The impact of state shares on corporate innovation strategy and performance in China

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Abstract This paper examines the impact of state shares on corporate innovation strategy and performance in the People's Republic of China (PRC). Through an investigation of 541 publicly traded companies in five high-tech industries during the period between 2000 and 2005, we find that the presence of state shares have a positive effect on the corporate choice of a process innovation strategy over a product innovation one. However, this relationship is moderated by the overall ownership concentration ratio. Moreover, our findings suggest that companies with large state shares prefer to conduct innovations independently rather than collaboratively with others, and they usually achieve better innovation performance. These findings indicate that the government play a role as both an investor and a resource allocation coordinator and therefore complicate the relationship between ownership structure and corporate innovation activities.

Keywords State shares · Innovation types · Innovation modes · Innovation performance

Recently there has been a surge of studies on the relationship between ownership structure and innovation strategy of a firm (Lee, 2005; Fulghieri & Sevilir, 2003; Ortega-Argilés, Moreno, & Caralt, 2005). For instance, state-owned enterprises

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(SOEs) present a distinctive behavior in the development of new products and their choice of innovation activities (Li, Sun, & Liu, 2006). A study of how state ownership influences a corporate innovation strategy is particularly important to transition economies, such as China, which embarks on a reform program to enhance the performance of state assets (Child, 1994; Delios, Wu, & Zhou, 2006; Peng, 2003, 2004; Peng & Heath, 1996). One reform policy is to introduce private investors and listing companies in a stock market (Li et al., 2006; Ma, Yao, & Xi, 2006). In China, where the state remains in control of resources, publicly traded companies with large state shares have the advantage of obtaining critical resources, such as capital, land and technology. At the same time, companies with large state shares may also experience direct or indirect interventions of the government which tend to influence corporate strategic decisions (Durand & Vargas, 2003; Eisenmann, 2002; Ma et al., 2006).

Thus, in shareholding companies with state dominant ownership, corporate strategy can be shaped and influenced by the state shareholders. Previous studies note that the firm controlled by such concentrated ownership structure may be less active in innovation than others since the dominant owner pays the full cost of innovation but only gains a part of the return from the firm's innovation (La Porta, Lopez-de-Salinas, & Shleifer, 1999; Morck, Stangeland, & Yeung, 2000; Morck & Yeung, 2003).

Innovation, as an important firm strategy, is the key activity that contributes to building core competitive advantage. Corporate innovations are generally categorized into two types: product innovation versus process innovation (Schilling, 2005; Utterback & Abernathy, 1975). The former focuses on the development of new products or modification of existing products in order to meet the demand of customers or markets. The latter concerns the investment in facilities in order to enhance or upgrade production capacities through an introduction of new technologies. Corporate innovation activities can also be categorized into two different modes: One that is undertaken by a given firm itself as an internal or independent innovation, and one that is jointly invested by the firm and others as cooperation for an innovation project (Hoskisson & Busenitz, 2002).

There remain a few important questions to answer regarding Chinese publicly traded companies which have a mixed ownership structure with state shares and private shares: What is the influence of state shares on a firm's choice of innovation strategies? What types of innovations do they prefer? Do these companies invest in innovation independently or cooperate with others to share the costs and risks?

The purpose of this paper is to answer these important but underexplored research questions. We examine the relationship between the ownership structure and corporate innovation strategy in terms of a choice of investments in development of products or production facilities. We further study whether the dominance of state shares in publicly traded companies influence a firm's selection of a mode of innovation, i.e., to innovate independently or jointly with others. Our overall research model is shown in Figure 1. Next we develop our hypotheses in detail.

The impact of state shares on a firm's choice of innovation types

Corporate strategies involving innovations are regarded as one of the mostly important factors affecting a firm's long-term development. In general, corporate
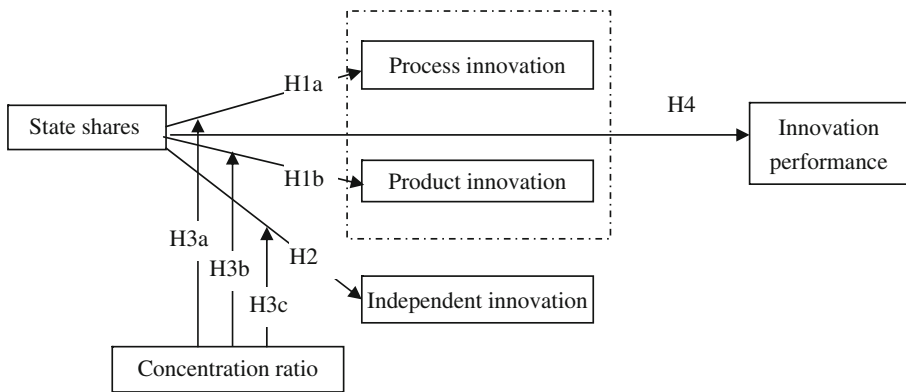
Figure 1 Our research model

innovations can be categorized into two types: (1) product innovations that require a company to assimilate customer need patterns, design, and manufacture the product accordingly; and (2) process innovations that require companies to apply technology to improve the efficiency of product development and commercialization (Ettlie, Bridgis, & O'Keefe, 1984). These two types of innovations are used to serve different strategic objectives. Product innovations are motivated by the desire to increase market share, increase customer loyalty, and develop a competitive edge ahead of market rivals. Process innovations are applied when a firm tends to increase the economies of scale for the purpose of minimizing costs, or when a corporate existing business is in the growth stage of a product life cycle (Damanpour & Gopalakrishnan, 2001).

Ownership is a topic that has long been of interest to scholars in social sciences. Ownership gives an investor—an individual or collective body that invests in a given asset—the legitimate rights to claim the returns from its investment as well as the power to monitor and control the management of the asset (Demsetz, 1988). In modern corporations, whereas ownership is concentrated with one or a handful of large shareholders, the dominant shareholder could exert significant power to control the corporate strategic decisions (Hitt, Hoskisson, & Kim, 1997).

How does a large concentration of state shares influence corporate innovation choices? State shareholders represent the state ownership and behave differently from institutional investors in two aspects. First, since the government plays multi-faceted roles in policy making and regulatory administration over other organizations, the state shareholders' expectations on the firms they have invested in go beyond the claim for the residual rights of the return on investment and extend to the achievement of political objectives and/or fulfillment of social and public obligations. For instance, Martinelli (1981) found that SOEs could build plants in unattractive regions for considerations of employment or regional economic development rather than the firm's performance. Second, in China, the state shares are generally not traded in a stock market. The state shareholders control a publicly traded company for strategic objectives, such as to retain the state monopoly in a pillar industry, in addition to profitability goals. As a result, the state shareholders regard the growth of state assets as a primary requirement on a firm's performance.

Aoki and Qian (1995) argue that a decentralization program in China's economic reform delegates decision autonomies to managers in SOEs and thus eventually forces managers to take control of corporate strategic decisions. One consequence is that managers tend to maximize their own personal interests and therefore undertake investments in innovation projects for measurable short-term revenue rather than for long term development (Aoki & Qian, 1995; Baysinger, Kosnik, & Turk, 1991). This means that managers in SOEs are more likely to pursue the maximization of the investments in production assets. Indeed, as a classical theory of the socialist economy points out, under soft budget constraints, SOEs are characterized by "investment hunger" and therefore pursue investments in production innovation rather than to take the risk on product innovation (Kornai, 1980). Such "investment hunger" remains a characteristic in Chinese SOEs during the reform period, particularly after the firm's performance is measured by a growth of state assets (Meyer & Lu, 2005; Lu & Yao, 2006; Nee, 1992). As a result, a process innovation project is favored specifically in companies where state shares have a majority control over management.

Furthermore, according to a study in knowledge management, process innovations are preferred by the companies that expand upon the existing knowledge base (Mahmood & Rufin, 2005). This assumes that process innovations have fewer demands on original and creative knowledge but rely more upon general and ordinary resources and infrastructure. By contrast, product innovations require substantial new knowledge and bear greater risks (Cohen & Levinthal, 1990). Since a majority of state shareholders comes from traditional planning authorities or government agencies, the support and favorable conditions given by the state shareholders are likely common factors and general knowledge. Thus, the companies with dominant state ownership may lack absorptive capacity to build new innovational knowledge because they are "locked out"[1] (Cohen & Levinthal, 1990) by knowledge necessary for product innovations. Therefore:

Hypothesis 1a   The greater the state shares in ownership structure, the more likely the firm adopts process innovations.
Hypothesis 1b   The greater sate shares in ownership structure, the less likely the firm adopts product innovations.

State shares and mode of innovation

If, as discussed above, companies with dominant state ownership enjoy advantages of resources given by the government support (Yiu, Bruton, & Lu, 2005), what mode of innovations will they adopt? There are two modes of innovation activities. One is when a firm invests in innovations by itself and is therefore called

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[1] Cohen and Levinthal (1990) explain "lockout" that "If the firm does not develop its absorptive capacity in some initial period, then its beliefs about the technological opportunities present in a given field will tend not to change over time because the firm may not be aware of the significance of signals that would otherwise revise its expectations. As a result, the firm does not invest in absorptive capacity and, when new opportunities subsequently emerge, the firm may not appreciate them."

"independent innovation". This is like an internal investment and will give the firm total control over an investment project. The other refers to collaboration with others to have a joint investment in an innovation project. This is called "cooperative innovation" in which partners share resources and costs. A number of scholars suggest that firms in a transition economy, such as China, adopt network-based strategies for development since traditional networks and linkages to the state still control the resource allocation and transaction activities (Guthrie, 1997; Keister, 1998; Peng, 2003; Tsang, 1996; Xin & Pearce, 1996). These studies contribute greatly to our understanding of firm behavior in transition economies under the circumstance where resources are coordinated by government agencies inherited from traditional planning authorities.

Now, the question is whether firms supported by favorable conditions of the state would like to share their resources with others in innovation activities. The literature on strategic partnership has noted that a major driver behind a corporate motivation to engage in collaboration is for resource complementarity and cost/risk sharing (Harrigan, 1988). For Chinese SOEs, the remaining soft budget constraints may reduce the manager's motivations avoiding risks, or the government may give more protection to the enterprises against risks caused by investment in a specific market, such as one with a state monopoly (Lunn, 1985).

Moreover, as managers seek growth in assets, they may be less willing to share resources with others in innovation activities (Lu, 1996; Yiu et al, 2005). For instance, in China, the large and mid-sized SOEs received RMB 4.54 billion of R&D funds from the government in 2005 alone, 28.6% more than 2004,[2] and 26.3% of total R&D expense came directly from government sources.[3] Whereas these enterprises enjoyed their distinctive linkages to the government allocation of resources, they are assumed to be less motivated to share this advantage with others. Finally, compared to the cooperation with others in which the partners share the residual revenue from joint investments, large state shareholders may prefer independent innovations because they could claim the whole or majority of the return on investment. Therefore:

Hypothesis 2 The dominance of state shares is positively correlated to a firm's choice of independent innovation.

Moderating effects of a concentration ratio of ownership in innovation types and modes

In modern shareholding companies, shareholders' control over management is determined by their proportion of stocks among the overall ownership. In Chinese

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[2] The State Census Bureau, "The R&D Funds for mid- and large industrial companies stride to billions" http://www.sts.org.cn/tjbg/dzxqy/documents/2006/060824.htm

[3] "A comparative Study of the R&D Expenditure" from Major Science and Technology Index, http://www.sts.org.cn/tjbg/zhqk/documents/2006/061116.htm#_ftn1

publicly traded companies, in addition to the state shareholders, there are a substantial number of institutional and common investors. These investors pay more attention to firm performance and therefore to some extent become the counterweights to the state shareholders. A previous study in the USA noted a positive relationship between stock concentration and R&D investment (Hansen & Hill, 1991). This can be understood as large shareholders claim the residual rights of the revenue generated from innovations and therefore managers are required by the large shareholders to invest in R&D activities. As Hill and Snell (1989) hypothesize, the larger and more the ownership concentrates, the more the company tends to invest in R&D. In other words, the higher the ownership concentration ratio is, the stronger the company's motivation for innovation (Holderness & Sheehan, 1988; Shleifer & Vishny, 1986; McEachern & Romeo, 1978).

Following this logic, we assume that the large shareholders other than the state in a publicly traded company may prefer more investments in product innovation because it will increase product variety, develop new markets, and enable the company to obtain competitive advantage by differentiating itself from rivals. Product innovation is crucial to long-term corporate development (Hansen & Hill, 1991; Wolff & Pett, 2006). In this case, large shareholders moderate the impact of the state shares in the selection of an innovation type. In other words, companies with a concentration of stock ownership will favor product innovation, while holding back on process innovation, which is preferred by the state shareholders.

Will large shareholders other than the state prefer independent or cooperative innovation? Large shareholders may follow the decision of the state shareholder and follow an independent innovation approach because an internal investment in innovation protects their residual rights to claim the revenue generated from the innovation project. Hence:

Hypothesis 3a   The concentration ratio of stock ownership has a negative moderating effect on the relationship between the state shares and process innovations.
Hypothesis 3b   The concentration ratio of the stock ownership has a positive moderating effect on the relationship between the state shares and product innovations.
Hypothesis 3c   The concentration ratio of the stock ownership has a positive moderating effect on the relationship between the state shares and independent innovations.

The impact of state shares on innovation performance

What are the effects of state shares on the performance of corporate innovations? Do companies with dominant state ownership have more productive R&D investments? A previous study of Chinese firms notes that large Chinese companies with state ownership have better performance due to the support and resources allocated by the government (Yiu et al., 2005). This relationship may be valid, too, in the relationship between state shares and innovations. As we have hypothesized before, if companies with dominant state shares invested more in process innovation and their businesses are at the same time protected by the state monopoly in respective markets, they may achieve better performance.

Moreover, as previous hypotheses on the choice of innovation modes have suggested, companies with high state shares concentration are assumed to prefer independent innovations. These independent innovations enable the state owners to claim the revenue generated from the innovation activities. We then have the following hypothesis:

**Hypothesis 4**   The concentration of state shares has a positive effect on innovation performance.

Methodology

Sample and data collection

Our sample come from Chinese publicly traded companies traded in Shanghai and Shenzhen stock markets. Following the definition of high-tech industries by Chinese government policy (High-Tech Industry Development Bureau of State Development and Planning Commission, 2001), we select publicly traded companies from five industries: chemicals, pharmaceuticals, mechanical, communications and electronics. Eventually, a total of 541 companies are chosen as our sample.

In China's stock markets, publicly traded companies, according to the regulations issue by the China Securities Regulatory Commission, are required to disclose 'strategic issues' in annual reports. These strategic issues include mergers and acquisitions, formation of joint ventures, and investments in technological areas and new product developments. We first scan all annual reports of the sampled companies during 2000 to 2005 and then extract each strategic issue that concerns an innovation activity as an event observed. Finally, we collect a total of 8,553 innovation events as observations from the sampled companies. Figure 2 depicts a number of innovation activities in the sampled companies between 2000 and 2005. Overall, the number of innovation activities increase over the observation period. Our next task is to develop constructs in order to test hypotheses.

Figure 2 The number of innovation activities in Chinese publicly traded companies during 2000 to 2005
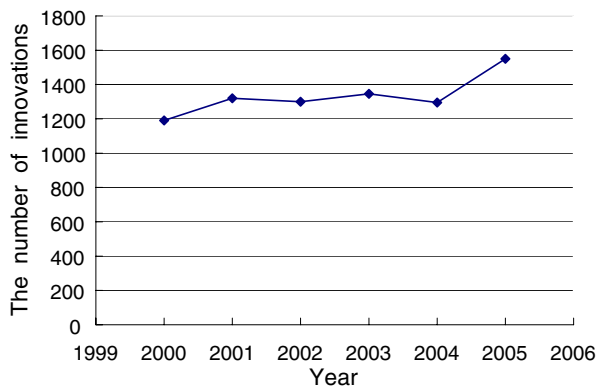
Measures

Dependent variables According to the hypotheses, there are three sets of dependent variables:

* *Types of innovations*: Publicly traded companies disclose all investments in *product innovation* and *process innovations* in their annual reports. We introduce two separate dummy variables to distinguish them: The first is used to measure the investment activities concerning process innovations (process innovation=1, others=0); the second is relevant to product innovations (product innovation=1, others=0).
* *Innovation mode (IM)*: We have classified modes of innovation into two types: *independent innovation* when a sample company invests in an innovation project alone and has the whole ownership of the project; and *cooperating innovation*, when a sample company invests in an innovation project jointly with other companies which could be suppliers, customers, universities, research institutes, etc. This information can be identified in a company's annual report, too. We introduce a dummy variable to measure a company's choice of innovation mode: independent innovation=1; cooperative innovation=0.
* *Innovation performance*: Innovation performance in this study is defined as the value created by an investment in a specific innovation project. It is measured by the revenue generated from the project. This type of data can be found from a company's annual report. According to the regulations of the China Securities Regulatory Commission, firms are required to disclose to the public total costs for an investment project and revenue generated during the first three years after the project is completed. We use the log value of the revenue (or loss) reported on an investment project as an indicator of innovation performance.

Independent variables According to our research model, as presented in Figure 2, there are two sets of independent variables: (1) the concentration of state shares, which is measured by the ratio of the state shares (RS) to total shares; and (2) the concentration ratio of stock ownership (CR), which is measured by the percentage of the top ten largest shareholders' equity to a company's total equity.

* *The ratio of state shares (RS)*: We measure state shares according to a percentage of state shares to the total equity in a given sample company;
* *Concentration Ratio (CR)*: This is measured by the percentage of the top ten largest stockholders' equity to a company's total equity.

Control variables We also introduce a number of control variables at the firm and industry levels. At the firm level, the control variable is the *firm size* which is measured by the log value of main business revenue in the year when an innovation project is invested. At the industry level, we control the effects of industry variances. Four dummy variables are used to distinguish these five industries in terms of (1) pharmaceuticals; (2) chemicals; (3) electronics; (4) mechanical; and (5) information technology.

Results

Table 1 exhibits the correlations matrix. Note that there is little evidence of multicollinearity problem.

We then apply a discrete-time event history technique (Allison, 1984; Yamaguchi, 1991) and use two methods to test hypotheses. The first is to deploy a logistic model of dichotomous outcomes for pooled time-series data in which the same units are observed at multiple intervals. This method is used to test the hypotheses concerning the effects of state shares on a sample company's choice of innovation type and innovation mode. Then, we use an ordinary least squares (OLS) regressions of variables to test the influence of state shares and moderating effect of independent innovation mode on innovation performance.

Table 2 exhibits the results of testing the first six hypotheses from H1a to H3c. These hypotheses concern the relationship between state shares, a firm's choice of innovation types, innovation modes, and the moderating effect of the concentration ratio of stock ownership on the above relationships.

Model 1 tests Hypothesis 1a, which assumes that the state shares contribute positively to a firm's choice of process innovation. Table 2 illustrates significant results showing a positive relationship between the presence of state shares and process innovation. This result is consistent with the findings of Mahmood and Rufin (2005). Therefore, Hypothesis 1a is supported.

Model 3 tests Hypothesis 1b that suggests that the state shares have a negative relationship with a firm's choice of product innovation. The relationship between the two variables is indeed negative as illustrated by significant results. Thus, Hypothesis 1b is supported.

Model 5 in Table 2 tests Hypothesis 2 on the relationship between state shares and independent innovations. We find that state shares have a significantly positive impact on a firm's decision to invest in innovations independently. Thus, Hypothesis 2 is supported.

In order to examine the moderating effects of the concentration ratio of stock ownership on the relationship between state shares, innovation types and innovation modes, which have been assumed by three hypotheses of Hypothesis 3a, Hypothesis 3b, and Hypothesis 3c, we introduce an interaction variable: RS×CR, i.e. the ratio of state shares×concentration ratio. Models 2, 4 and 6 test these hypotheses. Only Hypothesis 3b receives support, confirming that the large shareholders balance the state shareholders' negative relationship to product innovations. Hypothesis 3a received no support while Hypothesis 3c has only weak support. Thus, Hypothesis 3a should be rejected while Hypothesis 3c is only partially supported.

To illustrate the concentrate ratio's effect on the relationship between state shares and product innovations in Model 3, we plot the interactions of the variables in Figure 3. As Figure 3 shows, state shares indeed have a negative impact on a firm's choice of product innovations, although such an impact is relatively weak (in Model 3, the coefficient=−0.236). However, large shareholders have a relatively strong moderating effect on the choice of product innovation (in Model 4 the coefficient= 0.079). These results suggest that in publicly traded companies with dominant state shares when the concentration ratio of stock ownership increased, firm strategies began to adopt more product innovations.

Table 1 Descriptive statistics and correlations of variables.

	Mean	SD	1	2	3	4	5	6	7	8	9	10
Pharmaceutical	0.19	0.394	—									
Chemicals	0.22	0.412	-0.257**	—								
Electronic	0.06	0.246	-0.128***	-0.139**	—							
Mechanism	0.37	0.482	-0.373***	-0.403***	-0.201**	—						
Firm size: Ln(Sales revenue)	11.377	1.2207	-0.043**	0.016	0.005	0.019	—					
Innovation mode (IM)	0.81	0.393	-0.114***	0.072***	0.094***	-0.028***	0.067**	—				
Process innovation	0.51	0.500	-0.110***	0.060**	0.026*	-0.036***	0.024*	-0.022*	—			
Product innovation	0.21	0.407	0.091***	0.015	-0.027*	0.029***	0.051**	0.207**	-0.527**	—		
Ratio of state share (RS)	0.3007	0.2697	-0.011	0.092***	-0.039**	0.049***	0.107***	0.075***	-0.045**	0.075**	—	
Concentration ratio (CR)	0.6176	0.1247	0.012	0.055***	-0.009	0.051**	0.081**	0.085***	-0.016	0.085***	0.256**	—
Innovation performance: Ln (return on investment)	6.3317	2.1011	-0.070*	-0.068*	0.027	0.139***	0.191**	0.230**	0.082**	0.080*	0.094**	0.047

N=8,553
*$p<0.1$ (two-tail tests)
**$p<0.05$ (two-tail tests)
***$p<0.01$ (two-tail tests)

Table 2 Results of logistic regression analysis.

Variables	Model 1 Process innovations	Model 2	Model 3 Product innovations	Model 4	Model 5 Innovation Mode (IM)	Model 6
Constant	-4.345^{***}	-4.401^{***}	-0.107	-0.014	-0.792^{**}	-0.844^{**}
Control variables						
Firm size: Ln (sales turnover)	0.082^{***}	0.084^{***}	0.067^{***}	0.063^{***}	0.118^{***}	0.12^{***}
Pharmaceutical	1.543^{***}	1.532^{***}	-0.913^{***}	-0.893^{***}	-0.708^{***}	-0.731^{***}
Chemicals	1.207^{***}	1.209^{***}	-0.255^{***}	-0.255^{***}	0.073	0.069
Electronics	0.805^{***}	0.803^{***}	-0.2^{*}	-0.195^{**}	1.749^{***}	1.744^{***}
Mechanism	1.19^{***}	1.185^{***}	-0.523^{***}	-0.512^{***}	-0.383^{***}	-0.396^{***}
Independent variables						
Ratio of state shares (RS)	0.336^{***}	0.359^{***}	-0.236^{***}	-0.267^{***}	0.525^{***}	0.54^{***}
Concentration ratio(CR)	1.331^{***}	1.46^{***}	-0.136	-0.342	1.467^{***}	1.666^{***}
Interactions RS×CR		-0.42		0.079^{**}		-0.087^{*}
Wald χ^2	288.711^{***}	289.579^{***}	185.542^{***}	189.982^{***}	321.023^{***}	324.185^{***}
Log-likelihood	$7{,}146.397$	$7{,}145.529$	$9{,}978.171$	$9{,}973.731$	$7{,}147.4$	$7{,}144.238$

$N=8{,}553$
$^*p<0.1$ (two-tail tests)
$^{**}p<0.05$ (two-tail tests)
$^{***}p<0.01$ (two-tail tests)

Next, we examine the influence of state shares on innovation performance and the extent to which an independent innovation moderates such a relationship. The results of the analyses are shown in Table 3.

Model 7 tests Hypothesis 4a. As Table 3 shows, state shares have a positive influence on innovation performance. Thus, Hypothesis 4a is supported.

Discussion

Contributions

The purpose of this study is to examine the impact of state shares on a firm's choice of innovation strategies. Seven hypotheses are developed and tested. Our findings have three important contributions for the theoretical development on the relationship between state ownership and corporate innovation strategy (Li & Peng, 2008). First, the state shareholders are not merely playing a residual role as normal

Figure 3 The moderating effects of the concentration ratio on types of innovation in companies with state shares
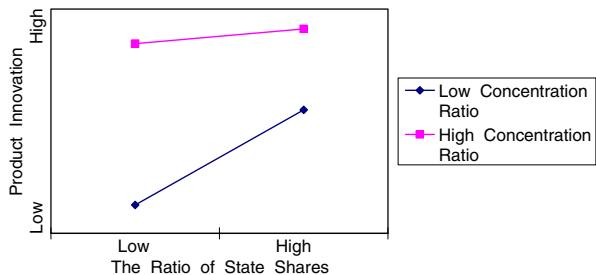
Table 3 Results of regression.

Variables	Model 7 Innovation performance Ln (return on investment in innovations)
Constant	0.318
Control variables	
Ln (Sales turnover)	0.422***
Electronics	0.476
Mechanism	0.574***
pharmaceutical	−0.022
Chemicals	−0.16
Independent variables	
Ratio of State Shares (RS)	0.182***
R^2	0.071
ΔR^2	0.065
F	11.5***
df	913

*$p<0.1$ (two-tail tests)
**$p<0.05$ (two-tail tests)
***$p<0.01$ (two-tail tests)

investors that expect economic returns (Petrotti, 2004). The companies controlled by state shares are more interested in investments in process innovations rather than product innovation even though the latter might contribute more to the firm's overall economic performance. An important motive driving the state shareholders to pursue process innovations is to achieve a rapid growth of state assets. Consistent with the findings of Guthrie (1997), Keister (1998), and Nee (1992), our research notes that state ownership inherited from previous planning authorities still continues to impose multiple functions and obligations on the companies under its control, despite the progress of China's economic reform in transforming SOEs into public shareholding companies.

Second, large investors emerged as important counterweights to more or less balance the state shareholders' power over corporate innovation strategy. As our findings indicate, while the state shareholders may tend to maximize assets, other investors place more pressure on management to develop products in order to achieve better performance. The coexistence of the state ownership and other investors in publicly traded companies leads to principal-principal conflicts between state shareholders and other shareholders (see Young, Peng, Ahlstrom, Bruton, & Jiang, 2008). A crucial question to China is how to design and develop effective corporate governance mechanisms in publicly traded companies dominated by state shares.

Third, our study suggests that companies with a large concentration of state shares achieved better innovation performance due to their advantage of obtaining critical resources through the linkage to state ownership. China's reform of state-owned assets is not done through large-scale privatization but an introduction of investors as partners to disperse the concentration of state ownership. As Meyer and Lu (2005) observe, these reform measures indeed enhance the performance of some firms, particularly certain large business groups. The performance improvement of state assets seems to further drive the government to retain its control over pillar industries.[4] The question is whether the companies with large state shares could

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[4] For instance, on December 18, 2006, China's State-Owned Assets Supervision and Administration Commission of the State Council announced that the state assets shall dominate in seven pillar industries, though large SOEs in these industries shall be traded in stock markets.

sustain their competitive advantage in resource allocation if the progress of China's reform overall improves the market conditions, particularly the factors market through which private and foreign firms could obtain crucial strategic factor resources, such as capital, information, and personnel.

Our study implies that the change in the state's role from a central planner to an investor in the transition economy like China is constrained by both the traditions of the country's history of a planning economy and the multiple functions of the state. The traditional administrative control by planning authorities might be diminished after the state ownership has been transformed into state shares while non-state investors are introduced. However, the multiple functions of the state still remain powerful to influence a firm's strategic management if the firm has dominant state shares. In this case, the firm is only partially oriented by market rules. As our research indicates, innovations are driven by investments in production assets rather than in new product development, although the latter might help companies enhance competitive advantages in the midst of market competition.

Limitations and future research directions

This research has numerous limitations. First, it relies upon archival data from which we are unable to detect managerial perspectives and motivations in the selection of an innovation strategy. Second, our study only focuses on five industries. The findings may not be generalizable to other industries since there are greater variances of innovation activities across industries. Third, we also need to examine the long-term effect of ownership structure on both innovation performance and the company's overall performance.

This study suggests opportunities for future research. One stream of research is to focus on alternative measures of innovations, perhaps by looking at innovations in strategic management, such as divestures or spin-off's, which, as corporate entrepreneurial activities, are equally important, as technological innovation, to companies. Another recommended research direction is to look at the stock price fluctuations in response to a company's announcements of innovation events. For instance, we can measure responses of investors on company announcement of product innovation versus investments in production assets. Such a study might let us better understand the interactions between other investors and state shareholders and how the former influence a company's strategic decision making in innovation.

Moreover, longitudinal research is needed. As innovations have a long-term influence on corporate capabilities, a longitudinal comparison of companies with different ownership structures and innovation strategies will provide an insight into the relationship between ownership structure, innovation and performance. Specifically, we suggest looking at the change in a company's innovations when it engages in the reform of state shares.

Finally, we suggest comparative studies across different transition economies in this area, since it is valuable for us to understand how different institutional environments shape or constrain large stockholders in corporate innovation activities.

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