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State Ownership and Innovations:

Lessons from the Mixed-Ownership Reforms of China's Listed Companies

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Abstract

Mixed-ownership reforms have been the mainstay of reforming China's state-owned enterprises (SOEs) in recent years. In relation to the broader context of the continuous slowdown in economic growth under the New Normal, the reshaping of the innovative capacity of SOEs has been widely considered to be of systemic importance. Yet, in the relevant literature, the effects of mixed-ownership reforms on innovations have remained unclear. This paper seeks to contribute to the literature by means of studying such effects for China's listed companies in the period 2007-2018, from the theoretical perspective of organizational controls in innovative firms. Our study finds that SOEs tend to be more innovative than non-SOEs, and increases in state shareholding do raise the innovative capacity of mixed-ownership enterprises. Further analyses reveal that, for mixed-ownership enterprises, the lower the level of state shareholding the more reliance of innovations on the capability of organizational controls in corporate governance. These findings offer useful policy lessons for China. Additionally, we discuss the contribution of our study to the broader literature at a conceptual level, with an emphasis on the novelty of highlighting the importance of organizational controls in the reform of SOEs.

Keywords: state-owned enterprises, mixed ownership, organizational controls, innovations

JEL Classification: L23, O32, P31

1. Introduction

The Chinese economy has been experiencing a continuous slowdown in its pace of growth since circa 2012, a state of affairs officially labelled the "New Normal". The annual growth rate of per-worker output has decreased to an average of 6.2% in the years 2012-2020, down from the level of 9.7% per annum in the preceding period 2000-2012 (or an average of 8.4% per annum from the beginning of market reform in 1978 until 2012). There is no sign that this downward trend will be reversed in the future. The best that can be hoped for is maintaining "medium-speed" growth of 5-6% per annum, as is evident in state planning over the short, medium and long terms.

Multiple factors have been identified as the causes of the growth slowdown under the New Normal (Lo 2018). The exhaustion of "the advantage of backwardness" is of particular importance. It is well recognized that, over the main part of the reform era, China has largely relied on assimilating and improving upon imported technology as a main engine of productivity growth. Yet, the extraordinary success in technological catching-up with the world advanced levels has largely reduced the scope available for further pursuing productivity growth along this path. Indigenously-generated technological development will be needed for sustaining medium-speed growth in the future.

In this connection, improving the innovative capacity of state-owned enterprises (SOEs) is top on the agenda of the Chinese state leadership's economic planning. It has been stated, repeatedly in official guidelines on reforming SOEs, that "SOEs must play a pivotal role, and serve as models for other enterprises, in the implementation of our innovation-led and industrial-upgrading economic development strategies". This orientation is understandable. To date, SOEs have continued to be in control of the "commanding heights" (strategic and high-tech industries) of the Chinese economy, and this control has tended to strengthen under the New Normal (Naughton 2019). SOEs are also the big business in the economy: in 2018, for instance, of the 115 Chinese firms that entered the rank of the *Fortune Global 500* biggest corporations, 90 were outright SOEs while some of the remainders were mixed-ownership enterprises with different degrees of state shareholding (Lo 2020).

Mixed-ownership reforms can be seen as the culmination of the successive programmes

of reforming China's SOEs in the past four decades. Lin *et al.* (2020) identify five programmes, or five stages, of the reform of SOEs. These, namely, are: the programme of relegating decision-making power from the state to the Soviet-type socialist enterprises in the initial stage of 1978-1984, the programme of granting control rights to the managers of SOEs via contractual arrangements in the second stage of 1984-1992, the programme of separating ownership and control by means of corporatization in the third stage of 1992-2002, the programme of restructuring the ownership administration of SOEs in the fourth stage of 2002-2012, and, finally, the programme of mixed-ownership reforms in the latest stage post-2012. Over these five stages, there is a discernible orientation of progressively making SOEs fully responsible for their profits and losses. This orientation need not be strictly in line with the principle of shareholders'-value maximization, although such principle has been highlighted in the official guidelines on mixed-ownership reforms. In addition to the profitability objective, there is also the emphasis that mixed-ownership reforms are the means for SOEs to become "bigger, stronger, and more efficient".

This paper is purported to investigate one particular aspect of the emphasis noted above. The research questions to be answered are: have mixed-ownership reforms helped to improve the innovative capacity of SOEs, and, by extension, related enterprises? Insomuch as the answer is a conditional "yes", what are the necessary conditions?

These questions are not trivial. They need justification on the theoretical and/or empirical grounds. Theoretical positions broadly in line with neoclassical economics tend to posit that SOEs, due to their deviations from (individualistic) property rights, are intrinsically inefficient. Recent developments of these theoretical positions have centred on the principal-agent paradigm, and the related applied studies have focused on verifying the relationship between degrees of conformity to shareholders'-value maximization and innovations. Contrary to neoclassical economics, a range of alternative theories rather tend to posit that the innovative enterprise necessarily requires collective learning and co-operation, and, as such, organizational controls over decision-makings are more important than market disciplines (Lazonick 2010, 2015). In this light, SOEs have the potential of outperforming private firms in terms of innovative capacity. Meanwhile, in the relevant literature of empirical studies, the comparative economic performance of Chinese SOEs versus non-SOEs has remained an

unsettled issue. It is a subject matter awaiting more definite assessments from systematic studies of the major attributes of SOEs and non-SOEs, including the attribute of innovative capacity (Kroll and Kou 2019; Lo 2020).

China's mixed-ownership reforms entail bi-directional flows of stake-acquiring investment among business firms. SOEs are allowed to acquire the stakes of non-SOEs, and so are the reverse acquisitions. These have resulted in the formation of a wide range of mixed-ownership enterprises. Concerning the acquisition of the stakes of SOEs by non-SOEs, as of 2017 year-end, 69% of the SOEs directly affiliated to the central government had been transformed into some forms of mixed-ownership. The ratio was 56% for provincial-level SOEs (Shen and Yang 2019).

In views of these developments, one appropriate way for systematically studying the outcomes of mixed-ownership reforms is to work on the data of listed companies. This has three distinctive advantages. First, SOEs and non-SOEs within the scope of listed companies are basically comparable, in the sense that issues such as firm sizes, monopolistic powers, and political connections are better controlled for, compared to analysing enterprise census data published by government statistical authorities. Second, compared to the simple dichotomy of SOEs versus private firms, the data of listed companies provide the necessary information for treating state shareholding as a continuous variable. This latter treatment helps to more accurately investigate the outcomes of mixed-ownership reforms. Third, the data of listed companies provide information about the modes of capital assets administration in different companies. This helps to control for the difference between SOEs and non-SOEs in terms of their diverse positions in the production chains and industrial sectors. It is well-known that there exists a discernible pattern of division of labour between SOEs and non-SOEs in Chinese industry: compared to non-SOEs, SOEs tend to be more concentrated in capital-intensive, large-scale, upstream industries.

This paper analyses the effects of mixed-ownership reforms on the innovative capacity of China's listed manufacturing companies in the period 2007-2018. In the light of the relevant theoretical context and empirical background, and seeking to address the research questions raised above, we expect that our study will add new knowledge to the literature in three ways. First, as an alternative to principal-agent studies in the neoclassical tradition, we seek to

verify the importance of state shareholding from the perspective of organizational controls and innovations. It is noted that the literature on organizational controls has been mostly composed of case studies. This paper is possibly the first attempt to apply the theory to large-sample econometric analysis. Second, in terms of research design, we seek to apply econometric models that control for possible interfering factors such as firm size, market power, political connections, and path dependency in China's enterprise reforms. Third, with respect to the selection of statistical indicators, we use the sum total of state shareholdings in the largest three shareholders of the company (rather than the customary practice of selecting the largest state shareholder alone). This selection helps to balance the desire for including all state shareholders, on the one hand, and the consideration that large shareholders typically have more than proportionate decision-making power at the expense of small shareholders, on the other hand.

The organization of the paper is as the following. After the present section of introduction, section two provides a concise summary of the alternative theorical perspectives and relevant previous studies on the topic. On that basis, section three seeks to construct an appropriate research design for this paper. Section four carries out the actual analysis of the relationship between state shareholding and innovations. Section five further analyses the role of organizational controls, as a key factor interacting with state shareholding to determine enterprise innovations. Section six concludes the paper.

2. Theoretical Perspectives and Previous Studies

Worldwide, entering the 2010, the tide has turned from privatization in the previous three decades to a phenomenal growth in SOEs coupled with their rising importance in both developed and developing economies (Bernier *et al.* 2020; Bernier and Reeves 2018; Christiansen 2011; Florio 2014a, 2014b; Leutert and Vortherms 2021). These SOEs are of various degrees of state shareholding, from full state ownership to minority shareholding. They are present not only in sectors of natural monopoly, but also in competitive markets. Some SOEs have served as the agents for carrying out government economic policies, particularly in innovation-intensive industries (Millward 2011, 2013). All these phenomena

call for scholarly research to clarify their significance, both empirically and conceptually.

Corporate investment in innovations necessarily involves uncertainty, intangibility, and information incompleteness and/or asymmetry (Hall and Lerner 2010; Kumar and Langberg 2009; Nelson 1991). In consideration of these attributes, principal-agent studies in the tradition of neoclassical economics contend that SOEs are intrinsically deficient in terms of generating innovations. The basic theory can be summarized as the following. The owner is assigned the role as the principal, and any deviation from the objective of profit maximization is deemed inevitably inefficient. This position is based on the principle of individualistic property rights, which states that, to be efficient, the owner can only be individuals, not collectives (let alone the government) – as otherwise there will be the problem of shirking. For modern business corporations, the owner takes the form of shareholders, profit-maximization becomes shareholder's-value maximization, and shirking becomes problems of the soft budget constraint.

More specifically, concerning SOEs, three reasons have been highlighted to substantiate the contention raised above. First, for lack of sufficient monitoring by the owners, SOEs are more likely than private firms to encounter the problems of shirking and risk-aversion on the part of the on-site management (Bortolotti *et al.* 2019; Boubakri *et al.* 2013). Second, again in comparison with private firms, SOEs are more likely to be subject to government discretionary interferences. As such, soft budget constraints are unavoidable for SOEs (Liang *et al.* 2012; Lin and Tan 1999), which tend to obstruct innovative activities (Huang and Xu 1998; Qian and Xu 1998). Third, the state-owner normally has multiple, conflicting objectives, and this is bound to influence the conduct of SOEs (Kahan and Rock 2011; Shleifer 1998; Wang 2014). Ultimately, in the vision of neoclassical economics, it is the likelihood of SOEs deviating from the principle of individualistic property rights that is deemed to inevitably lead to their underperformance in innovative activities (Heaton 2019; He and Tian 2018).

One possible response to the neoclassical contention is to ascertain how serious the consequences would be for deviating from profit maximization. Megginson *et al.* (1994) submit that, for corporatized SOEs with their shares at least partly tradable in the market, the share prices would reflect their performance. This means the stock market would perform the necessary monitoring and incentive functions with respect to the on-site management of SOEs

(Gupta 2005). Meanwhile, the pressure of competition in the product markets would also help to curtail agency problems, insofar as SOEs do operate in the market (Cao *et al.* 2016). The general point is that, in the same context of the market environment, the difference in terms of agency problems between SOEs and private firms is likely to be at most quantitative and not at all qualitative (Willner and Grönblom 2021).

A second possible response that has emerged more recently is to go beyond the narrow focus on internal governance as singularly the determinant of firm performance. For the study of the efficiency of SOEs, or public enterprises in general, a reasonable framework needs to include and disentangle the effects of both internal and external institutions as well as the interaction between the internal and the external (Castelnovo *et al.* 2020). The quality of government, both in terms of its motivation-capability and the actual measures it applies to SOEs, is crucial in this regard (Bernier 2021; Florio 2014a). Not only can government actions independently affect firm efficiency, but also, through their interactions with the internal institutions of enterprises, they can reshape the latter's nature and efficiency attributes. It is evident that government actions could help to overcome problems of inefficiency with SOEs as identified by the principal-agent theory; potentially, they could even turn the problems into positive attributes, thus turning on the head of the principal-agent theory (van Thiel *et al.* 2021).

Combining the emphasis on both internal and external governance, the theory of organizational controls indeed seeks to turn on the head of the neoclassical principal-agent theory. It contends that the alleged agency cost can be more than compensated for by the conducive effect of state ownership for promoting innovations. This theory, in the tradition of scholars including Alfred Chandler Jr., Edith Penrose, and William Lazonick, highlights the importance of collective learning and co-operation as the main driving force of innovations. Innovations necessarily require the firms commanding a wide range of resources, from both internal and external sources (Choi *et al.* 2011; Pfeffer 1972). In this light, state ownership does have the advantage of helping the firms to secure external resources (Wang *et al.* 2017). Of particular importance in this regard is financial commitments. Not only can the government and state shareholding help to mitigate risks, therefore reducing financial cost, but they also help to prevent the inclination of short-termism on the part of purely private

suppliers of finance (Acharya *et al.* 2016; Borisova *et al.* 2015; Iannotta *et al.* 2013). In this light, some forms and degrees of soft-budgeted relationships between the government and SOEs are in fact necessary for innovations.

Just like the theoretical literature, existing studies on state ownership and innovations in China also appear to be inconclusive. There is a substantial body of works that are in line with the theses and predictions of neoclassical economics. Lin *et al.* (2010) find that, compared to SOEs, non-SOEs have tended to devote a higher proportion of their income to research and development investment. Reductions in state shareholding have been found to be associated with increases in patents by enterprises (Jefferson *et al.* 2003; Tan *et al.* 2020). Evidence has also been reported that SOEs have had a lower rate of translating research and development investment into innovation outputs (Zhou *et al.* 2017), and a lower rate of translating patents into financial rewards (Jia *et al.* 2019). Finally, there is the concluding judgement that should resources be transferred from SOEs to non-SOEs, and should SOEs be privatized, the level of total factor productivity in the Chinese economy would substantially increase (Brandt et al. 2012; Nie and Jia 2011).

There also exists a substantial body of works that hold a competing view. Concerning the allocation of enterprise income to research and development investment, Xie *et al.* (2009) report that, of China's listed companies, SOEs are at least on a par with non-SOEs in this regard. For the sector of SOEs as a whole, it is found that both research inputs and outputs as ratios to enterprise income have substantially exceeded those of non-SOEs (Li and Song 2010). There is also evidence of spatial and sectoral variations regarding the influence of state shareholding on innovations. Kroll and Kou (2019) report their analytical finding that state shareholding does weaken the incentive and capability of enterprises to patent in North-eastern provinces and in medium-technology industries, but it also tends to have positive effects in other regions and in industries of higher technology. Finally, Zhou *et al.* (2017) find that the effects of state shareholding on enterprise innovations tend to be non-linear; they rather depend on a range of additional conditions that need to be more systematically investigated.

3. The Research Design and Data Issues

3.1. The Theoretical Underpinning

Central to the theory of organizational controls is the view that the working of the firm is normally a dynamic process of utilizing the resources at its disposable, for the purpose of creating new products, knowledge, and capabilities. In Penrose's (1959) theory of the growth of the firm, this process is endogenous to the strategic behaviour of the firm well beyond the disciplines of the market. Chandler's (1977) theory of the "visible hand" further pins down the strategic behaviour to the professional management devoted to the creation of the economies of scale and scope. Following Penrose and Chandler, Lazonick (2010, 2015) proposes that key to the success of the visible hand in promoting innovations is the following three aspects of corporate governance: strategic controls by insiders of the firm, financial commitments by outsiders, and organizational integrations of stakeholders both inside and outside.

The reason for the visible hand, compared to the market, being more consistent with the innovative firm lies on the contention that innovation is normally a collective endeavour. Innovative capabilities are the accumulated outcome from learn by doing, and they normally take the form of tacit knowledge embodied in the collective. Hence, the constituents of innovative capabilities are not subject to market pricing – they cannot be sourced from the market. This implies that the innovative firm cannot be a market-produced outcome, as the neoclassical principal-agent theory would have it. Nor are innovative capabilities divisible, meaning that they cannot be decomposed into pieces of knowledge independently held by individuals. This implies even idiosyncratic exchange between individuals cannot produce the innovative firm. The innovative firm cannot be conceptualized as "a nexus of contracts" among individuals, as New Institutional Economics would have it (Foss 1996; Garud *et al.*, 2013; Lazonick 2002; Pitelis and Teece 2009).

Lazonick's three-pronged approach to the visible hand provides a useful framework for studying the innovativeness of SOEs. Compared to private companies, SOEs are normally characterized by a higher degree of insider controls due to information asymmetry between the management and the state-owner. This character, albeit deemed a hotbed of agency cost

from the perspective of neoclassical economics, can have positive effects in the meantime. It can boost the incentive of the management, in the sense that the management's long-term interests are thereby tied to the development of the enterprise. It can also boost the capabilities of the management, in the form of controlling and integrating the relevant resources for enterprise innovations.

Meanwhile, compared to private companies that are subject to the pressure of shareholders'-value maximization, SOEs tend to have a more stable financing environment. Not only external financing entities tend to be more "patient", but also the scope allowed for retaining profits for long-term investment tends to be greater. Because innovations are infused with uncertainties, and their creation rest on the accumulation of knowledge over time, such stability is conducive and important. It could result in the soft budget constraint, though.

Finally, compared to private firms, SOEs are in a better position to integrate the internal and external resources that are necessary for innovations. This is because private firms are normally stand-alone entities in the market, with well-defined and strictly-enforced boundaries of interests vis-à-vis other business entities. SOEs, owing to their relationships with the state-owner, tend to have some degrees of embeddedness in broader business networks. This, together with the network-like internal relationships associated with insider controls, fosters the organizational integrations of the stakeholders for innovations (Choi *et al.* 2011; Christensen and Lundvall 2004; Feng 2020).

3.2. The Hypotheses

In consideration of the knowledge of the relevant theoretical literature and existing empirical studies of Chinese enterprises, reviewed in the preceding section, the analysis of this paper centres on verifying two main hypotheses.

Hypothesis one: state shareholding has a positive effect on enterprise innovations.

After decades of market reforms, China's SOEs have largely become business entities. They have been corporatized. Their governance has been commercialized. They do bear the pressure, and reap the benefit, of participating in globalized market competition. It is believable that insomuch as there is still agency cost with SOEs, such cost has been systematically curtailed. Meanwhile, the advantages of state ownership or state shareholding

might have remained. Compared to private firms, SOEs might be in a better position of commanding internal and external resources for innovative activities. There is thus the possibility that, on balance, state shareholding has enhanced the innovative capacity of enterprises.

Hypothesis two: organizational controls could serve as a key factor interacting with state shareholding to determine enterprise innovations.

Following mixed-ownership reforms, the proportion of state shareholding in enterprises has tended to decrease. This is true even for enterprises where state agents continue to hold a majority shareholding, i.e., SOEs as defined in the Chinese economic and statistical systems. In this connection, the innovative capacity of enterprises needs to be increasingly based on the development of organizational controls. These controls entail the mobilization of internal and external resources for innovative activities, transcending what the market would allow for. Conceivably, the decrease in the scope of resources mobilization due to diminishing state shareholding needs to be compensated by the development of organizational controls, so that the innovative capacity of enterprises can be maintained.

3.3. The Econometric Model

Borrowing from the contribution of studies such as Tan *et al.* (2020) and Kou and Kroll (2019), this paper uses the following econometric model for investigating the effect of the change in state shareholding on enterprise innovations:

$$Ln\left(1 + \text{Innov}_{i,t}\right) = \alpha + \beta StaOwn_{i,t-1} + \omega X_{i,t-1} + \mu_i + \tau_t + \varepsilon_{i,t}$$

Table 1 gives the definitions of the variables. For the dependent variable of enterprise innovations (*Innov*), the analysis below uses the number of patents as the indicator. This treatment of the dependent variable follows the studies by Balsmeier *et al.* (2017), Chang *et al.* (2015), and Mao and Weathers (2019). To differentiate the quality of different patents, it uses innovation patents to represent high-quality (radical) innovations, and the sum total of layout-design (utility-design) patents and increased-application patents to represent low-quality (marginal) innovations. To cope with the problems of data truncation and positive skewness, following the approach of Zhao *et al*. (2021), the dependent variable is further modified by adding a value of 1 to the number of patents and then taking the logarithm. This

yields the variables *LnPatent*, *LnPatent1* and *LnPatent2*, which denotes total innovations, high-quality innovations, and low-quality innovations, respectively. Meanwhile, in recognition of the fact that innovation takes time, the one-period lags of the dependent variable are used in the analysis, as opposed to using the current-period data of the core explanatory variables and control variables. The analysis uses the OLS method.

[Table 1]

There are two variables that can be used to represent the core explanatory variable *StaOwn* in the econometric model above. The first, *Stashar*, is defined as the proportion of state shareholding in the top three shareholders of the listed companies. The second, *SOE*, takes the value of 1 for SOEs and 0 for private firms. This is used to denote whether or not state shareholders are the final controller of the enterprise – that is, the enterprise as a SOE or a private firm.

Following the standard practices in the literature, a range of variables are used to represent the control variable *X*. These include the firm-characteristic variables of firm size (*Size*), political connections (*PoliCon*), the age of the firm (*Age*), capital structure (*Lever*), profitability (*ROA*), the mode of assets utilization (*Tangi*), the growth prospects (*Growth*), financing constraints (*SA*). Also included are variables that characterize corporate governance, such as shareholding by the management (*Manage*), the concentration of shareholding (*Top1*), and whether the chair of the board of directors doubles as the top manager (*Dual*). Moreover, there are the industry-characteristic variables of the degree of market concentration (*HHI* and *HHI2*), the proportion of shareholding by institutional investors (*InShar*), and the intensity of research and development in the industry (*IndRD*). Finally, the analysis below uses dummy variables to control for the industry (μ_i) and year (τ_t) fixed effects.

3.4. Sample Selection and Data Processing

This paper analyses the data of China's listed manufacturing companies in the period 2007-2018. There are several reasons for choosing this sample for analysis. First, systematic data are available only from the year 2007. Second, China adopted a new accounting system in 2007, which makes the data before and after that year incomparable. Third, the year 2018 is the latest where data of patents are available.

The data of corporate finance and research and development expenditures are accessed from the commonly-employed data banks of CSMAR, Wind and Sinofin. Concerning the profiles of company top executives, there are quite many missing data in CSMAR and Wind. This paper constructs the relevant data series by means of sourcing the relevant information from the companies and matching the information with the *STEM Designated Degree Program List 2016* of the United States. The data of state shareholding, in the form of the indicator *Stashar*, are sourced from the annual reports of the listed companies. Finally, for the indicator of the degree of marketization in the region where a company is located, the data are from *China Regional Marketization Index Report* (Fan *et al.* 2019).

Concerning data processing, the analysis in this paper focuses on manufacturing firms, and hence financial companies are excluded. In the meantime, considering that the sectors of telecom, internet, and software development, though not manufacturing in nature, do have strong connections with manufacturing (especially artificial intelligence manufacturing), the data of listed companies are included in the analysis. These high-tech sectors are innovation-intensive, with high degrees of presence of state shareholdings. Within manufacturing, the three sectors of alcohol making, foodstuffs processing, and agricultural side-products processing are with very limited association with innovations. The data of companies in these three sectors are excluded from the analysis.

For the consideration of data quality, the analysis excludes sample cases of companies that are with missing data of key indicators or with anomalous data (such as the value of total assets being less than fixed assets). Also excluded are the data of companies that are with less then 10 employees, which appear to be atypical in listed companies. The total number of company-annual observations analysed in the paper is 14584.

3.5. Descriptive Characteristics of the Variables

Table 2 gives the descriptive statistics of the main variables. It can be seen that the majority of innovations are marginal in nature, in the forms of layout-design and increased-application innovations. Figure 1 shows the sectoral distribution of the patents, in labour-intensive, capital-intensive and technology-intensive industries. It can be seen that, for both high-quality and low-quality innovations, those in technology-intensive industries are much less than in

the other two sectors. Concerning state shareholding, *StaShar*, the mean is 13.63, median 0, and standard deviation 21. These values indicate that state shareholding is a minority in China's listed companies. They also suggest that that there is an ample scope for mixed-ownership reforms that allow for SOEs to acquire the stakes of private firms. Whether or not such reforms are conducive to the innovative capacity of the listed companies is to be analysed in the next section.

[Table 2] [Figure 1]

4. State Shareholding and Innovative Capacity

4.1. The Baseline Analysis

Table 3 reports the regression analysis of the relationship between state ownership (*StaOwn*) and enterprise innovations. The results in columns (1)-(3) show that, within mixed-ownership enterprises, the higher the proportion of state shareholding (*StaShar*), the larger the number of patents registered. These results are of 1% level of significance. The results in columns (4)-(6) further show that, in consideration of the ultimate controllers of enterprises, SOEs have a higher level of innovations than private firms. From these results, it can be, tentatively, inferred that should SOEs increased their shareholdings via mixed-ownership reforms, enterprise innovations are likely to increase.

[Table 3]

4.2. Robust Tests: Omitted Variables

The baseline regression analysis is designed in a way that is quite standard in the literature. Still, this design cannot rule out the possibility of omitting important explanatory variables. Several possible variables deserve careful consideration.

First, the issue of financing constraints might be important. It is well-recognized that innovation activities, conducting over long durations and involving uncertainties, typically require sufficient financial commitments. Empirically, it is also well-known that Chinese SOEs and enterprises with state shareholdings can sometimes receive bank loans or other financial resources at below-market interest rates (Luo *et al*. 2011; Warner *et al.* 2004). An

explanatory variable of financing constraints (*SA*) can be added to the analysis.

Second, conceptually, there can be variation in the intensity of research and development, and the incentive for patenting, across different industrial sectors (Fagerberg 2004). Controlling for the industry-level fixed effects might still be insufficient in this regard. An explanatory variable of research and development intensity (*IndRD*) can be added to the analysis.

Third, the presence of institutional investors could influence innovations (Brossard *et al.* 2013; Singh and Gaur 2013). In the corporate governance of Chinese mixed-ownership enterprises, the interaction between institutional investors and state shareholders has been an important issue. Hence, it will be reasonable to add an explanatory variable of the proportion of shareholding by institutional investors (*InShar*) to the analysis.

Table 4 reports the regression analysis of adding the three explanatory variables to the baseline model. The results in columns (1)-(3) show that, compared to the baseline analysis, state shareholding (*StaShar*) remains basically of the same sign and coefficient, indicating that the core explanatory variable is not sensitive to the newly-added variables. State shareholding remains as the dominant influence on enterprise innovations. The results in columns (4)-(6) further show that, compared to the baseline analysis, there is only a modest change to the coefficient of the variable *SOE* (which denotes whether or not state shareholders are the final controller of the enterprise) with the sign remaining unchanged.

[Table 4]

According to the principle of the stability of regression coefficients, if the coefficient of the core explanatory variable does not vary significantly along with the addition of new control variables, that implies the key control variables in place are already basically adequate for avoiding selection error (Dale and Krueger 2002). Therefore, combining the regression results in Table 3 and 4, it can be concluded that any selection error arising from omitted variables would not significantly alter the result of the baseline analysis – namely, state shareholding in mixed-ownership enterprises has the effect of promoting innovations.

4.3. Robust Tests: Alternative Models and Methods

In the relevant literature, in consideration of possible time lags from patent registration (or

research and development spending) to its actual utilization, a standard practice is to use the one-period lags of the explanatory variables in the analysis. This is also the practice of the baseline analysis above. Yet, there is no certainty that one-period lags must be appropriate. Everything depends on the process of commercially utilizing the patents in the reality. For this reason, it is worthwhile also attempt to use two-period lags in the analysis.

Meanwhile, in consideration of possible problems with some data truncation, using the OLS method for analysis might not be sufficiently appropriate. It is reasonable also to attempt the Tobit method, to see if the analytical results would change.

Table 5 reports the analysis of still using the OLS method while replacing the *t+1* data of the dependent variables by the *t+2* data. Table 6 reports the baseline analysis using the Tobit method, instead of the OLS method. In both cases, there is no significant change with the analytical results. It can thus be inferred that the findings from the baseline regression analysis are robust.

[Table 5], [Table 6]

4.4. Robust Tests: Endogeneity

Conceptually, increases or decreases in state shareholding of an enterprise – and, more generally, whether or not an enterprise would become state-owned – need not be a random occurrence (Bradshaw *et al.* 2019). It depends on the broader political-economic context. Regarding the subject matter of this paper, though, it is unlikely that there exists a degree of causality running from enterprise innovative capacity to state shareholding. State shareholding, and state ownership in general, has been mainly exogenously determined (Chen *et al.* 2019). Still, because innovation is a complex process, it could be somewhat simplistic to use a linear function to capture the relationship between state shareholding and innovations. For this reason, the Propensity Score Matching (PSM) method is adopted to replace the OLS method in the baseline analysis below.

With the PSM method, following the standard practice in the literature of corporate finance, the analysis uses a 1:1 non-repeat matching. The results of the analysis are reported in Table 7. It can be seen that the results for both state shareholding (*StaShar*) and SOEs or otherwise (*SOE*) remain significant at 1% level. This reinforces the inference that the baseline

regression analysis is robust.

[Table 7]

5. The Role of Organizational Controls

5.1. The Background

Lazonick (2015), based on the stock of knowledge of business and industrial history, highlights the uncertain, cumulative, and collective character of the innovation process. This character implies that innovative enterprises need to have sufficient organizational controls over necessary internal and external resources. In terms of institutional arrangements, organizational controls require the capability of strategic control by the insider management, financial commitment by the investors, and organizational integration of the multiple types of productive resources by the enterprises.

Conceptually, following Lazonick's exposition (see also Lazonick and O'Sullivan 2000), organizational controls can be decomposed into two main aspects. These, namely, are: the distribution of the power of controls and the distribution of enterprise profits.

5.2. Insiders' Strategic Controls

The power of controls over the enterprise lies at the heart of rivalries between different shareholders, as well as between the shareholders and the management. Amid the emergence of "financial innovations", both in corporate finance and in the capital markets, the relationships between the proportion of shareholding and the power of controls have become diverse and complex (Wang 2014).

Against this background, the proportion of shareholding by top executives of the company is not necessary an appropriate indicator of insider (the management) versus outsider (shareholders) controls. A more appropriate indicator of insider controls might be the duration of tenure of top executives. It is conceivable that the longer the tenure of top executives, the closer to insider controls. Still, for innovative enterprises, further attributes of top executives are needed. These centre on their relevant incentives and capabilities, proxied by their education and career profiles (Kaplan 2008; Norburn 1988; Tripsas 2000). For this

consideration, the analysis below assumes that enterprises of which top executives are with sciences, technology, engineering and mathematics (*STEM*) backgrounds are close to organizational controls, as opposed to market controls.

The analysis of the interaction between state shareholding and insiders' strategic controls is reported in Table 8. The results in column (1)-(2) show that the interaction term of state shareholding and top executives relevant backgrounds, *STA*STEM*, has statistically significant negative coefficients. The results in column (3)-(4) further show that the interaction term of "SOEs or otherwise" and top executives relevant backgrounds, *SOE*STEM*, also has statistically significant negative coefficients. It can thus be inferred that, for innovative enterprises, the lower the proportion of state shareholding, the larger the need for (or reliance on) insiders' strategic controls. The same is true for private firms versus SOEs.

[Table 8]

5.3. Financing Commitments

The theory of organizational controls submits that financing commitments are essential to innovative enterprises. Of particular importance is the allocation of retained profits of the enterprise mainly for re-investment, instead of pursing shareholders'-value maximization in the forms of paying out as dividends or buying back its own shares (Lazonick 2015; Lazonick and O'Sullivan 2000).

Two indicators can be used for testing the applicability of this theoretical view on the experiences of China's innovative enterprises. The immediately relevant indicator is research and development as a ratio of retained profits (*lnFinC*). The broader indicator of financing commitments, in line with the stylized facts highlighted in the Chandler-Penrose-Lazonick tradition of business history studies, is the ratio of internal financing to total financing of the enterprise (*FinStr*). Both indicators are associated with the degrees of organizational versus market controls over productive resources.

Table 9 reports the analysis of the interaction between state shareholding and financing commitments to innovations via the allocation of retained profits (*lnFinC*). It can be seen that the interaction term, *Sta*LnFinC*, has statistically significant negative coefficients. This

suggests that, for innovative enterprises, the lower the proportion of state shareholding, the larger the need for (or reliance on) organizational controls over financing resources. Meanwhile, the coefficients of the interaction term between "SOEs or otherwise" and financing commitments so defined, *SOE*LnFinC*, are also negative, but are not statistically significant.

[Table 9]

Table 10 reports the analysis of the interaction between state shareholding and financing commitments to innovations by means of sourcing mainly internal financing (*FinStr*). It can be seen that, for high-quality innovations (*LnPatent1*), the explanatory variable in the form of the interaction term *SOE*FinStr* has statistically significant negative coefficients. This means private firms, compared to SOEs, are more reliant on organizational controls over financial resources in innovations. In the meantime, the interaction term *Sta*FinStr* does not have statistically significant coefficients.

[Table 10]

Together, the results in Table 9 and 10 indicate that organizational controls over financial resources are important for innovations. Enterprises with weaker state connections are more reliant on such controls. The difference between the findings on state shareholding versus state ownership, though, suggests that the situations are more complex. Further complicating the situations are the diverse findings from the analysis using the two different measurements of financing commitments.

6. Summary and Conclusion

Mixed-ownership reforms have been the mainstay of reforming Chinese SOEs in recent years. This paper analyses the effects of the reforms on innovations in China's listed manufacturing companies in the period 2007-2018. The study finds that SOEs tend to be more innovative than non-SOEs, and increases in state shareholding do raise the innovations of the firms. Further analyses reveal that, for mixed-ownership enterprises, the lower the level of state shareholding the more reliance of innovations on the capabilities of organizational controls over productive resources.

These findings contradict the theoretical positions of mainstream neoclassical economics, which rather consider state ownership as intrinsically inefficient and organizational controls prone to generating agency cost. Yet, the findings are consistent with the alternative view that organizational controls are normally the necessary underpinning of enterprise innovations. The effects of state ownership on innovations can thus be made sense in this perspective. Our study joins the rank of scholarly works that highlight the important role of SOEs in the innovations, technological progress, and productivity growth of the Chinese economy as a whole (Chen *et al.* 2009; Gabriele 2010; Hou and Mohnen 2013; Qi and Kotz 2020).

A possible limitation with our study concerns the sample of enterprises being analyzed. The data set does not include quite some high- calibre tech firms that are not listed in China's domestic market – such as the famous BAT (Baidu, Alibaba, and Tencent) which are listed in overseas markets only, or Huawei which is not a publicly traded company. Further studies will be needed for consolidating the robustness of our study.

Yet another possible limitation with our study concerns the effects on enterprise innovations arising from the external environment at the structural (rather than institutional) level. It is well known that, compared to private firms, China's SOEs have been granted with more favourable government treatments while being asked to take up more developmental and social responsibilities. The existing literature does recognize that it is difficult to disentangle the effects of these positive and negative factors, and thereby to clarify to what extent the actual performance of SOEs versus private firms is ascribable to the balance of all these external effects (Lo 2020). In this paper, we assume that the balance of the external effects is represented by SOEs' easier access to bank credits, which, albeit being viewed as distortionary by neoclassical economics, is found to be conducive to enterprise innovations. This treatment is not entirely satisfactory and, again, further studies will be needed to support the current study.

These limitations notwithstanding, insofar as the findings of the study have reasonable levels of truth, they provide useful lessons for China's mixed-ownership reforms. First, in the circumstances where the reforms take the form of state agents acquiring the stakes of private firms, the presence or increase in state shareholding could have the positive effect of promoting enterprise innovations. Second, in the circumstances where the reforms involve

private business acquiring the stakes of SOEs, the decrease in state shareholding might need to be accompanied by strengthening the capabilities of organizational controls, in order to maintain the innovative capacity of the mixed-ownership enterprises. Together, these two lessons imply that the theory of the innovative enterprise developed within the Chandler-Penrose-Lazonick tradition of business history studies are essential references for furthering the reform and development of Chinese enterprises, and the Chinese economy as a whole under the New Normal.

Bibliography

Acharya, V., D. Anginer, and J. Warburton (2016) "The end of market discipline? Investor expectations of implicit government guarantees", MPRA Paper 79700, University Library of Munich, Germany.

Balsmeier, B., L. Fleming, and G. Manso (2017) "Independent boards and innovation", *Journal of Financial Economics*, 123 (3): 536-557.

Bernier, L. (2014) "Public enterprises as policy instruments: the importance of public entrepreneurship", *Journal of Economic Policy Reform*, 17(3): 253–266.

Bernier, L., M. Florio, and P. Bance (2020) "Introduction", in L. Bernier, M. Florio, and P. Bance (eds.), *The Routledge Handbook of State-Owned Enterprises*, London: Routledge.

Bernier, L., and E. Reeves (2018). "The continuing importance of state-owned enterprise in the twenty first century: challenges for public policy", *Annals of Public and Cooperative Economics*, 89 (3): 453–8.

Borisova, G. (2015) "Government ownership and the cost of debt: evidence from government investments in publicly traded firms", *Journal of Financial Economics*, 118 (1): 168-191.

Bortolotti, B., V. Fotak, and B. Wolfe (2019) "Innovation at state-owned enterprises", BAFFI CAREFIN Centre Research Paper No. 2018-72, Milan Italy.

Boubakri, N., J.C. Cosset, and W. Saffar, (2013). "The role of state and foreign owners in corporate risk-taking: Evidence from privatization", *Journal of Financial Economics*, 108 (3): 641-658.

Bradshaw, M., G. Liao, and M. Ma (2019) “Agency costs and tax planning when the government is a major shareholder”, *Journal of Accounting and Economics*, 67 (2): 255-277.

Brandt, L., J. van Biesebroeck, Y. Zhang (2012) “Creative accounting or creative destruction? Firm-Level productivity growth in Chinese manufacturing”, *Journal of Development Economics*, 97 (2): 339-351.

Brossard, O., S. Lavigne, and M.E. Sakinç (2013) “Ownership structures and R&D in Europe: the good institutional investors, the bad and ugly impatient”, *Industrial and Corporate Change*, 22 (4): 1031-1068.

Cao, X., D.J. Cumming, and S. Zhou (2016) “State ownership and corporate innovation efficiency”, Working Paper, Research Collection Lee Kong Chian School of Business, Singapore Management University.

Castelnovo , P., and M. Florio (2020) “Mission-oriented public organizations for knowledge creation”, In L. Bernier, M. Florio, and P. Bance (eds.), *The Routledge Handbook of State-Owned Enterprises*, London: Routledge.

Chandler, A.D. (1977) *The Visible Hand: The Managerial Revolution in American Business*, Cambridge (Mass.)*:* Harvard University Press.

Chang, X., K. Fu, A. Low, and W. Zhang (2015) “Non-executive employee stock options and corporate innovation”, *Journal of Financial Economics*, 115 (1): 168-188.

Chen, G., M. Firth, and L. Xu (2009) “Does the type of ownership control matter? Evidence from China’s listed companies”, *Journal of Banking & Finance*, 33: 171–181.

Chen, L., P. Wan, and Y. Xu (2019) “Shareholding structures and innovative activities in mixed-ownership enterprises”, *Guanli Shijie* (Management World), 35 (10): 186-205.

Choi, S.B., S.H. Lee, and C. Williams (2011) “Ownership and firm innovation in a transition economy: evidence from China”, *Research Policy*, 40 (3): 441-452.

Christensen, J.L., and B-Å Lundvall (2004). “Product innovation, interactive learning and economic performance”, *Research on Technological Innovation, Management and Policy* no.8, JAI Press.

Christiansen, H. (2011). “The size and composition of the SOE sector in OECD countries”, OECD Corporate Governance Working Paper no.5, Paris: OECD.

Dale, S.B., and A.B. Krueger (2002) “Estimating the payoff to attending a more selective college: an application of selection on observables and unobservables”, *Quarterly Journal of Economics*, (4), 1491-1527.

Fagerberg, J. (2004) “Innovation: a guide to the literature”, in J. Fagerberg, D.C. Mowery, and R.R. Nelson (eds.), *The Oxford Handbook of Innovation*, Oxford, Oxford University Press.

Fan, G., X. Wang, and L. Hu (2019) *China Regional Marketization Index Report*, Beijing: Shehui Kexue Wenxian Chubanshe.

Feng, Kaidong (2020) *Innovation and Industrial Development in China: A Schumpeterian Perspective on China's Economic Transformation*, London: Routledge.

Florio, M. (2014a) “The return of public enterprise”, Working Papers 201401, Milan: Centre for Industrial Studies (CSIL).

Florio, M. (2014b) “Contemporary public enterprises: innovation, accountability, governance”, *Journal of Economic Policy Reform*, 17(3): 201-208.

Foss, N.J. (1993) “Theories of the firm: contractual and competence perspectives”, *Journal of Evolutionary Economics,* 3(2): 127–144.

Gabriele, A. (2010) “The role of the state in China’s industrial development: a reassessment”, *Comparative Economic Studies*, 52: 325–350.

Garud, R., P. Tuertscher, and A.H.Van de Ven (2013) “Perspectives on innovation processes”, *Academy of Management Annals*, 7(1), 775-819.

Gupta, N. (2005) “Partial privatization and firm performance”, *Journal of Finance*, 60 (2): 987-1014.

Hall, B.H., and J. Lerner (2010) “The financing of R&D and innovation”, in B.H. Hall and N. Rosenberg (eds.), Handbook of the Economics of Innovation, Amsterdam, Elsevier.

He, J.J., and X. Tian (2018) “Finance and corporate innovation: a survey”, *Asia-Pacific Journal of Financial Studies*, 47(2), 165-212.

Heaton, J.B. (2019) “Corporate governance and the cult of agency”, *Villanova Law Review*. 64 (2): 201-222

Hou, J., and P. Mohnen (2013) “Complementarity between in-house R&D and technology purchasing: evidence from Chinese manufacturing firms”, *Oxford Development Studies*,

41(3): 343–371.

Huang, H., and C. Xu (1998) “Soft budget constraint and the optimal choices of research and development projects financing”, *Journal of Comparative Economics*, 26 (1): 62-79.

Iannotta, G., G. Nocera, and A. Sironi (2013) “The impact of government ownership on bank risk”, *Journal of Financial Intermediation*, 22 (2): 152-176.

Jefferson, G., A.G. Hu, X. Guan, and X. Yu (2003) “Ownership, performance, and innovation in China's large- and medium-size industrial enterprise sector”, *China Economic Review*, 14 (1): 89-113.

Jia, N., K.G. Huang, and C.M. Zhang (2019) “Public governance, corporate governance, and firm innovation: an examination of state-owned enterprises”, *Academy of Management Journal*, 62 (1): 220-247.

Kahan, M., and E.B. Rock (2011) “When the government is the controlling shareholder”, Working Paper no.31, Faculty Scholarship at Penn Law.

Kaplan, S. (2008) “Cognition, capabilities, and incentives: assessing firm responses to the fibre-optic revolution. Academy of Management Journal, 51 (4):672-695.

Kroll, H., and K. Kou (2019) “Innovation output and state ownership: empirical evidence from China’s listed firms”, *Industry and Innovation*, 26 (2): 176– 198.

Kumar, P., and N. Langberg (2009) “Corporate fraud and investment distortions in efficient capital markets”, *Rand Journal of Economics*, 40 (1): 144–172.

Lazonick, W. (2002) “Innovative enterprise and historical transformation”, *Enterprise and Society*, 3(1): 3-47.

Lazonick, W. (2010) “The Chandlerian corporation and the theory of innovative enterprise”, *Industrial and Corporate Change*, 19 (2): 317-349.

Lazonick, W. (2015) “Innovative enterprise and the theory of the firm”, *Political Quarterly*, 86 (S1): 77-97.

Lazonick, W., and M. O’Sullivan (2000) “Maximizing shareholder value: a new ideology for corporate governance”, *Economy and Society*, 29(1): 13–35.

Leutert, W., and S. Vortherms (2021) “Personnel power: governing state-owned enterprises”, *Business and Politics, 23*(3): 419-437.

Li, C., and M. Song (2010) “The innovative activities of China’s manufacturing enterprises:

the effects of ownership and CEO incentives", Jingji Yanjiu (*Economic Research Journal*), 45 (5): 55-67.

Liang, X., X. Lu, and L. Wang (2012) "Outward internationalization of private effect of competitive advantages and disadvantages compared to home market rivals", *Journal of World Business*, 47 (1): 134–144.

Lin, C., P. Lin, and F. Song (2010) "Property rights protection and corporate R&D: evidence from China", *Journal of Development Economics*, 93 (1): 49–62.

Lin, J.Y., and G. Tan (1999) "Policy burdens, accountability and soft budget constraint", *American Economic Review*, 89 (2:, 426–431.

Lin, K.J., X. Lu, J. Zhang, and Y. Zhang (2020) "State-owned enterprises in China: a review of 40 years of research and practice", *China Journal of Accounting Research*, 13 (1): 31-55.

Lo, D. (2018) "Consideration on China's New Normal economic growth", *Journal of China and International Relations*, 6 (1): 73-94

Lo, D. (2020) "State-owned enterprises in China's economic transformation: institutional functionality and credibility in alternative perspectives", *Journal of Economic Issues*, 54 (3): 813-837

Luo, Y., H. Zhao, Y. Wang, and Y. Xi (2011) "Venturing abroad by emerging market enterprises: a test of dual strategic intents", *Management International Review*, 51 (4): 433-459.

Mao, C.X., and J. Weathers (2019) "Employee treatment and firm innovation", *Journal of Business Finance & Accounting*, 46 (7-8): 977-1002.

Megginson, W.L., R.C. Nash, and M. van Randenborgh (1994) "The financial and operating performance of newly privatized firms: an international empirical analysis", *Journal of Finance*, 49 (2): 403-452.

Millward, R. (2011) "Public enterprise in the modern Western world," *Annals of Public and Cooperative Economics*, 82 (4): 375–398.

Millward, R. (2013) *The State and Business in the Major Powers. Explorations in Economic History*, London: Routledge.

Naughton, B. (2019) "The financialization of the state sector in China", *East Asian Policy*, 11

(2): 46-60.

Nelson, R.R. (1991) “Why do firms differ, and how does it matter?”, *Strategic Management Journal*, 12v(S2): 61－74.

Nie, H., and R. Jia (2011) “Productivity and allocative inefficiency in China’s manufacturing enterprises”, *Shijie Jingji* (World Economy), 34 (7): 27-42.

Norburn, D., and S. Birley (1988) “The top management team and corporate performance”, *Strategic Management Journal*, 9 (3): 225 − 237.

Penrose, E. (1959) *The Theory of the Growth of the Firm*, Oxford: Oxford University Press.

Pfeffer, J. (1972) “Interorganizational influence and managerial attitudes”, *Academy of Management Journal*, 15(3): 317-330.

Pitelis, C.N., and D. J. Teece (2009) “The (new) nature and essence of the firm”, *European Management Review*, 6(1): 5-15.

Qi, H., and D.M. Kotz (2020) “The impact of state-owned enterprises on China’s economic growth”, *Review of Radical Political Economics*, 52(1): 1–19.

Qian, Y., and C. Xu (1998) “Innovation and bureaucracy under soft and hard budget constraints”, *Review of Economic Studies*, 65 (1): 151–164.

Shen, H., and M. Yang (2019) “Models of mixed-ownership reforms of state-owned enterprises and corporate governance”, *Guanli Shijie* (Management World), 35 (4):171-182.

Shleifer, A. (1998) “State versus private ownership”, *Journal of. Economic Perspectives*, 12 (4): 133-150.

Singh, D.A., and A.S. Gaur (2013) “Governance structure, innovation and internationalization: evidence from India”, *Journal of International Management*, 19 93): 300-309.

Tan, Y., X. Tian, C.X. Zhang, and H. Zhao (2020) “The real effects of privatization: evidence from China's split share structure reform”, *Journal of Corporate Finance*, 64 (3): 1-23.

Tripsas, M., and G. Gavetti (2000) “Capabilities, cognition, and inertia: evidence from digital imaging”, *Strategic Management Journal*, 21(10-11): 1147 − 1161.

van Thiel, S., M. van Genugten, and B. Voorn (2020) “Principals and agents: The relationship between governments and state-owned enterprises”, In L. Bernier, M. Florio, and P.

Bance (eds.), *The Routledge Handbook of State-Owned Enterprises*, London: Routledge.

Wang, J. (2014) "The political logic of corporate governance in China's state-owned enterprises", *Cornell International Law Journal*, 47 (3): 632-669.

Wang, R., F. Wang, L. Xu, and C. Yuan (2017) "R&D expenditures, ultimate ownership and future performance: evidence from China", *Journal of Business Research*, 71 (1): 47-54.

Warner, M., N.S. Hong, amd X. Xu (2004) "Late development experience and the evolution of transnational firms in the People's Republic Of China", *Asia Pacific Business Review*, 10 (3–4): 324–45.

Willner, J., and S. Grönblom (2020) "Motivation and performance in state-owned enterprises", In L. Bernier, M. Florio, and P. Bance (eds.), *The Routledge Handbook of State-Owned Enterprises*, London: Routledge.

Xie, W., Q. Tang, and S. Lu (2009) "Government R&D subsidies, enterprise R&D expenditures, and independent innovations: evidence from China's listed companies", *Jinrong Yanjiu* (Finance Research Journal), 2009 (6):86-99.

Zhao, Q., Z. Li, and Y. Yu (2021) "Does top management quality promote innovation? Firm-level evidence from China", *China Economic Review*, forthcoming.

Zhou, K.Z, G.Y. Gao, and H. Zhao. (2017) "State ownership and product innovation in China: an integrated view of institutional and efficiency logics", Administrative Science Quarterly, 62 (2): 375-404.

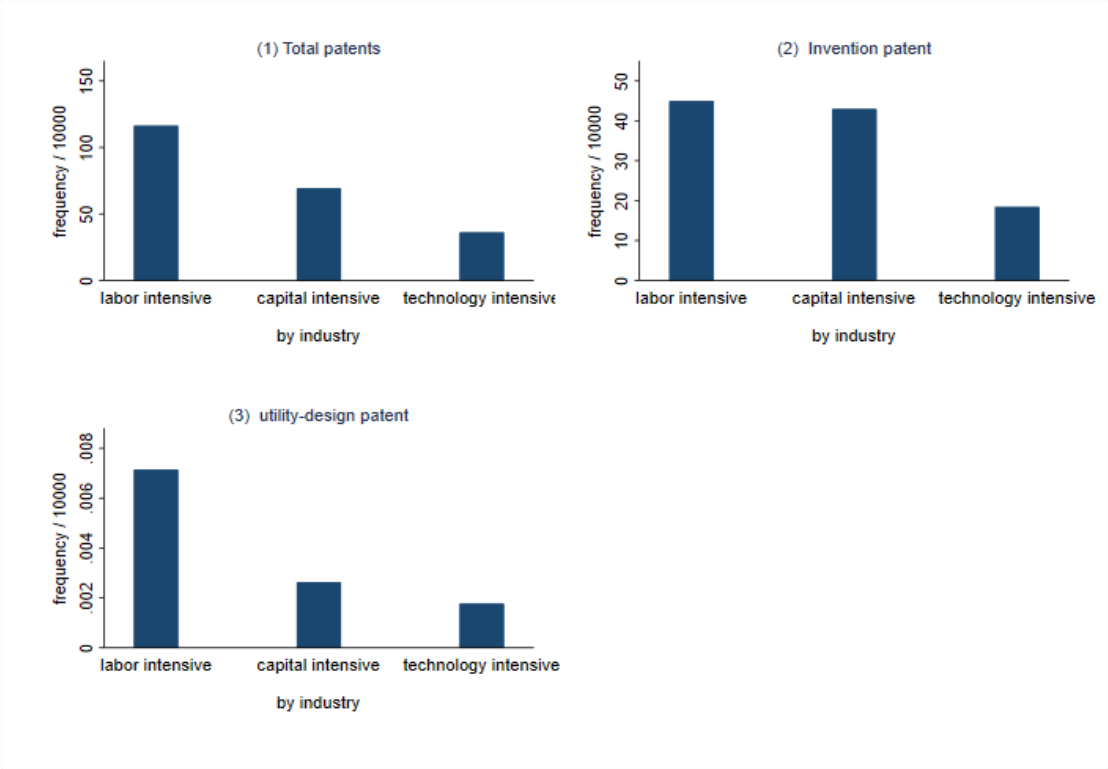
Table 1. Variables Definitions and Explanations

Variable types	Variables	Variable definitions
Innovations	*LnPatent*	Innovation patents, and the sum total of layout-design patents and increased-application patents, registered in current year
Radical innovations	*LnPatent1*	Innovation patents registered in the current year
Marginal Innovations	*LnPatent2*	Layout-design patents and increased-application patents registered in current year
Core explanatory variables	*StaShar*	Proportion of state shareholding in the top three shareholders
	SOE	Types of ownership: 1 for SOEs, 0 for non-SOEs
Control variables	*Size*	Logarithm of the value of gross assets of enterprises
	Policon	Political connection: 1 management team containing at least a member that is a CPC member or used be a government or army official, 0 for none
	Age	Logarithm of the number of years from the establishment of the enterprise until the latest accounting year
	Lever	Liability to asset ratio
	ROA	Return on assets
	Tangi	Value of net assets as a ratio to total assets
	Growth	Growth of operation revenue in current year
	Dual	1 for chairman of the board also the top manager, 0 if otherwise
	Manage	Sum total of the shares held by directors, supervisors and top managers, as a ratio to total shares of the enterprise
	Top1	Proportion of shareholding by the biggest shareholder
	HHI	Herfindahl index
	HHI2	Square of Herfindahl index
	SA	Index of financing contraints
	Inshar	Proportion of shareholding by institutional shareholders
	IndRD	Industrial average of the ratio of research and development expenditures to operation revenues

Table 2. Descriptive Statistics of the Main Variables

	count	Mean	Sd	p10	p50	p90
LnPatent	14584	3.410	1.778	0.000	3.611	5.525
LnPatent1	14584	2.526	1.687	0.000	2.565	4.663
LnPatent2	14584	2.704	1.851	0.000	2.944	4.990
StaShar	14584	13.363	21.192	0.000	0.000	50.090
SOE	14584	0.365	0.481	0.000	0.000	1.000
Size	14584	22.015	1.220	20.611	21.823	23.688
Age	14584	2.832	0.294	2.435	2.848	3.195
ROA	14584	0.041	0.051	0.002	0.037	0.100
Tangi	14584	0.222	0.148	0.054	0.194	0.435
Top1	14584	0.348	0.146	0.171	0.331	0.550
Dual	14584	0.264	0.441	0.000	0.000	1.000
PoliCon	14584	0.771	0.420	0.000	1.000	1.000
Manage	14584	0.143	0.205	0.000	0.006	0.495
Growth	14584	0.197	0.396	-0.150	0.129	0.551
HHI	14584	0.070	0.057	0.020	0.053	0.155
HHI2	14584	0.008	0.015	0.000	0.003	0.024
SA	14584	4.074	1.434	2.511	3.813	6.013
InShar	14584	0.087	0.107	0.001	0.047	0.233
RD	14581	0.048	0.052	0.003	0.036	0.103
IndRD	14584	0.052	0.039	0.015	0.043	0.098

Figure 1. Sectoral Distribution of the Patents in the Data Set



Note: The classification is worked out by the author according to the standards of China Securities Regulatory Commission.

Table 3. OLS Regression Analysis: State Shareholding and Enterprise Innovations

	(1)	(2)	(3)	(4)	(5)	(6)
	LnPatent	*LnPatent1*	*LnPatent2*	*LnPatent*	*LnPatent1*	*LnPatent2*
StaShar	0.0060***	0.0074***	0.0046***			
	(0.0014)	(0.0015)	(0.0014)			
SOE				0.2026***	0.2584***	0.1380**
				(0.0610)	(0.0624)	(0.0612)
Size	0.6966***	0.6713***	0.6416***	0.6987***	0.6734***	0.6445***
	(0.0233)	(0.0239)	(0.0232)	(0.0232)	(0.0237)	(0.0231)
Age	-0.0516	-0.1272	-0.0398	-0.0465	-0.1219	-0.0335
	(0.0886)	(0.0899)	(0.0892)	(0.0885)	(0.0899)	(0.0892)
ROA	4.1944***	3.7685***	3.4629***	4.1899***	3.7689***	3.4460***
	(0.4079)	(0.4084)	(0.4169)	(0.4046)	(0.4008)	(0.4142)
Tangi	-0.2921	-0.5464***	0.0334	-0.2918	-0.5468***	0.0355
	(0.1892)	(0.1885)	(0.1809)	(0.1891)	(0.1885)	(0.1810)
Top1	-0.2452	-0.4671***	-0.0195	-0.1391	-0.3395**	0.0693
	(0.1708)	(0.1708)	(0.1686)	(0.1696)	(0.1696)	(0.1667)
Dual	0.0990**	0.1072**	0.0392	0.1009**	0.1109**	0.0379
	(0.0450)	(0.0461)	(0.0463)	(0.0456)	(0.0469)	(0.0467)
PoliCon	0.0132	0.0326	-0.0074	0.0156	0.0353	-0.0050
	(0.0444)	(0.0421)	(0.0462)	(0.0443)	(0.0422)	(0.0462)
Manage	0.3153***	0.1877	0.2649**	0.3086**	0.1856	0.2462*
	(0.1209)	(0.1173)	(0.1256)	(0.1247)	(0.1214)	(0.1286)
Growth	-0.0085	0.0127	0.0131	-0.0064	0.0158	0.0137
	(0.0402)	(0.0373)	(0.0393)	(0.0401)	(0.0372)	(0.0393)
HHI	4.1313***	3.3866**	3.8182**	4.1448***	3.3975**	3.8412**
	(1.5214)	(1.4988)	(1.4948)	(1.5184)	(1.4943)	(1.4935)
HHI2	-8.9198*	-6.4478	-7.9243*	-9.0878*	-6.6352	-8.0972*
	(4.7386)	(4.4194)	(4.7976)	(4.7316)	(4.4031)	(4.7988)
_cons	-12.1722***	-12.1265***	-11.7545***	-12.2654***	-12.2287***	-11.8543***
	(0.5778)	(0.5972)	(0.5695)	(0.5733)	(0.5926)	(0.5674)
Indus FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	14521	14521	14521	14521	14521	14521
A-R²	0.3962	0.3496	0.4215	0.3949	0.3477	0.4206

Note: *, **and ***denote 10%, 5% and 1% significant levels, respectively. Figures in parentheses indicate the robust standard deviation. The same for all subsequent tables of the results of regression analysis.

Table 4. Robust Test of Possible Omitted Variables

	(1)	(2)	(3)	(4)	(5)	(6)
	LnPatent	*LnPatent1*	*LnPatent2*	*LnPatent*	*LnPatent1*	*LnPatent2*
StaShar	0.0060***	0.0074***	0.0046***			
	(0.0014)	(0.0015)	(0.0014)			
SOE				0.2267***	0.2830***	0.1604***
				(0.0609)	(0.0623)	(0.0612)
Size	0.1787	0.1616	0.1453	0.1430	0.1164	0.1225
	(0.1605)	(0.1595)	(0.1642)	(0.1605)	(0.1595)	(0.1647)
Age	0.1798	0.1017	0.1802	0.1977*	0.1237	0.1944*
	(0.1111)	(0.1105)	(0.1137)	(0.1104)	(0.1101)	(0.1131)
ROA	3.7120***	3.2447***	3.0430***	3.6954***	3.2268***	3.0202***
	(0.4180)	(0.4107)	(0.4258)	(0.4147)	(0.4028)	(0.4234)
Tangi	-0.2795	-0.5311***	0.0433	-0.2809	-0.5332***	0.0437
	(0.1875)	(0.1871)	(0.1797)	(0.1872)	(0.1870)	(0.1797)
Top1	-0.2223	-0.4394**	-0.0028	-0.1246	-0.3205*	0.0786
	(0.1704)	(0.1705)	(0.1684)	(0.1694)	(0.1693)	(0.1667)
Dual	0.0903**	0.0982**	0.0312	0.0953**	0.1049**	0.0329
	(0.0446)	(0.0457)	(0.0459)	(0.0453)	(0.0465)	(0.0464)
PoliCon	0.0110	0.0304	-0.0098	0.0125	0.0321	-0.0081
	(0.0442)	(0.0419)	(0.0460)	(0.0441)	(0.0419)	(0.0459)
Manage	0.1994*	0.0694	0.1593	0.2032*	0.0766	0.1518
	(0.1197)	(0.1165)	(0.1248)	(0.1232)	(0.1202)	(0.1274)
Growth	-0.0239	-0.0044	-0.0001	-0.0213	-0.0010	0.0011
	(0.0402)	(0.0373)	(0.0392)	(0.0401)	(0.0372)	(0.0392)
HHI	3.5871**	2.8176*	3.4153**	3.5583**	2.7792*	3.4046**
	(1.5338)	(1.5037)	(1.5057)	(1.5305)	(1.4983)	(1.5043)
HHI2	-8.0640*	-5.5310	-7.2802	-8.1326*	-5.6066	-7.3699
	(4.7742)	(4.4411)	(4.8201)	(4.7677)	(4.4231)	(4.8219)
SA	0.4243***	0.4166***	0.4075***	0.4540***	0.4541***	0.4274***
	(0.1342)	(0.1344)	(0.1371)	(0.1341)	(0.1342)	(0.1373)
InShar	0.8482***	0.9154***	0.7329***	0.8996***	0.9792***	0.7710***
	(0.1776)	(0.1738)	(0.1835)	(0.1777)	(0.1735)	(0.1837)
IndRD	0.6888	0.6879	-0.0687	0.6583	0.6497	-0.0896
	(0.5944)	(0.5538)	(0.6155)	(0.5919)	(0.5512)	(0.6146)
_cons	-3.2016	-3.3015	-3.1190	-2.6262	-2.5706	-2.7634
	(2.8201)	(2.8100)	(2.8788)	(2.8221)	(2.8096)	(2.8893)
Indus FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	14521	14521	14521	14521	14521	14521
A-R²	0.3996	0.3537	0.4240	0.3987	0.3524	0.4233

Table 5. OLS Regression Analysis Using t+2 Data of Dependent Variables

	(1)	(2)	(3)	(4)	(5)	(6)
	LnPatent	*LnPatent1*	*LnPatent2*	*LnPatent*	*LnPatent1*	*LnPatent2*
StaShar	0.0059***	0.0075***	0.0045***			
	(0.0015)	(0.0016)	(0.0015)			
SOE				0.1920***	0.2619***	0.1275*
				(0.0648)	(0.0671)	(0.0654)
Size	0.6795***	0.6614***	0.6314***	0.6818***	0.6630***	0.6343***
	(0.0246)	(0.0256)	(0.0249)	(0.0245)	(0.0254)	(0.0248)
Age	-0.0746	-0.1623*	-0.0470	-0.0679	-0.1560	-0.0397
	(0.0939)	(0.0962)	(0.0945)	(0.0938)	(0.0962)	(0.0944)
ROA	4.7280***	3.9181***	4.0789***	4.7056***	3.9040***	4.0482***
	(0.4593)	(0.4630)	(0.4682)	(0.4563)	(0.4546)	(0.4663)
Tangi	-0.2980	-0.5320***	0.0405	-0.2966	-0.5315***	0.0428
	(0.2025)	(0.2038)	(0.1926)	(0.2022)	(0.2038)	(0.1926)
Top1	-0.2690	-0.5068***	-0.0142	-0.1528	-0.3656**	0.0796
	(0.1805)	(0.1826)	(0.1808)	(0.1790)	(0.1810)	(0.1784)
Dual	0.0667	0.0941*	0.0087	0.0664	0.0964*	0.0059
	(0.0496)	(0.0507)	(0.0509)	(0.0502)	(0.0515)	(0.0514)
PoliCon	0.0079	0.0428	-0.0193	0.0111	0.0464	-0.0163
	(0.0475)	(0.0460)	(0.0493)	(0.0473)	(0.0459)	(0.0492)
Manage	0.3180**	0.2067	0.2997**	0.3036**	0.2020	0.2757**
	(0.1301)	(0.1272)	(0.1349)	(0.1347)	(0.1320)	(0.1386)
Growth	0.0308	0.0674*	0.0476	0.0333	0.0717*	0.0486
	(0.0427)	(0.0406)	(0.0429)	(0.0427)	(0.0405)	(0.0429)
HHI	6.7265***	6.1433***	5.7561***	6.7044***	6.1071***	5.7473***
	(1.6556)	(1.6272)	(1.6436)	(1.6543)	(1.6236)	(1.6437)
HHI2	-15.7491***	-13.0317***	-13.0806**	-15.8537***	-13.1308***	-13.1919**
	(5.2617)	(4.8583)	(5.3461)	(5.2622)	(4.8450)	(5.3566)
_cons	-11.7397***	-11.8411***	-11.5142***	-11.8365***	-11.9356***	-11.6144***
	(0.6157)	(0.6410)	(0.6109)	(0.6105)	(0.6352)	(0.6080)
Indus FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	11900	11900	11900	11900	11900	11900
A-R²	0.3877	0.3389	0.4167	0.3863	0.3368	0.4158

Table 6. Tobit Regression Analysis

	(1)	(2)	(3)	(4)	(5)	(6)
	LnPatent	*LnPatent1*	*LnPatent2*	*LnPatent*	*LnPatent1*	*LnPatent2*
StaShar	0.0044***	0.0050***	0.0041***			
	(0.0012)	(0.0013)	(0.0014)			
SOE				0.1617***	0.2167***	0.1638**
				(0.0566)	(0.0598)	(0.0644)
Size	0.6249***	0.6128***	0.6395***	0.6259***	0.6119***	0.6399***
	(0.0193)	(0.0205)	(0.0222)	(0.0194)	(0.0206)	(0.0223)
Age	-0.0369	-0.0784	-0.0436	-0.0355	-0.0811	-0.0440
	(0.0943)	(0.0994)	(0.1046)	(0.0946)	(0.0997)	(0.1049)
ROA	2.3316***	2.3012***	2.3920***	2.3182***	2.2932***	2.3822***
	(0.2553)	(0.2729)	(0.3068)	(0.2553)	(0.2729)	(0.3068)
Tangi	0.1782	-0.1460	0.4466***	0.1800	-0.1474	0.4463***
	(0.1242)	(0.1323)	(0.1456)	(0.1244)	(0.1324)	(0.1457)
Top1	-0.2132	-0.4178***	0.0163	-0.1431	-0.3422**	0.0795
	(0.1370)	(0.1451)	(0.1573)	(0.1348)	(0.1427)	(0.1546)
Dual	0.1319***	0.1594***	0.0668*	0.1345***	0.1646***	0.0700*
	(0.0315)	(0.0334)	(0.0372)	(0.0316)	(0.0336)	(0.0374)
PoliCon	0.0213	0.0085	0.0343	0.0234	0.0109	0.0361
	(0.0290)	(0.0308)	(0.0343)	(0.0290)	(0.0308)	(0.0343)
Manage	0.3497***	0.1955*	0.3037**	0.3514***	0.2129*	0.3125**
	(0.1035)	(0.1098)	(0.1195)	(0.1051)	(0.1115)	(0.1215)
Growth	-0.0454*	-0.0340	-0.0198	-0.0449*	-0.0325	-0.0190
	(0.0255)	(0.0271)	(0.0303)	(0.0255)	(0.0272)	(0.0304)
HHI	1.7891*	0.9305	2.6917**	1.7491*	0.8664	2.6475**
	(1.0352)	(1.1071)	(1.2457)	(1.0354)	(1.1071)	(1.2461)
HHI2	-5.5561*	-2.1565	-6.7954*	-5.4344*	-1.9705	-6.6776*
	(3.1429)	(3.3636)	(3.7656)	(3.1432)	(3.3633)	(3.7666)
_cons	-12.5134***	-13.0681***	-14.0604***	-12.6158***	-13.1472***	-14.1476***
	(0.5236)	(0.5535)	(0.5979)	(0.5226)	(0.5523)	(0.5960)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	14522	14522	14522	14522	14522	14522
Wald chi²	3951.4662	3084.6976	4186.5735	3940.5916	3078.4493	4180.1153

Table 7. PSM Regression Analysis

	(1)	(2)	(3)	(4)	(5)	(6)
	LnPatent	*LnPatent1*	*LnPatent2*	*LnPatent*	*LnPatent1*	*LnPatent2*
StaShar	0.0065***	0.0079***	0.0050***			
	(0.0014)	(0.0015)	(0.0014)			
SOE				0.2155***	0.2650***	0.1496**
				(0.0611)	(0.0627)	(0.0612)
Size	0.7012***	0.6747***	0.6469***	0.7036***	0.6775***	0.6500***
	(0.0230)	(0.0238)	(0.0230)	(0.0229)	(0.0237)	(0.0228)
Age	-0.0737	-0.1581*	-0.0453	-0.0669	-0.1502*	-0.0376
	(0.0895)	(0.0910)	(0.0901)	(0.0893)	(0.0910)	(0.0900)
ROA	4.1702***	3.7298***	3.4418***	4.1687***	3.7299***	3.4276***
	(0.4097)	(0.4095)	(0.4189)	(0.4056)	(0.4014)	(0.4157)
Tangi	-0.2753	-0.5625***	0.0706	-0.2769	-0.5647***	0.0710
	(0.1887)	(0.1889)	(0.1804)	(0.1889)	(0.1892)	(0.1808)
Top1	-0.2508	-0.4673***	-0.0277	-0.1394	-0.3327*	0.0654
	(0.1710)	(0.1722)	(0.1690)	(0.1695)	(0.1711)	(0.1668)
Dual	0.0922**	0.0990**	0.0369	0.0933**	0.1008**	0.0350
	(0.0456)	(0.0468)	(0.0468)	(0.0462)	(0.0475)	(0.0473)
PoliCon	0.0165	0.0331	-0.0051	0.0190	0.0360	-0.0026
	(0.0445)	(0.0427)	(0.0463)	(0.0443)	(0.0428)	(0.0463)
Manage	0.3769***	0.2353**	0.3210**	0.3670***	0.2253*	0.2999**
	(0.1213)	(0.1191)	(0.1267)	(0.1253)	(0.1234)	(0.1297)
Growth	-0.0008	0.0212	0.0171	0.0009	0.0235	0.0174
	(0.0411)	(0.0383)	(0.0401)	(0.0410)	(0.0382)	(0.0401)
HHI	4.5700***	3.4997**	4.5555***	4.6048***	3.5406**	4.5916***
	(1.5613)	(1.5525)	(1.5486)	(1.5589)	(1.5477)	(1.5492)
HHI2	-10.0543**	-6.7282	-9.8796*	-10.3210**	-7.0493	-10.1107*
	(5.1097)	(4.7897)	(5.2506)	(5.1050)	(4.7744)	(5.2573)
_cons	-12.2286***	-12.0954***	-11.8989***	-12.3349***	-12.2207***	-12.0086***
	(0.5718)	(0.5954)	(0.5656)	(0.5675)	(0.5919)	(0.5630)
Indus FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
N	14045	14045	14045	14045	14045	14045
Adjust-R²	0.3973	0.3469	0.4237	0.3957	0.3444	0.4226

Table 8. The Interaction between State Shareholding and Insiders' Strategic Control

	(1)	(2)	(3)	(4)
	LnPatent	*LnPatent1*	*LnPatent*	*LnPatent1*
StaShar	0.0065***	0.0079***		
	(0.0015)	(0.0015)		
SOE			0.2196***	0.2706***
			(0.0624)	(0.0638)
STEM	0.3627***	0.4587***	0.3436***	0.4234***
	(0.0847)	(0.0878)	(0.0860)	(0.0877)
*Sta*STEM*	-0.0073**	-0.0072*		
	(0.0034)	(0.0037)		
*SOE*STEM*			-0.2724*	-0.2166
			(0.1560)	(0.1711)
Size	0.6960***	0.6697***	0.6975***	0.6709***
	(0.0232)	(0.0238)	(0.0231)	(0.0236)
Age	-0.0545	-0.1298	-0.0483	-0.1230
	(0.0883)	(0.0895)	(0.0881)	(0.0895)
ROA	4.1615***	3.7150***	4.1533***	3.7089***
	(0.4090)	(0.4093)	(0.4053)	(0.4010)
Tang	-0.2805	-0.5331***	-0.2785	-0.5335***
	(0.1886)	(0.1878)	(0.1886)	(0.1878)
Top1	-0.2465	-0.4661***	-0.1430	-0.3398**
	(0.1701)	(0.1700)	(0.1690)	(0.1690)
Dual	0.1080**	0.1180**	0.1086**	0.1198**
	(0.0450)	(0.0460)	(0.0456)	(0.0467)
PoliCon	0.0085	0.0254	0.0111	0.0280
	(0.0446)	(0.0422)	(0.0445)	(0.0423)
Manage	0.2949**	0.1608	0.2887**	0.1598
	(0.1198)	(0.1155)	(0.1236)	(0.1195)
Growth	-0.0116	0.0090	-0.0084	0.0132
	(0.0401)	(0.0371)	(0.0400)	(0.0370)
HHI	4.2140***	3.4921**	4.2316***	3.5021**
	(1.5216)	(1.5019)	(1.5182)	(1.4979)
HHI2	-9.2893**	-6.9156	-9.4603**	-7.0842
	(4.7326)	(4.4330)	(4.7253)	(4.4173)
_cons	-12.1740***	-12.1122***	-12.2574***	-12.1984***
	(0.5749)	(0.5925)	(0.5707)	(0.5884)
Indus FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	14521	14521	14521	14521
Adjust- R^2	0.3979	0.3528	0.3965	0.3506

Table 9. The Interaction between State Shareholding and Retained Profits Distribution

	(1)	(2)	(3)	(4)
	LnPatent	*LnPatent1*	*LnPatent*	*LnPatent1*
StaShar	0.0067***	0.0080***		
	(0.0015)	(0.0015)		
SOE			0.2233***	0.2762***
			(0.0642)	(0.0643)
LnFincom	0.7500***	0.7637***	0.7008***	0.7169***
	(0.0855)	(0.0853)	(0.0910)	(0.0886)
*Sta*LnFinC*	-0.0072***	-0.0067**		
	(0.0026)	(0.0029)		
*SOE*LnFinC*			-0.1909	-0.1737
			(0.1231)	(0.1293)
Size	0.6944***	0.6693***	0.6958***	0.6706***
	(0.0228)	(0.0234)	(0.0227)	(0.0233)
Age	-0.0255	-0.1009	-0.0236	-0.0988
	(0.0865)	(0.0878)	(0.0864)	(0.0878)
ROA	4.1765***	3.7509***	4.1694***	3.7492***
	(0.4052)	(0.4065)	(0.4019)	(0.3982)
Tangi	-0.2974	-0.5486***	-0.2950	-0.5469***
	(0.1861)	(0.1856)	(0.1860)	(0.1856)
Top1	-0.2206	-0.4412***	-0.1266	-0.3258*
	(0.1673)	(0.1671)	(0.1665)	(0.1663)
Dual	0.0880**	0.0965**	0.0921**	0.1023**
	(0.0444)	(0.0455)	(0.0450)	(0.0462)
PoliCon	0.0153	0.0350	0.0176	0.0376
	(0.0438)	(0.0413)	(0.0436)	(0.0414)
Manage	0.2882**	0.1610	0.2915**	0.1688
	(0.1185)	(0.1152)	(0.1221)	(0.1190)
Growth	-0.0422	-0.0215	-0.0394	-0.0177
	(0.0391)	(0.0362)	(0.0391)	(0.0360)
HHI	3.9094***	3.1462**	3.9052***	3.1392**
	(1.5119)	(1.4854)	(1.5091)	(1.4810)
HHI2	-8.8435*	-6.3195	-8.8730*	-6.3737
	(4.6815)	(4.3575)	(4.6806)	(4.3452)
_cons	-12.2934***	-12.2561***	-12.3558***	-12.3278***
	(0.5665)	(0.5858)	(0.5627)	(0.5821)
Indust FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N	14518	14518	14518	14518
A-R²	0.4064	0.3615	0.4049	0.3594

Table 10. The Interaction between State Shareholding and Internal vs. External Financing

	(1)	(2)	(3)	(4)
	LnPatent	*LnPatent1*	*LnPatent*	*LnPatent1*
StaShar	0.0059***	0.0072***		
	(0.0022)	(0.0021)		
SOE			0.1303	0.0065***
			(0.0946)	(0.0015)
FinStr	0.1082	-0.0012	0.0444	
	(0.0864)	(0.0854)	(0.0892)	
StaShar×FinStr	-0.0002	0.0008		
	(0.0034)	(0.0036)		
SOE×FinStr			0.1831	0.3627***
			(0.1496)	(0.0847)
Size	0.6816***	0.6605***	0.6818***	0.6960***
	(0.0264)	(0.0273)	(0.0264)	(0.0232)
Age	-0.0452	-0.1423	-0.0411	-0.0545
	(0.0962)	(0.0980)	(0.0960)	(0.0883)
ROA	4.5505***	4.3295***	4.5444***	4.1615***
	(0.4536)	(0.4681)	(0.4501)	(0.4090)
Tangi	-0.2059	-0.4844**	-0.1918	-0.2805
	(0.2097)	(0.2067)	(0.2093)	(0.1886)
Top1	-0.2801	-0.5028***	-0.1744	-0.2465
	(0.1846)	(0.1862)	(0.1830)	(0.1701)
Dual	0.1300***	0.1462***	0.1330***	0.1080**
	(0.0491)	(0.0508)	(0.0499)	(0.0450)
PoliCon	0.0051	0.0319	0.0080	0.0085
	(0.0482)	(0.0460)	(0.0481)	(0.0446)
Manage	0.2190*	0.1338	0.2405*	0.2949**
	(0.1321)	(0.1288)	(0.1365)	(0.1198)
Growth	-0.0123	-0.0151	-0.0122	-0.0116
	(0.0447)	(0.0417)	(0.0446)	(0.0401)
HHI	2.3741	1.5620	2.3486	4.2140***
	(1.7022)	(1.7055)	(1.6997)	(1.5216)
HHI2	-3.5240	-1.7065	-3.6359	-9.2893**
	(5.1897)	(4.8768)	(5.1839)	(4.7326)
_cons	-11.7592***	-11.7313***	-11.7860***	-12.1740***
	(0.6647)	(0.6887)	(0.6624)	(0.5749)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
N.	11561	11561	11561	14521
A-R²	0.3909	0.3536	0.3900	0.3979