficient on AGE and positive on the young-firm dummy). However, age does not emerge as a distinguishing feature of persistent high-growth firms, as indeed none of the interaction coefficients with lagged HG status turns out as statistically significant. Second, we do not observe significant changes in the coefficient estimates of the other firm attributes, as compared to the baseline estimates reported in Table 5. We still observe that productivity, interest-to-sales ratio and profitability tend to associate with HG status, but none of the firm attributes displays statistical association with high-growth persistence, neither within young nor within old firms, although the relatively low number of observations for young firms can play a role in the generalized lost of significance observed for most variables in column 4.

7.2. Small, medium and large firms

In Table 7 we perform a similar analysis focusing on firm size. We first add an interaction between lagged size (as number of employees) and lagged HG status (in column 1). Next, we explore the relevance of different splits of the sample that identify small vs. medium-large firms, and small-medium vs. large enterprises. We exploit two "official" definitions employed by Chinese authorities: small firms are defined as having less than 300 employees, while small-medium firms are defined as employing less than 1000 employees.[14] Dummy variables for small and small-medium firms are added, both alone and interacted with lagged HG status in column 2 and column 5, respectively, while split sample analysis by size groups

[13] Notice that, given the data span 10 years, young firms include only firms entering the sample exactly during the years covered in the data.

[14] This size categorization method was adopted by Chinese State Economic and Trade Commission in 2011.

Regressors	(1) All	(2) All	(3) Old	(4) Young
HG_{p-1}	0.0541*	0.0664**	0.0667*	-0.0269
	(0.0265)	(0.0257)	(0.0263)	(0.1312)
$PROD_{p-1}$	0.0340***	0.0374***	0.0372***	0.0439
	(0.0032)	(0.0031)	(0.0032)	(0.0226)
$PROD_{p-1} \times HG_{p-1}$	0.0097	0.0080	0.0076	0.0130
	(0.0062)	(0.0061)	(0.0063)	(0.0305)
ROS_{p-1}	-0.0143*	-0.0143*	-0.0142*	-0.0197
	(0.0066)	(0.0066)	(0.0067)	(0.1993)
$ROS_{p-1} \times HG_{p-1}$	0.0323	0.0265	0.0333	-0.0536
	(0.0435)	(0.0433)	(0.0444)	(0.2822)
INV_{p-1}	-0.0006	-0.0004	-0.0004	-0.0001
	(0.0013)	(0.0013)	(0.0013)	(0.0060)
$INV_{p-1} \times HG_{p-1}$	0.0008	0.0006	0.0006	0.0067
	(0.0013)	(0.0013)	(0.0013)	(0.0240)
$NEWPROD_{p-1}$	0.0268	0.0147	0.0155	-0.0530
	(0.0194)	(0.0193)	(0.0196)	(0.1227)
$NEWPROD_{p-1} \times HG_{p-1}$	-0.0163	-0.0101	0.0119	-0.3155*
	(0.0360)	(0.0357)	(0.0366)	(0.1570)
IE_{p-1}	0.5041***	0.5020***	0.5011***	0.4864
	(0.1092)	(0.1081)	(0.1092)	(0.7116)
$IE_{p-1} \times HG_{p-1}$	-0.2060	-0.2000	-0.2299	1.2259
	(0.1870)	(0.1861)	(0.1858)	(1.2613)
LEV_{p-1}	0.0034	-0.0065	-0.0042	-0.1182
	(0.0105)	(0.0105)	(0.0106)	(0.0764)
$LEV_{p-1} \times HG_{p-1}$	-0.0104	-0.0090	-0.0102	0.0752
	(0.0211)	(0.0209)	(0.0214)	(0.1118)
AGE_{p-1}	-0.0017***			
	(0.0002)			
$AGE_{p-1} \times HG_{p-1}$	-0.0001			
	(0.0004)			
$YOUNG$		0.0420*		
		(0.0164)		
$YOUNG \times HG_{p-1}$		-0.0229		
		(0.0244)		
$SIZE_{p-1}$	-0.0327***	-0.0375***	-0.0372***	-0.0418**
	(0.0023)	(0.0022)	(0.0023)	(0.0129)
EXP_{p-1}	0.0078	0.0119*	0.0103*	0.0498
	(0.0050)	(0.0050)	(0.0050)	(0.0274)
$STATE_{p-1}$	-0.0509***	-0.0684***	-0.0694***	-0.0494
	(0.0059)	(0.0056)	(0.0057)	(0.0392)
Constant	0.3482***	0.3376***	0.3415***	0.3402**
	(0.0222)	(0.0222)	(0.0226)	(0.1259)
Observations	45976	45976	44374	1602
R2	0.0386	0.0368	0.0365	0.0589

Table 6: Linear probability (OLS) estimates of Equation 1 adding an interaction of HG_{p-1} with lagged age (colum 1) or with a dummy for lagged young firm status (column 2), and split-sample analysis by old and young firms (columns 3 and 4). 2-digit sectoral dummies are included. Robust standard errors in parentheses: asterisks denote significance levels (***: p<1%; **: p<5%; *: p<10%).

is reported in columns 3-4 (small vs medium-large firms) and in columns 6-7 (small-medium vs. large firms). To avoid simultaneity between growth patterns and the definition of the size groups, we consider the number of employees in the initial year of the sample (1998). Small firms account for 63.75% of the observations in our balanced panel, while 90.12% of the sample falls into the small-medium size category.

The results are quite invariant across the different specifications and the different definition of size groups. We confirm that HG firms are generally smaller in size than the non-HG firms, but comparatively smaller size does not play any role in the degree of persistence of high-growth performance, no matter if we take small or small-medium firms as the focal size category. Finally, much in line with what observed when splitting by age, we confirm that productivity, profitability and the interests-to-sales ratio are important for high-growth, but none of the firm attributes associates with persistence of high-growth.

7.3. State-controlled vs. non-state-controlled firms

Finally, in Table 8 we explore whether there is a relation between high-growth persistence and state ownership. In column 1 we simply add an interaction between the (lagged) dummy STATE with (lagged) HG status. Next, in columns 2 and 3, we report split-sample estimates of the baseline regression model performed separately in the two groups of state-controlled vs. non-state-controlled firms.

Two remarkable results emerge. First, we find that non-state-controlled firms are more likely to become HG, but ownership type does not affect persistence of HG status (see column 1). Second, we broadly confirm that structural characteristics and performance do not have a great predictive power on the ability to replicate high-growth over time. However, productivity does show a positive association with persistence of HG status for state-controlled firms (in column 3). This is essentially the only instance, out all of our analysis, where we find some contribution of firm attributes to persistence of high-growth.

8. Final remarks

While a large literature studies the characteristics of high-growth firms, and the conditions that can ease their birth and development, in this paper we ask the perhaps more crucial question concerning the characteristics that are associated with the ability to achieve high-growth *persistently* over time. From a policy perspective, persistent high-growth firms turn more attractive than "simple" high-growers, since more substantive and long-lasting gains for the economy are plausibly to be expected from firms that

Regressors	(1) All	(2) All	(3) Medium-Large	(4) Small	(5) All	(6) Large	(7) SMEs
HG_{p-1}	0.0497	0.0385	0.0123	0.0710*	0.0570	0.1417	0.0382
	(0.0395)	(0.0262)	(0.0444)	(0.0326)	(0.0308)	(0.0913)	(0.0271)
$PROD_{p-1}$	0.0339***	0.0371***	0.0254***	0.0466***	0.0394***	0.0292***	0.0396***
	(0.0032)	(0.0032)	(0.0047)	(0.0052)	(0.0031)	(0.0085)	(0.0041)
$PROD_{p-1} \times HG_{p-1}$	0.0100	0.0123*	0.0087	0.0081	0.0119	-0.0079	0.0129
	(0.0063)	(0.0062)	(0.0112)	(0.0080)	(0.0062)	(0.0225)	(0.0068)
ROS_{p-1}	-0.0143*	-0.0149*	-0.0183*	-0.0138	-0.0158*	-0.0188	-0.0044
	(0.0066)	(0.0063)	(0.0079)	(0.0390)	(0.0064)	(0.0120)	(0.0298)
$ROS_{p-1} \times HG_{p-1}$	0.0316	0.0156	0.1278	-0.0277	0.0132	0.2898	-0.0144
	(0.0434)	(0.0436)	(0.0764)	(0.0635)	(0.0437)	(0.1669)	(0.0529)
INV_{p-1}	-0.0006	-0.0008	0.0002	-0.0018	-0.0008	0.0002	-0.0014
	(0.0013)	(0.0013)	(0.0016)	(0.0016)	(0.0013)	(0.0026)	(0.0014)
$INV_{p-1} \times HG_{p-1}$	0.0008	0.0010	0.0093	0.0019	0.0010	0.0066	0.0016
	(0.0013)	(0.0013)	(0.0052)	(0.0016)	(0.0013)	(0.0039)	(0.0014)
$NEWPROD_{p-1}$	0.0273	0.0086	-0.0063	0.0368	0.0044	0.0372	-0.0089
	(0.0195)	(0.0193)	(0.0248)	(0.0316)	(0.0194)	(0.0396)	(0.0226)
$NEWPROD_{p-1} \times HG_{p-1}$	-0.0178	-0.0137	0.0091	-0.0432	-0.0167	-0.0162	-0.0109
	(0.0363)	(0.0361)	(0.0542)	(0.0508)	(0.0362)	(0.0875)	(0.0404)
IE_{p-1}	0.5052***	0.4673***	0.4829**	0.4266**	0.4299***	0.2900	0.4389***
	(0.1093)	(0.1092)	(0.1493)	(0.1621)	(0.1082)	(0.2285)	(0.1193)
$IE_{p-1} \times HG_{p-1}$	-0.2076	-0.1627	-0.3398	-0.0888	-0.1348	0.6733	-0.1648
	(0.1867)	(0.1855)	(0.3553)	(0.2355)	(0.1843)	(0.7739)	(0.1927)
LEV_{p-1}	0.0034	0.0064	-0.0081	0.0169	0.0075	0.0290	0.0056
	(0.0105)	(0.0106)	(0.0162)	(0.0139)	(0.0106)	(0.0302)	(0.0113)
$LEV_{p-1} \times HG_{p-1}$	-0.0107	-0.0110	0.0272	-0.0299	-0.0127	-0.1227	-0.0054
	(0.0209)	(0.0209)	(0.0383)	(0.0252)	(0.0209)	(0.0813)	(0.0217)
$SIZE_{p-1}$	-0.0329***						
	(0.0026)						
$SIZE_{p-1} \times HG_{p-1}$	0.0006						
	(0.0046)						
$SMALL$		0.0442***					
		(0.0056)					
$SMALL \times HG_{p-1}$		-0.0003					
		(0.0106)					
$SMEs$					0.0293***		
					(0.0079)		
$SMEs \times HG_{p-1}$					-0.0144		
					(0.0185)		
AGE_{p-1}	-0.0018***	-0.0020***	-0.0016***	-0.0024***	-0.0022***	-0.0010**	-0.0026***
	(0.0002)	(0.0002)	(0.0002)	(0.0003)	(0.0002)	(0.0004)	(0.0002)
EXP_{p-1}	0.0079	-0.0041	-0.0091	-0.0023	-0.0092	-0.0091	-0.0106*
	(0.0050)	(0.0048)	(0.0078)	(0.0063)	(0.0048)	(0.0146)	(0.0052)
$STATE_{p-1}$	-0.0508***	-0.0576***	-0.0694***	-0.0519***	-0.0612***	-0.0566***	-0.0655***
	(0.0059)	(0.0059)	(0.0081)	(0.0088)	(0.0060)	(0.0159)	(0.0065)
Constant	0.3495***	0.1481***	0.2094***	0.1482***	0.1498***	0.1466*	0.1843***
	(0.0235)	(0.0191)	(0.0297)	(0.0253)	(0.0204)	(0.0608)	(0.0203)
Observations	45976	45976	16668	29308	45976	4542	41434
R2	0.0386	0.0358	0.0328	0.0263	0.0344	0.0403	0.0315

Table 7: Linear probability (OLS) estimates of Equation 1 exploring the role of firm size (as number of employees): in column 1 we add an interaction $SIZE_{p-1} \times HG_{p-1}$; in column 2 we add an interaction between HG_{p-1} and a dummy for lagged small firm status (less than 300 employees); in column 3 and 4 we split the sample between small vs medium-large (more than 300 employees) firms; in column 5 we add an interaction between HG_{p-1} and lagged small-medium firm status (less than 1000 employees); in column 6 and 7 we split the sample between small-medium vs large (more than 1000 employees) firms. All specifications include 2-digit sectoral fixed effects. Robust standard errors in parentheses: asterisks denote significance levels (***: p<1%; **: p<5%; *: p<10%).

Regressors	(1) All	(2) Non-State-control	(3) State-control
HG_{p-1}	0.0564*	0.0730**	-0.0635
	(0.0258)	(0.0280)	(0.0688)
$PROD_{p-1}$	0.0343***	0.0366***	0.0153*
	(0.0032)	(0.0044)	(0.0068)
$PROD_{p-1} \times HG_{p-1}$	0.0095	0.0046	0.0402**
	(0.0061)	(0.0071)	(0.0155)
ROS_{p-1}	-0.0148*	0.0155	-0.0032
	(0.0065)	(0.0343)	(0.0064)
$ROS_{p-1} \times HG_{p-1}$	0.0319	0.0257	-0.0682
	(0.0435)	(0.0575)	(0.0869)
INV_{p-1}	-0.0005	0.0022	-0.0030*
	(0.0013)	(0.0016)	(0.0013)
$INV_{p-1} \times HG_{p-1}$	0.0007	-0.0020	0.0146
	(0.0013)	(0.0016)	(0.0080)
$NEWPROD_{p-1}$	0.0237	0.0104	0.0694*
	(0.0194)	(0.0245)	(0.0327)
$NEWPROD_{p-1} \times HG_{p-1}$	-0.0091	0.0160	-0.0890
	(0.0361)	(0.0428)	(0.0694)
IE_{p-1}	0.4865***	0.5109***	0.3386
	(0.1087)	(0.1315)	(0.1756)
$IE_{p-1} \times HG_{p-1}$	-0.1750	-0.2249	0.0410
	(0.1883)	(0.2224)	(0.2859)
LEV_{p-1}	0.0023	-0.0024	0.0301
	(0.0105)	(0.0121)	(0.0217)
$LEV_{p-1} \times HG_{p-1}$	-0.0104	-0.0085	0.0034
	(0.0209)	(0.0228)	(0.0541)
$STATE_{p-1}$	-0.0452***		
	(0.0066)		
$STATE_{p-1} \times HG_{p-1}$	-0.0255		
	(0.0146)		
AGE_{p-1}	-0.0018***	-0.0023***	-0.0011***
	(0.0002)	(0.0002)	(0.0003)
$SIZE_{p-1}$	-0.0330***	-0.0356***	-0.0289***
	(0.0023)	(0.0027)	(0.0047)
EXP_{p-1}	0.0083	0.0087	-0.0008
	(0.0050)	(0.0055)	(0.0116)
Constant	0.3468***	0.3429***	0.3678***
	(0.0222)	(0.0261)	(0.0466)
Observations	45976	38736	7240
R2	0.0385	0.0306	0.0392

Table 8: Linear probability (OLS) estimates of Equation 1 adding an interaction of HG_{p-1} with a dummy of lagged state-control status (column 1) , and split-sample analysis by non-State-control and State-control firms (columns 2 and 3). 2-digit sectoral dummies are included. Robust standard errors in parentheses: asterisks denote significance levels (***: p<1%; **: p<5%; *: p<10%).

consistently outperform over time.

Notwithstanding, persistence of high-growth performance receives little and only very recent attention in the empirical literature. From the few existing studies, mostly based on developed countries, we know that persistently high-growing firms represent a small subset of the industrial sector and are usually smaller in size and younger. But very few studies address if persistent high-growth is related to structural characteristics, in fact providing a negative answer. The Chinese miracle of the 2000s provide a interesting test to the identification of the characteristics and drivers of high-growth and persistently high-growth firms, for its dynamism and orientation of the Chinese authorities toward the promotion of entrepreneurship and private business.

Our main finding, however, confirms that structural characteristics of firms do not display any statistically significant association with the probability to replicate high-growth over time. The result challenges most theories of firm-industry dynamics sharing the notion that idiosyncratic specificities of firms are the key drivers of comparative advantages leading to sustained growth over time. Rather, as previously emphasized in the literature, our findings speaks more in favor of firm growth as a random process essentially guided by luck. The implications of this interpretation are perhaps not good news for policy makers. Our analysis indeed speak against too simplistic views on the large benefits usually attributed to policy measures sustaining the emergence and development of high-growth firms. We find evidence that such policy may be doomed to only exert short-term effects on the economy. Indeed, those few firms that display a systematic ability to persistently achieve high-growth over time do not differ from other firms along any of the dimension of industrial and financial performance considered. Therefore, it is not to be expected that they contribute to improving the overall performance of the economy over the medium-long-run.

References

Acs, Z. and P. Mueller (2008). Employment effects of business dynamics: Mice, Gazelles and Elephants. *Small Business Economics 30*(1), 85–100.

Acs, Z., J. Parsons, and W. Tracy (2011). High-impact firms: Gazelles revisited. In M. Fritsch (Ed.), *Handbook of research on entrepreneurship and regional development: National and regional perspectives*, pp. 133–174. Cheltenham: Edward Elgar Publishing.

Audretsch, D. B., A. Coad, and A. Segarra (2014). Firm growth and innovation. *Small business economics 43*(4), 743–749.

Barney, J. B. (1997). On flipping coins and making technology choices: Luck as an explanation of technological foresight and oversight. In R. Garud, P. R. Nayyar, and Z. B. Shapira (Eds.), *Technological Innovation: Oversights and Foresights*. Cambridge University Press: Cambridge, UK.

Beck, T., A. Demirgüç-Kunt, and V. Maksimovic (2005). Financial and legal constraints to growth: Does firm size matter? *The Journal of Finance 60*(1), 137–177.

Bellak, C. (2004). How domestic and foreign firms differ and why does it matter? *Journal of economic surveys 18*(4), 483–514.

Bianchini, S., G. Bottazzi, and F. Tamagni (2017). What does (not) characterize persistent corporate high-growth? *Small Business Economics 48*(3), 633–656.

Bianchini, S., G. Pellegrino, and F. Tamagni (2016). Innovation strategies and firm growth. LEM Working Papers 2016/03, Laboratory of Economics and Management (LEM), Sant'Anna School of Advanced Studies, Pisa, Italy.

Birch, D. L. and J. Medoff (1994). Gazelles. In C. S. Lewis and R. L. Alec (Eds.), *Labor markets, employment policy and job creation*, pp. 159–167. Boulder: Westview Press.

Bottazzi, G., G. Dosi, and G. Rocchetti (2001, September). Modes of knowledge accumulation, entry regimes and patterns of industrial evolution. *Industrial and Corporate Change 10*(3), 609–38.

Bottazzi, G. and A. Secchi (2006). Explaining the distribution of firms growth rates. *The RAND Journal of Economics 37*, 235–256.

Bottazzi, G., A. Secchi, and F. Tamagni (2014). Financial constraints and firm dynamics. *Small Business Economics 42*(1), 99–116.

Brandt, L., J. Van Biesebroeck, and Y. Zhang (2012). Creative accounting or creative destruction? Firm-level productivity growth in Chinese manufacturing. *Journal of Development Economic 97*(2), 339–351.

Capasso, M., E. Cefis, and K. Frenken (2014). On the existence of persistently outperforming firms. *Industrial and Corporate Change 23*(4), 997–1036.

Chang, W. and I. C. MacMillan (1991). A review of entrepreneurial development in the people's republic of china. *Journal of Business Venturing 6*(6), 375–379.

Cimoli, M., G. Dosi, and J. E. Stiglitz (Eds.) (2009). *Industrial Policy and Development: the Political Economy of Capabilities Accumulation*. Oxford: Oxford University Press.

Clementi, G. L. and H. A. Hopenhayn (2006). A theory of financing constraints and firm dynamics. *The Quarterly Journal of Economics 121*(1), 229–265.

Coad, A. (2007). Testing the principle of 'growth of the fitter': the relationship between profits and firm growth. *Structural Change and economic dynamics 18*(3), 370–386.

Coad, A. (2009). *The growth of firms: A survey of theories and empirical evidence*. Edward Elgar Publishing.

Coad, A., S.-O. Daunfeldt, W. Hölzl, D. Johansson, and P. Nightingale (2014). High-growth firms: introduction to the special section. *Industrial and Corporate Change 23*(1), 91–112.

Coad, A. and W. Hölzl (2012). Firm growth: Empirical analysis. In *Handbook on the Economics and Theory of the Firm*. Cheltenham, UK: Edward Elgar Publishing, Inc.

Coad, A. and R. Rao (2008). Innovation and firm growth in high-tech sectors: A quantile regression approach. *Research policy 37*(4), 633–648.

Coad, A., R. Rao, and F. Tamagni (2011, February). Growth processes of Italian manufacturing firms. *Structural Change and Economic Dynamics 22*(1), 54–70.

Coad, A., A. Segarra, and M. Teruel (2016). Innovation and firm growth: Does firm age play a role? *Research Policy 45*(2), 387–400.

Covin, J. G., K. M. Green, and D. P. Slevin (2006). Strategic process effects on the entrepreneurial orientation–sales growth rate relationship. *Entrepreneurship theory and practice 30*(1), 57–81.

Daunfeldt, S.-O., N. Elert, and D. Johansson (2010). The economic contribution of high-growth firms: Do definitions matter? *Stockholm: The Ratio Institute*.

Daunfeldt, S.-O. and D. Halvarsson (2015). Are high-growth firms one-hit wonders? Evidence from Sweden. *Small Business Economics 44*(2), 361–383.

Davidsson, P. and M. Henrekson (2002). Determinants of the Prevalence of Start-Ups and High-Growth Firms. *Small Business Economics 19*(2), 81–104.

Delmar, F., P. Davidsson, and W. B. Gartner (2003). Arriving at the high-growth firm. *Journal of Business Venturing 18*(2), 189–216.

Dosi, G. et al. (2007). Statistical regularities in the evolution of industries. a guide through some evidence and challenges for the theory. *Perspectives on innovation*, 1110–1121.

Dosi, G., O. Marsili, L. Orsenigo, and R. Salvatore (1995). Learning, market selection and evolution of industrial structures. *Small Business Economics 7*(6), 411–36.

Dosi, G., R. Nelson, and S. Winter (2001). *The nature and dynamics of organizational capabilities*. OUP Oxford.

Du, J. and Y. Temouri (2015). High-growth firms and productivity: evidence from the united kingdom. *Small business economics 44*(1), 123–143.

Ericson, R. and A. Pakes (1995). Markov-perfect industry dynamics: A framework for empirical work. *Review of Economic Studies 62*(1), 53–82.

Fazzari, S. M., R. G. Hubbard, and B. C. Petersen (1988). Financing constraints and corporate investment. *Brookings Papers on Economic Activity 1988*(1), 141–206.

Fligner, M. A. and G. E. Policello (1981). Robust rank procedures for the behrens-fisher problem. *Journal of the American Statistical Association 76*(373), 162–168.

Freeman, C., J. Clark, and L. Soete (1982). *Unemployment and technical innovation: a study of long waves and economic development*. London: Frances Printer.

Fu, X. and Y. Gong (2011, July). Indigenous and Foreign Innovation Efforts and Drivers of Technological Upgrading: Evidence from China. *World Development 39*(7), 1213–1225.

Goedhuys, M. and L. Sleuwaegen (2010). High-growth entrepreneurial firms in africa: a quantile regression approach. *Small Business Economics 34*(1), 31–51.

Guarascio, D. and F. Tamagni (2016). Innovation persistence and patterns of firm growth. LEM Working Papers 2016/31, Sant'Anna School of Advanced Studies, Pisa, Italy.

Guariglia, A., X. Liu, and L. Song (2011, September). Internal finance and growth: Microeconometric evidence on Chinese firms. *Journal of Development Economics 96*(1), 79–94.

Haltiwanger, J., R. S. Jarmin, and J. Miranda (2013). Who Creates Jobs? Small versus Large versus Young. *The Review of Economics and Statistics 95*(2), 347–361.

Henrekson, M. and D. Johansson (2010). Gazelles as job creators: a survey and interpretation of the evidence. *Small Business Economics 35*(2), 227–244.

Hobday, M. and F. A. d. B. Perini (2009). Latecomer entrepreneurship: a policy perspective. In M. Cimoli, G. Dosi, and J. E. Stiglitz (Eds.), *Industrial Policy and Development: the political economy of capabilities accumulation*. Oxford University Press.

Hölzl, W. (2009). Is the r&d behaviour of fast-growing smes different? evidence from CIS III data for 16 countries. *Small Business Economics 33*(1), 59–75.

Hölzl, W. (2014). Persistence, survival, and growth: a closer look at 20 years of fast-growing firms in austria. *Industrial and corporate change 23*(1), 199–231.

Hopenhayn, H. A. (1992). Entry, exit, and firm dynamics in long run equilibrium. *Econometrica 60*(5), 1127–50.

Hu, A. G. Z., G. H. Jefferson, and J. Qian (2005, November). R&D and Technology Transfer: Firm-Level Evidence from Chinese Industry. *The Review of Economics and Statistics 87*(4), 780–786.

Huang, Y. (2010, December). Entrepreneurship in China. *The World Financial Review*.

Jovanovic, B. (1982). Selection and the evolution of industry. *Econometrica 50*(3), 649–70.

Li, H. (2013). History and development of entrepreneurship in China. In T. Zhang and R. R. Stough (Eds.), *Entrepreneurship and Economic Growth in China*, pp. 13–33. World Scientific.

Li, J. and H. Matlay (2006). Chinese entrepreneurship and small business development: an overview and research agenda. *Journal of Small Business and Enterprise Development 13*(2), 248–262.

Luttmer, E. G. J. (2007). Selection, growth and the size distribution of firms. *The Quarterly Journal of Economics 122*(3), 1103–1144.

Metcalfe, S. J. (1998). *Evolutionary Economics and Creative Destruction*. London, UK: Routledge.

Nelson, R. R. and S. G. Winter (1982). *An Evolutionary Theory of Economic Change*. Harvard University Press.

Oliveira, B. and A. Fortunato (2006). Firm growth and liquidity constraints: A dynamic analysis. *Small Business Economics 27*(2), 139–156.

Penrose, E. T. (1959). *The theory of the growth of the firm* (3rd ed.). Oxford: Blackwell.

Pisano, G. P. (2015). A normative theory of dynamic capabilities: Connecting strategy, know-how, and competition. *Harvard Business School Technology & Operations Mgt. Unit Working Paper* (16-036).

Robson, P. J. and R. J. Bennett (2000). SME growth: The relationship with business advice and external collaboration. *Small business economics 15*(3), 193–208.

Segarra, A. and M. Teruel (2014). High-growth firms and innovation: an empirical analysis for Spanish firms. *Small Business Economics 43*(4), 805–821.

Silverberg, G., G. Dosi, and L. Orsenigo (1988). Innovation, diversity and diffusion: A self-organisation model. *Economic Journal 98*, 1032–1054.

Stam, E. and K. Wennberg (2009). The roles of R&D in new firm growth. *Small Business Economics 33*(1), 77–89.

Stanley, M. H., L. A. Amaral, S. V. Buldyrev, S. Havlin, H. Leschhorn, P. Maass, M. A. Salinger, and H. E. Stanley (1996). Scaling behaviour in the growth of companies. *Nature 379*(6568), 804–806.

Teece, D. and G. Pisano (1994). The dynamic capabilities of firms: an introduction. *Industrial and corporate change 3*(3), 537–556.

Teece, D. J., G. Pisano, and A. Shuen (1997). Dynamic capabilities and strategic management. *Strategic management journal*, 509–533.

Winter, S. G. (1984). Schumpeterian competition under alternative technological regimes. *Journal of Economic Behavior and Organization 5*, 287–320.

Winter, S. G., Y. M. Kaniovski, and G. Dosi (2003, October). A baseline model of industry evolution. *Journal of Evolutionary Economics 13*(4), 355–3833.

Yang, J. Y. and J. Li (2008). The development of entrepreneurship in China. *Asia Pacific Journal of Management 25*(2), 335–359.

Yu, X., G. Dosi, M. Grazzi, and J. Lei (2015). Inside the virtuous cycle between productivity, profitability, investment and corporate growth: An anatomy of China industrialization. *LEM Working Paper Series 2015/03*.

Yu, X., G. Dosi, J. Lei, and A. Nuvolari (2015). Institutional change and productivity growth in China's manufacturing: the microeconomics of knowledge accumulation and "creative restructuring". *Industrial and Corporate Change 24*(3), 565–602.

Zhang, M. and P. Mohnen (2013). Innovation and survival of new firms in Chinese manufacturing, 2000-2006. *UNU-MERIT*.

A. Table Appendix

Year	Original Dataset		Firms with missing, zero, or negative values, manufacturing firms only								
	Total	Manuf. (CIC 13-42)	Output	Value Added	Sales	Original Value of Fixed Assets	Unemployment insurance	Wage	Welfare	Employment (< 8)	Liabilities (< 0)
1998	165097	148661	543	12239	5406	4555	102	5	180	4237	82
1999	162010	146075	6111	10931	6115	4881	134	10	167	5390	98
2000	162879	147246	5533	9342	5732	4615	94	10	118	4708	107
2001	171187	155659	4216	7019	4492	3412	61	9	76	3468	13
2002	181494	165793	4014	7877	4120	3163	53	2	49	3194	29
2003	196154	181001	2672	5383	2654	2473	4	0	20	2126	16
2004	279012	258869	5789	20661	5186	4097	1	0	2	5923	59
2005	271747	250952	1965	6212	1721	1501	25	1	41	1884	83
2006	301873	278644	2044	5625	2138	2021	39	1	35	2637	66
2007	336678	312284	1144	4928	1520	1768	28	0	115	1790	61

Table A.1: Number of observations of the original dataset, number of observations with missing, zero or negative values for each variable, manufacturing firms only (CIC 13 - 42). Note: number of observations with missing and negative values for unemployment insurance, wage and welfare. Output and value added in year 2004 are not available. We proxy output as the sum of sales and the difference of inventories between year-end and year-beginning.