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Mass Entrepreneurship and Innovation in China: An Analysis of Breadth and Depth of High-Tech Small Businesses

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Abstract

Promoting innovation and strengthening the development of high-tech small and medium-sized enterprises (SMEs) have been a key economic development strategy in China. Particularly, the essence of the new "Mass Entrepreneurship and Innovation" (MEI) strategy is the cultivation, development, and wellbeing of high-tech SMEs. High-tech SMEs are critical in regional innovation systems and entrepreneurial ecosystems. They have not only served as major drivers of innovation and thus the engine for economic growth, they have also, in China particularly, played an important role in the transformation from labor-intensive to technology-intensive production.

The paper therefore seeks to explore the conditions conducive to the development of high-tech SMEs, particularly high-tech small-scaled enterprises (SEs) across Chinese provinces, and seeks to provide policy options, based on the empirical findings, for the implementation of the MEI strategy. This paper differs from earlier studies in that it not only examines the density of high-tech SEs but also the profitability of high-tech SEs among Chinese provinces, which measures both entrepreneurial breadth and depth. A panel model with corrected standard errors (PCSE) is calibrated for all 31 Chinese provinces and for the period of 2011-2014.

Special attention is paid on the relationships between China's domestic high-tech SEs with high-tech state-owned enterprises (SOEs) and with high-tech firms from Hong Kong, Macau and Taiwan. It is hypothesized that domestic high-tech SEs would benefit from knowledge spillovers from high-tech SOEs, while high-tech SEs would be in competition with high-tech firms from Hong Kong, Macau and Taiwan for resources. The preferential policy treatment for high-tech firms from Hong Kong, Macau and Taiwan may also be detrimental to the growth of domestic high-tech SEs. The central hypotheses are that 1) higher profits of high-tech SEs will be correlated with higher profits of high-tech SOEs; 2) lower profits of high-tech SEs will be correlated with higher profits of high-tech firms from Hong Kong, Macau and Taiwan.

Regression results show that there is no evidence suggesting positive spillover from high-tech SOEs. But competition is evident between high-tech SEs and high-tech firms from Hong Kong, Macau and Taiwan, both in the density and in profitability. The competitive relationship may suggest that the MEI strategy emphasizing domestic high-tech SEs may not be compatible with the traditional FDI driven economic development strategy which has focused on production and technology from outside.

Key words: High-tech, small businesses, state-owned enterprises, FDI, entrepreneurship, innovation

Mass Entrepreneurship and Innovation in China: An Analysis of Breadth and Depth of High-Tech Small Businesses

Introduction

China has been experiencing the deepening reform to optimize its economic structure and to change the economic growth drivers over the past few years. Mass entrepreneurship and innovation (MEI), which was first proposed by Premier Li in 2014, is considered as the new engine fueling China's economic growth. Literally, MEI means everyone opens startups and innovates. It is believed that this strategy will contribute to the innovation-based and entrepreneurship-driven economic growth, through creating more job opportunities, improving social equity, and most importantly, boosting structural reform. The core of MEI is high-tech small businesses. This strategy aims to create new modes of business, which would foster more favorable conditions especially for micro and small businesses, and promote start-ups in high-tech sectors.

High-tech small businesses play an important role in the shift from labor-intensive to technology-intensive production in China. This is because high-tech industry grows more rapidly than other types of firms (Goetz & Rupasingha, 2002) and radical innovation generally comes from new startups (Acs, Braunerhjelm, Audretsch, & Carlsson, 2009). Although the components extracted from the regional innovation systems (RIS) and entrepreneurial ecosystems (EE) theories which would facilitate the development of high-tech small and medium-sized enterprises (SMEs) are well documented, very limited studies focus on the relationships among these components, particularly for small enterprises (SEs). In China, high-tech state-owned enterprises (SOEs) and high-tech firms from Hong Kong, Macau and Taiwan (HKMCTWEs) are granted various privileged treatments by the government and are the major player in the RIS and EE. However, lack of studies explores their relations with high-tech SEs. Besides, despite the extensive research accounting for the factors that affect the density of high-tech SEs, which is in line with the notion of entrepreneurial breadth (Low, Henderson, & Weiler, 2005), few studies take their profitability, which is the measure of entrepreneurial depth, into consideration. Even fewer studies address the trade-off among these factors.

The purpose of this paper is, therefore, to explore the conditions conducive to high-tech SEs. It aims to examine the current well-being of high-tech SEs in China. It not only includes the relations with SOEs and foreign direct investment (FDI) but also discusses the related economic, human capital and policy correlates with the breadth as well as depth of high-tech SEs. We adopt the RIS and EE theories to hypothesize the potential factors. Using the panel data covers 31 provinces from 2011 to 2014, which is right before the MEI strategy was proposed, we provide policy guidance on taking advantage of different factors to facilitate the development of high-tech firms in China. Since the development of high-tech firms varies widely from province to province and depends on its previous status, the Prais-Winsten models with panel-corrected standard errors (PCSE) are utilized to solve these issues.

Subsequently, we first give an empirical and theoretical background for the development of high-tech firms. Thereafter, we explain our research methodology and data. We present the empirical analysis and discuss our findings. Finally, we briefly elaborate on the contributions and further research directions. Our conclusions provide some policy options for the MEI strategy going forward in China.

Literature review

Realizing that a firm, particularly an SME, is not isolated and it actually interacts with other players within a region is supported by two main theories: RIS and EE. Integrating the two theories would promote our understanding of the factors that affect the breadth and depth of high-tech SEs. RIS can be conceptualized as a cluster of knowledge-based organizations (Asheim & Isaksen, 2002). Autio (1998) proposed two subsystems of RIS. The first subsystem is the knowledge application and exploitation subsystem, which consists of firms, their clients, suppliers, competitors, and partners. The second one is the knowledge generation and diffusion subsystem. It includes educational and research institutions (Asheim & Coenen, 2006). According to a set of organizational and institutional arrangements, these organizations interact with others to generate, utilize, and diffuse knowledge (Doloreux & Parto, 2005). In addition, there is various infrastructure that supports the RIS. The hard infrastructure includes transport and telecommunications (Cooke, 2001). Regional financial competence (Cooke, 2001), regional policy (Tödtling & Trippl, 2005), and productive culture (Cooke, Uranga, & Etxebarria, 1997) belong to the softer infrastructure, which is more complex.

EE shares the same focus on the external business environment with RIS, however, it begins with the entrepreneurial individual instead of the enterprise (Stam, 2015) and aims to foster new firm formation. Auerswald (2015) argued that “entrepreneurship is a highly context-dependent activity.” In other words, it is the regional activity. There are many studies on EE consistent with the RIS literature. EE includes economic, political, social, and cultural elements to facilitate the development of innovative startups (Spigel, 2015). They are characterized by the presence of the investment capital services (Dubini, 1989; Prevezer, 2001), business infrastructure (Neck, Meyer, Cohen, & Corbett, 2004), public incentive policies (Isenberg, 2011;

Mason & Brown, 2013), available human capital (World Economic Forum, 2013), accessible local and international markets (Isenberg, 2011), and supportive entrepreneurial culture (Dubini, 1989; Neck, Meyer, Cohen, & Corbett, 2004). With the above components, the key players in the EE are startups, large established firms (Kenney & Patton, 2005; Mason & Brown, 2013), major universities (Bruno & Tybejee, 1982; Spilling, 1996; Isenberg, 2011), and governments (Siegel, Wessner, Binks, & Lockett, 2003). These players come into being a formal network within the EE (Birley, 1985; Neck, Meyer, Cohen, & Corbett, 2004; Isenberg, 2011).

Even though these two approaches differ in the conceptual outlooks, both of them attach importance to certain attributes within a region which promote innovation and entrepreneurship. The attributes include but do not limit to the shared culture, social networks and government policies (Feldman & Francis, 2004; Owen-Smith & Powell, 2004). Among them, the development of social networks within a region draws much more attention. In the RIS, Cooke (2001) advocated the interactions between innovative actors, such as between small startups and large established enterprises, or between firms and universities. Similarly, the concept of ecosystem map in the EE is proposed to identify central players (nodes) and key relationships (edges) within the system (Auerswald, 2015). Particularly, there are a few researches focusing on the significant role of the large established businesses. Some staff would leave the large established businesses to start their own firms, which is known as knowledge spillover (Acs, Braunerhjelm, Audretsch, & Carlsson, 2009; Adams, 2011). Besides, large enterprises can also provide SEs with much resources and opportunities (Mason & Brown, 2013). Large established businesses flourish the EE intentionally or without intention (Isenberg, 2013).

In sum, while the components of the RIS and EE have been well documented, there are limited studies on the relationships among these components. The RIS and EE, which are originated in the context of developed economies, have been intensively studied in Western countries, but much less in China. No matter within an RIS or EE, high-tech SOEs play a supporting and leading role in the system. With a wide range of privileged treatments, SOEs in China benefit from their monopoly status. They generally have superior access to resources (Luo, 2003) and government funding (Guana & Yam, 2015). And there tends to be a higher level of sociopolitical approval towards SOEs (Aldrich & Fiol, 1994) and legitimacy to potential external partners (Oliver, 1990; Huang, Bai, & Tan, 2017). Furthermore, the protection of intellectual property rights is much stronger (Wang, Hong, Kafouros, & Wright, 2012). In addition, since FDI has contributed to the economic growth in China for a few years, it is another major player in the RIS and EE. Based on the important roles of high-tech SOEs and FDI, this paper contributes to the literature by exploring the relationships within the network in the RIS or EE in the Chinese context. It is also a complement and extension for the research on the relation between the large enterprises and small startups. Moreover, there are very few studies on comparing the relative strength of potential economic and institutional correlates of SEs breadth and depth. This paper intends to address this research gap through the comparison among major components of the RIS and EE.

Theoretical framework and hypotheses

Building on the RIS and EE, we establish our theoretical framework to hypothesize the relationships among factors that affect the breadth and depth of high-tech SEs. In addition to the major actors in the two theories, such as the universities and government, we focus on the network which consists of the high-tech SEs, SOEs, and HKMCTWEs. Universities provide the human capital to the networks. And the government support the networks through the incentive and regulatory policies.

Within the network, the relations between high-tech SOEs and SEs, and between HKMCTWEs and SEs are hypothesized (See Figure 1). Currently, there seems to be an unbalance between high-tech SOEs and SEs in China. There is high innovative capacity but limited resources in SEs, while there are intensive R&D expenditure and personnel but worse innovative efficiency in SOEs (Huang, Bai, & Tan, 2017). Even though the expansion of high-tech SOEs may have a negative effect on SEs' innovation, as it will be much more difficult for SEs to obtain debt financing and make SEs face with higher interest rate (Cheng & Lei, 2015), we assume that the knowledge spillovers from SOEs to SEs would dominate their relations. These spillovers will have an effect on both the breadth and depth of SEs. Thus, our first hypothesis regarding the relation between high-tech SOEs and SEs is as follows:

Hypothesis 1a: More establishments of high-tech SEs will be correlated with more establishments of high-tech SOEs.

Hypothesis 1b: Higher profits of high-tech SEs will be correlated with higher profits of high-tech SOEs.

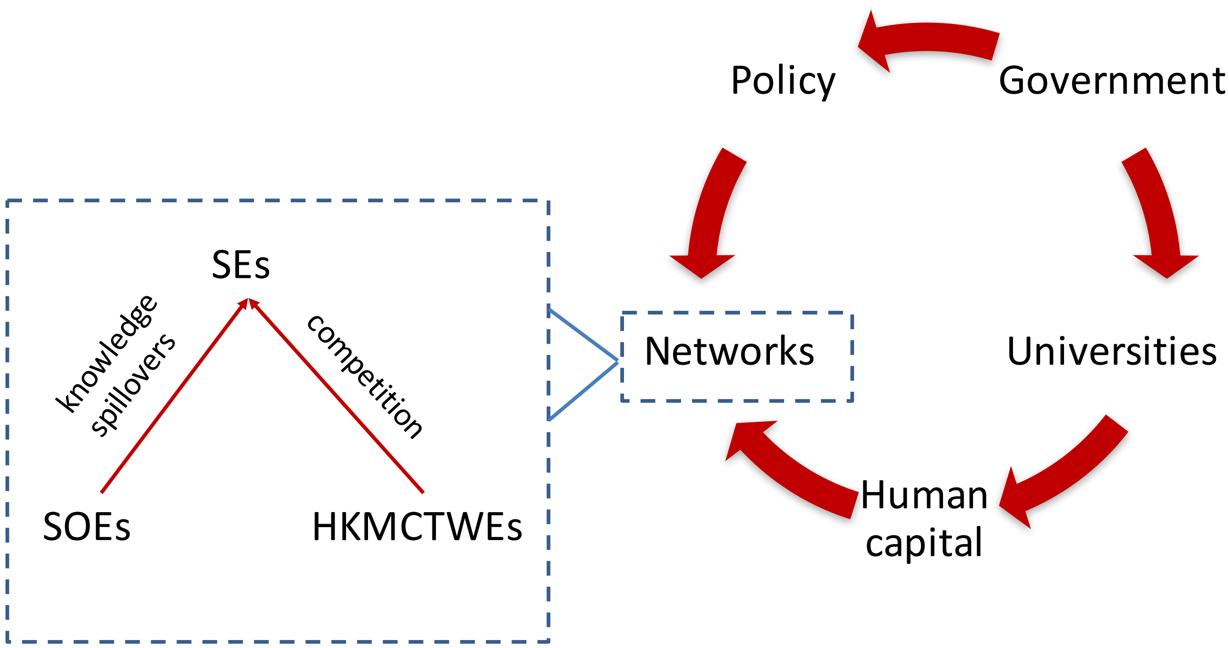

Figure 1. Entrepreneurial ecosystems of High-tech firms

Although FDI is believed to make a great contribution to the economic growth of the countries which receive the investment (Urata & Kawai, 2000), it may affect the innovation of local high-tech firms negatively. Liu, Lu, Filatotchev, Buck, and Wright (2010) gave the two following explanations. The first reason is that there is a possibility to increase the market competition at local levels. With the reduction of Schumpeterian incentives to innovate and high risks and costs to innovate, local firms are likely to imitate technologies of multinational enterprise instead. Second, in order to protect the intellectual property rights, foreign firms tend to establish wholly foreign-owned subsidiaries which may fail to stimulate local innovation. As a result, a few scholars argued that once the local technological capacity is established, the catch-up process is the development of their own innovative capacities (Chuang & Lin, 1999; Lemoine & Ünal-Kesenci, 2004). HKMCTWEs are the common FDI in China. The literature on the relationship between FDI and local firms motivates the following hypotheses:

Hypothesis 2a: Fewer establishments of high-tech SEs will be correlated with more establishments of high-tech HKMCTWEs.

Hypothesis 2b: Lower profits of high-tech SEs will be correlated with higher profits of high-tech HKMCTWEs.

Methods

In consideration of the unobserved heterogeneity across provinces, fixed effects model is used to deal with this issue. Since each province has its own unobserved individual characteristics, it is possible to bias statistical estimation. Fixed effects model removes the effect of time-invariant characteristics from independent variables so we can assess their net effect. There is no time-invariant variable in our model, therefore using fixed effects model is the appropriate way to investigate the impact of high-tech SOEs and HKMCTWEs establishments and profits on those of the SEs. The fixed effects model equations are as follows:

$$SEs\ establishments_{it} = \alpha_1 + \beta_1(SOEs\ establishments)_{it} + \beta_2(HKMCTWEs\ establishments)_{it} + \beta_3(Controls)_{it} + f_i + e_{it} \quad (1)$$

$$Avg.\ SEs\ profits_{it} = \alpha_2 + \beta_4(Avg. SOEs\ profits)_{it} + \beta_5(Avg. HKMCTWEs\ profits)_{it} + \beta_6(Controls)_{it} + \mu_i + \varepsilon_{it} \quad (2)$$

where $SEs\ establishments_{it}$ and $Avg.\ SEs\ profits_{it}$ are the establishments and profits of the high-tech SEs of province *i* in year *t*. The same goes for the establishments and profits of the high-tech SOEs and HKMCTWEs. $Controls$ is a column vector of control variables including educational, economic, demographic variables, etc.. α_1 and α_2 denote the intercepts, β_1 to β_6 refer to the vector of coefficients, f_i and μ_i are the unobserved effects.

Furthermore, Prais-Winsten estimation with PCSE is adopted to solve the problem of heteroskedasticity and autocorrelation across panels. On the one hand, because of the regional differences, the development of the high-tech SEs varies widely in China (Li, 2009). The differences on the scale of SEs establishments and profits between provinces may lead to panel heteroscedasticity (Beck & Katz, 1995). On the other hand, it is likely that the errors of a panel study present temporal dependence. In our study, the current establishments and profits of high-tech SEs in a province may be influenced by the state over the past few years. Therefore, based on the above two assumptions, we use PCSE to estimate the models.

Data

Data on the breadth and depth of the high-tech SEs from 2011 to 2014 are obtained from the China Statistical Yearbook on High Technology Industry. This is an annual publication of the National Bureau of Statistics (NBS) of China. We also collect the data on the breadth and depth of the high-tech SOEs and HKMCTWEs from this source. The unit of analysis in our study is the province. All the data on the establishments and profits of the high-tech firms are standardized by the total population of each province.

Other explanatory variables include educational, science and technology, innovative fund, economic and demographic variables, which are based on the theories of RIS and EE. Table 1 presents the variable definitions and sources. These provincial data are mainly picked from the China Statistical Yearbook over the period from 2011 to 2014. University is one of the important players in both RIS and EE. And we include human capital and the expenditure on education in the educational variables. In addition, R&D expenditure and patents are the commonly used proxies for science and technology variables. We also take the average R&D

project size into account. For the data on the National High-tech SMEs Innovative Fund, it is obtained from the Report on the Evaluation of Regional Innovation Capacity in China. Then we use the per capita income of the urban household, gross regional product indices, and consumer price to measure for the economic development of each province. Total population and population density are also included. All the explanatory variables are standardized in consideration of the differences in populations.

Table 1. Explanatory variables and descriptions

Variables	Descriptions	Source
Dependent variables		
SEs breadth	Number of small-scaled high-tech businesses per 10,000 persons	
SEs depth	Average profits per small-scaled high-tech business (100 million yuan)	
Independent variables		
Establishments		
SOEs breadth	Number of state-owned high-tech enterprises per 10,000 persons	China Statistical Yearbook on High Technology Industry
HKMCTWEs breadth	Number of high-tech firms from Hong Kong, Macau and Taiwan per 10,000 persons	
Profits		
SOEs depth	Average profits per state-owned high-tech enterprise (1,000 million yuan)	
HKMCTWEs depth	Average profits per high-tech firm from Hong Kong, Macau and Taiwan (1,000 million yuan)	
Educational variables		
Human capital	Percentage of population with college degree and higher level (%)	
Universities	Number of schools (institutions) of higher education per 10,000 persons	
Education exp	Education expenditure per capita (1 million yuan)	
Science & Technology variables		China Statistical Yearbook
R&D exp	R&D expenditure per capita (10,000 yuan)	
Avg. R&D exp size	Average R&D expenditure per project (10 billion yuan)	
Patents	Number of patent applications granted per 100 persons	
Internet users	Percentage of internet users of total population (%)	
Innovative fund variables		

Fund	Amount of National High-tech SMEs Innovative Fund per capita (100 yuan)	Report on the Evaluation of Regional Innovation Capacity in China[1]
Avg. fund size	Average amount of the fund per project (10 million yuan)	
Economic variables		
Total income	Per capita income of urban households (1 million yuan)	
Gross regional product indices	Per capita gross regional product indices (preceding year=10,000)	
Consumer price	Consumer price index (preceding year=10,000)	China Statistical Yearbook
Demographic variables		
Total population	Total population per province (1 billion persons)	
Population density	Population density of urban area (100,000 persons/sq.km)	

Descriptive statistics for all the variables are displayed in Table 2. We also examine the variance inflation factor (VIF) of these variables. The average value of VIF in the two model specifications is well below the acceptable level of 10 (Neter, Wasserman, & Kutner, 1985), indicating that there is no misspecification caused by multicollinearity.

Table 2. Descriptive statistics, 2011-2014

Variables	Mean	SD	Min	Max
SEs breadth	0.0631	0.0516	0.00860	0.257
SOEs breadth	0.0138	0.0195	0	0.0931
HKMCTWEs breadth	0.0169	0.0301	0	0.147
SEs depth	-0.1977	0.6039	-3.7656	0.4796
SOEs depth	0.0423	0.0315	-0.0093	0.1517
HKMCTWEs depth	0.0656	0.1542	-0.0189	1.4800
Human capital	0.0092	0.0051	0.0018	0.0324
Universities	0.0204	0.0066	0.0118	0.0431
Education exp	0.0017	0.0006	0.0008	0.0045
R&D exp	0.0510	0.0494	0.0005	0.2128
Avg. R&D exp size	0.0003	0.0001	0.0001	0.0006
Patents	0.0711	0.0884	0.0039	0.3680
Internet users	0.4373	0.1213	0.2421	0.7496
Fund	0.0420	0.0309	0.0054	0.1473
Avg. fund size	0.0686	0.0139	0.0062	0.1187
Total income	0.0258	0.0070	0.0163	0.0489
Gross regional product indices	1.1798	0.0560	1.0380	1.3177
Consumer price	1.0610	0.0149	1.0376	1.1000

[1] This report is compiled by the Chinese Group of Science and Technology for Development and Center of Innovation and Entrepreneurship of University of Chinese Academy of Sciences from 2001 to 2015.

Total population	0.0436	0.0275	0.0030	0.1072
Population density	0.0280	0.0122	0.0052	0.0582

Empirical Findings

Factors affect the breadth and depth of high-tech SEs are presented in Table 3. In order to check the robustness of the findings, we ran certain tests before interpreting the regression results. The first is the Pesaran's test of cross sectional independence. It is used to test whether the residuals are correlated across units (De Hoyos & Sarafidis, 2006). Both Model 1 and Model 2 do not have the cross-sectional dependence problem. The second test is the modified Wald test for groupwise heteroscedasticity. The two models reject the null hypotheses of homoscedasticity and conclude that there is heteroscedasticity in our panel. Third, serial correlation in panel data is checked through Wooldrige test for autocorrelation. The two models have first-order autocorrelation under the conventional significance level. In sum, Model 1 and Model 2 show that heteroscedasticity and first-order autocorrelation are present across panels. Thus, Prais-Winsten regression with PCSE is adopted to correct the above problems and to provide significant and not biased results. In these two models, the parameters of the Wald chi-square test are highly significant and the overall goodness of fit for the models is 0.62 and 0.45, respectively.

Table 3. Factors affect the breadth and depth of high-tech SEs: Prais-Winsten regression with panel-corrected standard errors, 2011-2014

Variables	Dependent variable: SEs breadth (1)	Dependent variable: SEs depth (2)
SOEs breadth	-0.472	
	(0.385)	
HKMCTWEs breadth	-0.643***	
	(0.211)	
SOEs depth		-0.872
		(1.605)
HKMCTWEs depth		-0.748***
		(0.0879)

Human capital	0.848	-5.424
	(0.964)	(19.08)
Universities	1.900**	21.50
	(0.927)	(17.95)
Education exp	1.018	112.3
	(4.259)	(88.06)
R&D exp	0.138	-9.703***
	(0.164)	(2.660)
Avg. R&D exp size	4.403	599.1*
	(26.24)	(331.1)
Patents	0.420***	3.178**
	(0.0989)	(1.428)
Internet users	0.0436	-1.691
	(0.0477)	(1.504)
Fund	-0.133	-4.103*
	(0.100)	(2.486)
Avg. fund size	0.387***	5.584*
	(0.126)	(3.129)
Total income	-0.829	3.772
	(0.919)	(31.20)
Gross regional product indices	0.111**	2.76**
	(0.000446)	(0.0117)
Consumer price	-0.293**	-7.03*
	(0.00130)	(0.0381)
Total population	0.683***	0.695
	(0.165)	(4.506)
Population density	-0.332*	-3.974
	(0.191)	(3.261)
Constant	0.134	4.129
	(0.0992)	(3.070)
R-squared	0.617	0.450
Pesaran's test of cross sectional independence (P-value)	0.4372	0.8240
Modified Wald test for heteroscedasticity (P-value)	0.0000	0.0000
AR(1) test (P-value)	0.0000	0.0008
Number of Provinces	31	31
Observations	124	124

Note: Panel-corrected standard errors in parentheses, *** p<0.01; ** p<0.05; * p<0.1.

Part of variables in the high-tech SEs breadth model are statistically significant and have expected signs, consistent with the findings of RIS and EE. However, the SOEs breadth has a negative sign but is insignificant. The HKMCTWEs breadth is significant at the 1% level and also takes a negative value, which proves the competition effect of the HKMCTWEs breadth on the SEs breadth. Besides, the number of universities, patent applications granted, gross regional product and total population are significantly positively correlated with SEs breadth. Interestingly, only the average amount of the National High-Tech SMEs Innovative Fund per project is positively significant, indicating that the average innovative fund amount, not the total fund expenditure, matters. In addition, the consumer price and population density have negative signs. In other words, SEs tend to locate in the provinces which have a lower level of urbanization. While the expenditure on education and R&D turns out to be insignificant.

In addition to the high-tech SEs breadth model, an alternative specification based on the depth is also estimated. Similar to the effect of SOEs and HKMCTWEs breadth on the SEs breadth, there shows no relationship between the SOEs depth and SEs depth and the depth of HKMCTWEs is negatively related to that of SEs. Furthermore, given the total expenditure on R&D, the average R&D expenditure per project is positively correlated with the SEs depth; given the average amount of R&D expenditure per project, the total expenditure on R&D is negatively correlated with the SEs depth. In terms of the National High-Tech SMEs Innovative Fund, it shares the same trend with the expenditure on R&D. Given the total amount of the innovative fund, the larger fund amount per project, the higher SEs profits; given the average amount of the fund per project, increasing the total amount of the fund is likely to yield lower SEs profits. And only the number of patent applications granted as well as gross regional product are significantly positively correlated with SEs depth. The consumer price also has a negative effect on the depth of SEs.

To sum up, no matter based on the breadth or depth, there seems no relationship between high-tech SOEs and SEs, while HKMCTWEs are negatively related to SEs. Although the expenditure on R&D does not contribute to the breadth of SEs, the total expenditure on R&D and the average R&D expenditure per project have opposite effect on SEs depth. The average amount of the National High-Tech SMEs Innovative Fund per project is positively correlated with both breadth and depth of SEs, however, the total amount of the fund has a negative influence on SEs depth if the average size of the fund is controlled. The number of patent applications granted and gross regional product have a positive effect on both breadth and depth of SEs. And the negative signs of the consumer price in both models suggest that high-tech SEs, particularly profitable ones, are likely to locate where has the lower living cost. Additionally, only the number of universities show a positive effect on the SEs breadth, other traditional factors which are thought to be beneficial for the breadth as well as depth of SEs, like the human capital and expenditure on education, are proved to make no difference.

Conclusions and policy options

This paper intends to examine the current well-being of high-tech SEs in China and explore conditions conducive to them. A Prais-Winsten estimation with PCSE is calibrated for all 31 Chinese provinces and for the period of 2011-2014. It is shown that there is no evidence suggesting positive spillovers from high-tech SOEs to SEs. However, competition does exist between high-tech SEs and HKMCTWEs in both breadth and depth, indicating that there needs to be a policy trade-off between MEI and FDI. In addition, for the factors that affect the breadth and depth of high-tech SEs, we obtain some interesting findings. With respect to the innovative investment, such as R&D expenditure and innovative fund, it is the average amount per project, not the total expenditure matters. Also, as the human capital and education expenditure turn out to be not statistically significant, it may suggest that the "universal" policy does not work well for innovation and entrepreneurship. It is probably a less effective strategy due to its diminishing variations across provinces in China. Furthermore, it presents that the level of urbanization is negatively related to high-tech SEs breadth and depth. SEs tend to locate where has a lower level of population density and living cost.

There are some contributions and limitations of this paper. A major strength of the study is that we take the profitability of high-tech firms into account. Based on not only the breadth of the firms but also the depth of this firms, we discuss the relations among the major players in the network as well as the factor affecting their establishments and profits. Another strength is the separation of small and medium-sized high-tech firms. There is much work concentrates on the SMEs rather than the SEs. Moreover, we provide the new policy directions for MEI in China. Despite these strengths, our study has several limitations which point to the future directions. First, the data used in this study is from 2011 to 2014, which is right before the MEI strategy was proposed. Time period extension could be considered to allow for the comparison of the states before and after the implementation of MEI and evaluation of its effects. Second, future study can compare the high-tech industry with other sectors to see the relationships among the major actors. Third, besides the high-tech HKMCTWEs, other FDI could be included.

Each of the findings in this paper has implications for policy. First of all, since knowledge spillovers are a major and effective mechanism between large enterprises and small business in the developed countries, we need to strengthen the spillovers from high-tech SOEs to SEs in China. Besides, as the MEI and FDI are not compatible with each other due to the competition, policy trade-off and priority need to be considered. There may be some paradigm changes in economic growth strategy. The choice between "sprinkling of pepper" and targeted support towards high-tech SEs is also important, particularly with limited resources. In addition to the general and basic R&D support, funding on innovation in SEs also turns out to be an efficient strategy for entrepreneurship and innovation.

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