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Product market competition, state ownership and internal control quality*

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ABSTRACT

Based on a sample of Chinese A-share listed firms on the Shenzhen Stock Exchange and the Shanghai Stock Exchange between 2007 and 2012, we examine the effect of product market competition on the internal control quality of Chinese listed firms and the difference in this effect between state owned firms and non-state owned firms. Using the internal control index constructed by Chen et al. (2013) as the proxy for internal control quality, we find that product market competition has a significant effect on the internal control quality of Chinese listed firms: the more intense the product market competition is, the higher the internal control quality will be. However, the effect is only significant for non-state owned firms, not for state owned firms. In addition, we find that high quality internal control can improve product market competition advantage, providing support for our main findings. Overall, our study extends the literature on internal control and product market competition, provides evidence on whether internal control can help firms realise their development strategies, and offers advice to related government departments and firms on improving internal control quality.

1. Introduction

Since the Sarbanes-Oxley Act of 2002 (SOX), enacted by the United States Congress, internal control has received considerable attention from corporations and governments worldwide, and it has also become a hot topic among accounting scholars. For the most part, recently, studies of internal control have aimed at testing the effect of Section 404 of the Sarbanes-Oxley Act (SOX 404), which is designed to increase the reliability of financial reporting through internal control (Donaldson, 2005; Public Company Accounting Oversight Board, 2004), helping investors make better decisions.[1] Therefore, many studies have focused on

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[1]SOX 404 (a) requires management to file a report on the company's internal control over financial reporting (ICFR). The management report must include (1) a statement of management's responsibility for ICFR, (2) management's assessment of the effectiveness of ICFR, and (3) a statement identifying the framework used by management. SOX 404 (b) requires the auditor to issue an attestation report on management's assessment of the company's ICFR.

the relationship between internal control over financial reporting (ICFR) and capital markets and measure the quality of ICFR by whether a firm has (discloses) material weaknesses of its internal control (see, for example, Chan, Farrell, & Lee, 2008; Doyle, Ge, & McVay, 2007; Skaife, Veenman, & Wangerin, 2013). However, Chinese regulations on internal control,[2] such as *The Basic Standards of Enterprise Internal Control*, enacted in 2008 and dubbed the Chinese version of SOX 404, focus primarily on controlling firms' risks and building a modern enterprise system through establishing internal control systems.

Relative to SOX 404's focus on financial reporting objective, the Chinese SOX 404 is intended to encompass other categories, not only including the financial reporting objective, but also including compliance with applicable laws and regulations, safeguarding of assets, effectiveness and efficiency of operations and promotion of enterprise development strategy.[3] As internal control is expanded to include more functions and expectations in China, more attention should be payed to the influence of internal control on a firm's operation and development, such as improvement of operational effectiveness and efficiency and promotion of enterprise development strategy, from the product market perspective. In this context, firms may have different motivations for building internal control systems, and as a result, the effect and influence of internal control may vary greatly among different firms. However, studies on the association between internal control and the product market have been rare up until now.

Product market competition has proven to be an important market competition mechanism and an external restriction mechanism of corporate governance. Its impact on a firm's strategic decisions and value has increasingly drawn attention. According to relative literature, product market competition can affect a company's capital structure adjustment (Campello, 2006; Jiang, Qu, Lu, & Li, 2008), investment mode selection (Akdoğu & MacKay, 2008), mergers and acquisitions (Shahrur, 2005), insider trading (Tookes, 2008), disclosure policy choice (Botosan & Stanford, 2005), risk management strategy (Haushalter, Klasa, & Maxwell, 2007), and asset pricing (Hou & Robinson, 2006). This raises the question of whether product market competition can affect the construction and implementation of a firm's internal control, and if so, what the consequences and mechanisms of this effect are. The answers to these questions are still not known. However, we expect that product market competition will affect the decisions and behaviour of shareholders and managers through the threat of liquidation effect and agency costs effect, and further influence the internal control quality. The more intense the product market competition is, the higher the internal control quality will be.

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[2]In 2006, the Shanghai Stock Exchange (SSE) and the Shenzhen Stock Exchange (SZSE) issued the Guideline of Internal Controls for Listed Firms, respectively. In 2008, *The Basic Standards of Enterprise Internal Control* was issued by the Committee on Internal Control Standards jointly established by five Chinese government authorities and regulatory bodies, including the Ministry of Finance (MOF), the China Securities Regulatory Commission (CSRC), the National Audit Office (NAO), the China Banking Regulatory Commission (CBRC), and the China Insurance Regulatory Commission (CIRC). To prepare firms to comply with the *Basic Standards of Enterprise Internal Control,* the Committee on Internal Control Standards further released *Supplemental Guidelines o*f Firms' Internal Controls on April 26, 2010, and formulated an implementation schedule: from January 1, 2011 companies dual-listed on stock exchanges, both in China and abroad, were expected to implement the regulations; from January 1, 2012 companies listed on the main board of the Shanghai Stock Exchange and the Shenzhen Stock Exchange were expected to follow the regulations; companies listed at the small and medium sized board and growth enterprise market were expected to implement the regulations at the proper time; large and medium unlisted companies are encouraged to implement the regulations in advance.

[3]According to the Basic Standards of Enterprise Internal Control, the five objectives of internal control in China are the following: compliance with applicable laws and regulations; safeguarding of assets; reliability of financial reporting; effectiveness and efficiency of operations and promotion of enterprise development strategy.

At present in China, both the market and the government can influence the national economy. For the sake of economic performance and political promotion, government officials may shelter state owned firms. For example, local governments may protect state owned firms from market competition through various institutional measures such as administrative monopoly barriers (Yu & Fu, 2008; Zhang, Ren, & Hua, 2011) in which state owned firms can easily obtain subsidies, bank loans, and stock market financing opportunities (Lin & Li, 2004). As a result, firms with dissimilar property rights may perform differently when they face product market competition. Specifically, when it comes to the construction and implementation of internal control, the motivation and actual execution of them among these enterprises may vary. This raises another question of whether the impact of product market competition on internal control quality varies among firms with different types of property rights. Liu, Luo, He, and Chen (2012) find that differences in the level of marketisation between provinces have a significant impact on the internal control quality of both non-state owned firms and local government owned firms. However, this does not answer the question of whether the effect of product market competition on internal control quality varies among firms with different types of property rights.[4] We expect that the effect of product market competition on internal control quality is greater for non-state owned firms than for state owned firms.

Using the internal control index constructed by Chen, Dong, Han, and Zhou (2013) as the proxy for internal control quality, we examine the effect of product market competition on the internal control quality of Chinese listed firms and the difference this effect has on state owned firms and non-state owned firms. We find that product market competition has a significant effect on the internal control quality of Chinese listed firms: the more intense the product market competition is, the higher the internal control quality will be. However, this effect is only significant for non-state owned firms, not for state owned firms. Further, we find that high quality internal control can improve product market competition advantage.

Our study contributes to the literature and practice in several important ways.

First, it enriches the literature on product market competition and internal control. We not only answer the question of whether and how product market competition affects internal control quality, but also answer the question of whether the effect of product market competition on internal control quality varies between firms with different ownership structures.

Second, our study provides empirical evidence to support the proposition that internal control can help a firm realise its development strategy. Miao, Yang, and Wang (2014) use

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[4]Liu et al. (2012) measure marketisation by the marketisation index constructed by Fan, Wang, Zhang, and Zhu (2003). The marketisation index measures the level of marketisation in different provinces through five aspects: the relationship between government and the market, the development of non-state owned firms, the development of a product market, the development of a factor market, and the development of market intermediary and law and institutional environment. Fan et al. (2003) point out that marketisation is a system reform in the process of the transition from planned economy to market economy in China and that marketisation is not a simple change of regulations but a series of reforms of economy, society, law and even the political system. Therefore, marketisation in Liu et al. (2012) is a system reform reflecting the institutional differences in different provinces and a macroscopic institutional factor in country or region level. However, the product market competition in this paper is more regarded as an external restriction mechanism of corporate governance and has become a hot and independent research topic. Thus marketisation in Liu et al. (2012) and product market competition in this paper belong to different category. Besides, Liu et al. (2012) treat state ownership as an important determinant of internal control quality, but this paper focuses on the moderating effect of state ownership on the association between product market competition and internal control quality.

survey responses to assess the difference between the expected effect and the actual effect of internal control and find agreement among their respondents that promotion of a firm's development strategy should be the most important objective of internal control, but that the effect of internal control on promoting a firm's development strategy is not optimistic in practice. Therefore, the result of our study on the association between internal control quality and product market competition advantage provides new empirical evidence on whether internal control can advance the realisation of a firm's development strategy.

Finally, our findings will enlighten relative regulators and firms. In promoting the construction of internal control systems and modern enterprise systems, related departments and regulatory agencies should pay attention to the optimisation and upgrading of the Chinese industrial structure and give full play to the external governance role of product market competition. The management of Chinese firms should also change their skeptical attitudes toward the positive effects of internal control and recognise the importance of strengthening the construction of them.

The remainder of the paper is organised as follows. Section 2 discusses the related literature and develops the hypothesis. Section 3 describes the research methodology. Section 4 presents the empirical results. Sections 5 presents the results of robustness tests. Section 6 concludes the paper.

2. Related literature and hypothesis development

2.1. Product market competition and internal control quality

As a market competition mechanism, product market competition can increase the probability that a firm with high costs becomes unprofitable and must be liquidated, inducing managers to work hard to keep their jobs, and to avoid the disutility of liquidation. This is the threat of liquidation effect of product market competition. As an external restriction mechanism of corporate governance, product market competition can influence agency costs between controlling shareholders and minority shareholders, and between shareholders and managers. This may affect the behaviour of shareholders and managers, which may then affect a firm's operational decisions and performance. This is the agency costs effect of product market competition. As we know, shareholders and managers are vital to the construction and implementation of internal control.[5] The concern of managers is an important fact that affects internal control quality (Zhang, Ji, & Sun, 2013). Therefore, product market competition can affect internal control quality by affecting the behaviour of shareholders and managers through the threat of liquidation effect and the agency costs effect.[6]

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[5]According to the *Basic Standards of Enterprise Internal Control*, internal control is a process, affected by an entity's board of directors, board of supervisors, management, and all employees, designed to achieve the objectives of internal control. The board of directors is responsible for establishing and perfecting the internal control system and effectively implementing the internal control system. The board of supervisors is responsible for monitoring the establishment and implementation of internal control. Management is responsible for the daily operation of the internal control system. At the same time, according to the company law, the company's board of directors and board of supervisors are composed of representative shareholders and employees.

[6]According to the *Basic Standards of Enterprise Internal Control*, the internal control deficiencies include deficiencies in the design and deficiencies in the operation, so the internal control quality can be reflected by the design quality and operation quality. At the same time, internal control includes five underpinning components: control environment; risk assessment; control activities; information and communication; and monitoring. Accordingly, to some extent, the internal control quality can be reflected by the quality of the five underpinning components.

Our first point is that fierce product market competition can not only reduce a firm's profits, but also expose a firm to more liquidity risks (Hou & Robinson, 2006), thereby increasing the probability of losses and bankruptcy. As a result, both shareholders and managers have a strong incentive to find effective methods, such as increasing cash holdings (Han & Zhou, 2011), providing commercial credit (Fisman & Raturi, 2004; Yu & Pan, 2010) and optimising capital structure (Jiang et al., 2008), to improve their operating efficiency and competitiveness in coping with the risks brought on by product market competition. Coincidently, the purpose of internal control is to promote the sustainable development of a firm by improving its management quality and risk prevention ability. A significant body of empirical evidence has shown that effective internal control can achieve these desired objectives. In particular, Cheng, Dhaliwal, and Zhang (2013) and Li, Lin, and Song (2011) have found that effective internal control may inhibit inefficient investments. Cheng, Goh, and Kim (2014) and Feng, Li, McVay, and Skaife (2015) have additionally found that high quality internal control can improve firm's operational efficiency. Thus we firmly believe that, given the Chinese government's vigorous promotion of the construction and implementation of internal control, for firms in industry with intense product market competition, their board of directors will have a strong motivation for construction of internal control, which will help improve the design quality of the internal control system; and their managers will take their obligations seriously and will work with employees to implement internal control activities and improve the operation quality of the internal control system, which will improve the quality of financial reporting and operational efficiency, helping firms cope with intense competition.

Our second point is that intense product market competition can lower the information asymmetry between shareholders and managers, and as a result reduce agency costs, which is the positive agency costs effect. Specifically, Hart (1983) and Nalebuff and Stiglitz (1983) contend that the larger the number of industry peers is, the greater the amount of information is available to principals for more accurate monitoring and performance evaluation of managers, thereby leading to a mitigation of moral hazard. Thus the positive agency costs effect of product market competition can urge managers to work more diligently. As for the construction and implementation of internal control, when faced with intense product market competition, managers will diligently work with employees to construct and implement internal control to improve the internal control quality and to accomplish the objectives of internal control, and as a result to cope with the intense product market competition. To understand this mechanism, we should know the special background of the internal control implementation and the *Basic Standards of Enterprise Internal Control* and its *Supplemental Guidelines* in China. Firstly, the purpose of internal control is to achieve the internal control objectives. In China, besides the financial reporting objective, improving financial reporting quality, reducing information asymmetry and mitigating agency problems, the internal control objectives also include compliance with applicable laws and regulations, safeguarding of assets, effectiveness and efficiency of operations and promotion of enterprise development strategy. Therefore, the accomplishment of the internal control objectives can help improve a firm's product market competition advantage. Secondly, internal control is a process, designed to optimise a firm's control environment, risk assessment, control activities, information and communication, and monitoring. As the process covers a firm's cash flow, material flow, human flow and information flow, the process of improving internal control

quality is also a process of integrating and optimising a firm's various resources, which plays an important role in improving a firm's product market competitive advantage. Lastly, managers are vital to the daily operation of the internal control system and whether they are diligent in the implementation of internal control plays an important role in the internal control quality. Therefore, as the positive agency costs effect of product market competition can urge managers to work more diligently and in terms of the important role of internal control in promoting product market competition advantage and in helping firms cope with product market competition, when faced with fierce product market competition, managers will diligently work with employees to construct and implement the internal control to improve the internal control quality.

However, product market competition also has a negative agency costs effect, which reduces managers' initiative in work and increase the agency costs. Schmidt (1997) find that an increase in competition induces managers to work hard in order to avoid the disutility of liquidation, but, it also reduces managers' initiative in work because a reduction in profits caused by an increase in competition may lower the value of a cost reduction and thus also the benefit of inducing higher effort. When product market competition becomes intense, managers may be prone to adjust profits by earnings management as a result of increasing their own private benefits, avoiding reporting losses or achieving special profit objectives (Chen & Xu, 2011; Datta, Iskandar-Datta, & Singh, 2013). Especially in China, where capital markets are not efficient and the legal system is not perfect, managers of listed firms may have a strong incentive to manipulate profits if they need to because they face less supervision from unsophisticated individual investors and a weaker supervisory system. Coincidently, relative studies find that high quality internal control can inhibit both accruals earnings management and real earnings management (Altamuro & Beatty, 2010; Dong & Chen, 2011; Doyle et al., 2007; Fang & Jin, 2011) and as a result mitigate information asymmetry and improve financial reporting quality (Nagy, 2010). Therefore, when faced with intense product market competition, shareholders will have stronger incentives to improve internal control quality to enhance internal supervision and standardise control activities, through which to mitigate agency problems, preventing managers from manipulating profits and urging managers to carry out their duties diligently, and to effectively cope with intense product market competition.

Based on the above analysis, we expect that product market competition will have a positive effect on internal control quality: the more intense the product market competition is, the higher the internal control quality will be.

2.2. Product market competition, state ownership and internal control quality

Though we expect that product market competition will have a positive effect on internal control quality, the effect may vary in firms with different ownership structures. First, the product market competition environment may vary, depending on whether or not firms are state owned. On the one hand, as a consequence of deep reform in China, state owned firms are gradually being grouped into strategic industries and key areas related to the national economic lifeline through cartels, mergers and acquisition, and restructuring. They are gradually being withdrawn from general competitive industries. On the other hand, for the sake of economic performance and political promotion, local government officials may shelter

state owned firms from market competition through various institutional measures such as administrative monopoly barriers (Yu & Fu, 2008; Zhang et al., 2011). Therefore, the product market competition pressure may be greater for non-state owned firms than for state owned firms, and the effect of product market competition on internal control quality may be greater in non-state owned firms than in state owned firms.

Second, the ability to cope with the threat of liquidation, caused by intense product market competition, may vary among firms with different ownership structures. Intense product market competition may expose a firm to more liquidity risk and increase its probability for loss and bankruptcy. Social stability or policy burdens such as maintaining employment and providing public goods may lead to soft budget constraints in state owned firms and as a result state owned firms may easily obtain subsidies, bank loans, and stock market financing opportunities (Lin & Li, 2004). State owned firms whose performance declines or who have a large deficit are more likely to obtain subsidies from the government (Dong & Putterman, 2003), to get more bank loans with lower interest rates and less limiting terms (Brandt & Li, 2003), and to receive priority for going public (Aharony, Lee, & Wong, 2000). Kong, Liu, and Wang (2013) find that the more intense the product market competition is, the more subsidies state owned firms can receive from the government. Therefore, as state owned firms have adequate resources and policy advantages to cope with the threat of liquidation caused by intense product market competition, they may lack strong motivation to cope with this threat by improving their internal control quality. When it comes to non-state owned firms, the situation is different. These firms cannot get a helping hand from the local or central government when they are facing liquidation. The shareholders themselves must take all of the operational risks and losses upon themselves. Hence, in terms of risk control, non-state owned firms have a more urgent need to improve their internal control quality to manage risk, in accordance with the requirements of the regulators, changes in the market environment, and the reality of their own development. Especially, when the product market competition is intense, as the risks and uncertainty become larger and more serious, firms urgently need to improve their internal control quality to increase operational efficiency to cope. Therefore, the effect of product market competition on internal control quality through the threat of liquidation effect may be greater in non-state owned firms than in state owned firms.

Finally, the effect of product market competition on internal control quality in terms of the agency costs effect may vary in firms with different types of ownership structures. One should remember, the controlling shareholder of state owned firms is the government, representing all Chinese people. This public property attribute determines its confused agency relationship: there is "separation of ownership and control" at both the principal level and the agent level. At the same time, governments provide financial and policy support to state owned firms through soft budget constraints. Both the confused agency relationship and the soft budget constraints in state owned firms weaken or even deactivate the positive and negative agency costs effects of product market competition. In contrast, the agency relationship in non-state owned firms is more simple and clear, and there are no soft budget constraints. Thus, the effect of product market competition on internal control quality by agency costs effect may be greater in non-state owned firms than in state owned firms.

Based on the above analysis, we put forward our hypothesis:

H: Product market competition has a positive effect on internal control quality: other things being equal, the more intense the product market competition is, the higher the internal control quality will be. The effect is more significant in non-state owned firms than in state owned firms.

3. Research design

3.1. Data

For our sample, we chose Chinese A-share listed firms from both the Shenzhen Stock Exchange and the Shanghai Stock Exchange between 2007 and 2012. Firm-year observations from financial industries, being specially treated, and with missing data on our main variables are all excluded from the sample. Our final sample contains 9,475 firm-year observations. The data used to calculate product market competition and other financial data are all from the dataset of CCER (China Center for Economic Research) and CSMAR (China Stock Market & Accounting Research). The internal control index used as the proxy for internal control quality is from Chen et al. (2013). The internal control index is available from 2007 to the current year. All continuous variables are winsorized at the 1% and 99% levels to reduce the effects of outliers.

3.2. Variables definition

Internal control quality. We use the internal control index constructed by Chen et al. (2013) as the proxy for internal control quality. Specifically, we use the natural logarithm of the internal control index to measure the internal control quality (*IC_quality*). The larger the index is, the higher the internal control quality is. The index not only includes the main internal control index, but also includes five sub-indexes (control environment, risk assessment, control activities, information and communication, and monitoring). The internal control index uses the COSO components—control environment, risk assessment, control activities, information and communication, and monitoring—as the five first-level criteria, and then the five first-level criteria are further divided into 24 second-level criteria, 43 third-level criteria, and 144 fourth-level criteria. The 144 fourth-level criteria are scored according to the information manual collected through the annual financial reports of listed firms, media websites and other open ways. Finally, the analytic hierarchy process (AHP) is used to transform the qualitative information obtained in the four levels of the evaluation system into a quantitative measurement of a firm's internal control.[7]

[7]Chen et al. (2013) gives detailed introduction of the internal control index, including the construction principle, method and framework. Although the index was constructed using public data and information, it not only measures the internal control information disclosure quality, but measures a firm's overall internal control quality with the detailed criteria of the index covering most of the information of the five internal control components.

As for the validity of the internal control index, for one thing, Chen et al. (2013) validates the internal control index by confirming the known relation between internal control quality and earnings management and documents a negative association between internal control quality and earnings management. For another, the index has been accepted by *European Accounting Review,* where. Chen, Chan, Dong, and Zhang (2016) published their paper "Internal Control and Stock Price Crash Risk: Evidence from China". Using the internal control index as the proxy for internal control quality, Chen et al. (2016) examines the role played by internal control in alleviating future stock price crash risk and finds that internal control is negatively associated with future stock price crash risk. Specifically, control environment, information and communication, and monitoring are significantly and negatively associated with future stock price crash risk. The findings highlight internal control as a mechanism in preventing a stock price crash.

Product market competition. Following Chemmanur and He (2011), Giround and Mueller (2011), Peress (2010), Yu and Pan (2010) and Wu, Yang, and Wei (2012), we establish proxies for product market competition using three different measures, including the entropy index (*Entropy_index*), number of firms in an industry (*Number_of_firms*) and four-firm concentration ratio (*Concentration4*). We use *the industry classification guidance of listed companies (2012 edition)* issued by the *China Securities Regulatory Commission (CSRC)*, to classify the industries. Specially, in order to more accurately measure the product market competition, we use all the listed firms to measure the product market competition in an industry. After excluding the firm-year observations with missing data, we finally get 12814 firm-year observations.

State ownership. We use the nature of the ultimate controller of a firm to judge the nature of the firm. The data of the ultimate controller of a firm can be obtained from the dataset of CCER. We set an indicator variable (*State_ownership*) for state owned firms with a value of one if a firm is state owned, and zero otherwise.

Control variables. Following Doyle et al. (2007), Liu et al. (2012) and Skaife, Collins, Kinney, and LaFond (2008), we control for the following variables: firm size (*Size*), firm inventory (*Inventory*), return on equity (*ROE*), firm growth (*Growth*), firm age (*Age*), firm business segments (*Bsegment*), foreign sales (*Export*), Auditor firm (*Big4*), mergers and acquisitions (*M&A*), restructuring (*Restructuring*) and year effect (*Year*).

The detailed definition of the main variables is in Table 1.

3.3. Regression model specification

Following Doyle et al. (2007) and Liu et al. (2012), we estimated the following model to test our hypothesis. In all the regressions, the *p*-values are computed using standard errors, adjusted for clustering by firm.

$$IC\_quality = \beta_0 + \beta_1 \, Competition + \beta_2 \, State\_ownership + \beta_i \, Controls + \varepsilon \qquad (1)$$

where *IC_quality* is the logarithm of the internal control index; *Competition* is product market competition with the above three measures as the proxy; *State_ownership* is an indicator variable for state owned firms and has a value of one if a firm is state owned and zero otherwise; *Controls* are control variables mentioned above.

4. Empirical results

4.1. Descriptive statistics

Table 2 presents the year distribution and ownership distribution of our sample firms. The number of listed firms in China increased year by year from 2007 to 2012. The percentage of non-state owned firms increased from 34.13% in 2007 to 56.98% in 2012. The results mean that the reform of state-owned firms in China has won an initial success and more firms participate in the product market competition. In general, the number of non-state owned firms is less than state owned firms.

Table 3 reports the descriptive statistics on the main variables in the full sample, the state owned firms sample and the non-state owned firms sample, respectively. The mean (median) of *IC_quality* is 3.64 (3.68) in the state owned firms sample, but the mean (median) of *IC_quality* is 3.65 (3.70) in the non-state owned firms sample. We conduct a *t*-test (Wilcoxon test) to

Table 1. Definitions of the main variables.

Variables	Definition
Dependent variable	
IC_quality	Internal control quality. The natural logarithm of the internal control index constructed by Chen et al. (2013)
Independent variables	
Entropy_index	Entropy Index. The entropy index assigns a weight $\ln(1/S_f)$ to each firm's market share S_f, and is computed as the sum of that weighted market shares in a specific industry

$$Entropy\_index = \sum_{f=1}^{n} S_f \ln(1/S_f)$$

where S_f is the market share of firm f in its industry (the market share is calculated as a firm's sales to the sum of all the firms' sales in an industry. n is the number of firms in an industry. The larger the score of *Entropy_index* is, the lower the industry concentration is and the more intense the competition is

| Number_of_firms | Number of firms in an industry. We employ the logarithm of the number of firms in an industry as an alternative proxy for competition. The larger the score of *Number_of_firms* is, the lower the industry concentration is and the more intense the competition is |
| Concentration4 | Four-firm Concentration Ratio. We measure concentration as the fraction of entire industry sales that is accounted for by the aggregate sales of the four largest firms in the industry |

$$Concentration4 = \left(\sum_{i=1}^{4} S_i \right)/S$$

where S is the sum of all the firms' sales in an industry. The smaller the score of *Concentration4* is, the lower the industry concentration is and the more intense the competition is

State_ownership	State ownership. An indicator variable that takes a value of one if the firm is state owned, zero otherwise
Control variables	
Size	The natural logarithm of the mean of a firm's total assets in the fiscal year end and the lagged total assets
Inventory	The mean of a firm's total inventory in the fiscal year end and lagged total inventory scaled by total assets
ROE	The ratio of net income to common stockholders' equity
Growth	The ratio of operating income to the lagged operating income minus one
Lage	The natural logarithm of one plus the number of years since a firm first listed at a Stock Exchange
Bsegment	The natural logarithm of a firm's business segments for fiscal year t
Export	An indicator variable that takes a value of one if a firm has foreign sales for fiscal year t, and zero otherwise
Big4	An indicator variable that takes a value of one if a firm's auditor is a Big 4 audit firm for fiscal year t, and zero otherwise
M&A	An indicator variable that takes a value of one if a firm is involved in mergers and acquisitions for fiscal year t, and zero otherwise
Restructuring	An indicator variable that takes a value of one if a firm is involved in restructuring for fiscal year t, and zero otherwise

Table 2. Annual distribution of sample firms by state ownership.

Year	No. of obs.	State owned firms		Non-state owned firms	
		No. of obs.	%	No. of obs.	%
2007	1,172	772	65.87	400	34.13
2008	1,309	826	63.10	483	36.90
2009	1,383	844	61.03	539	38.97
2010	1,524	860	56.43	664	43.57
2011	1,881	898	47.74	983	52.26
2012	2,206	949	43.02	1,257	56.98
Total	9,475	5,149	54.34	4,326	45.66

Table 3. Descriptive statistics.

	All firms			State owned firms			Non-state owned firms		
	Mean	Median	STD	Mean	Median	STD	Mean	Median	STD
IC_quality	3.65	3.69	0.27	3.64	3.68	0.28	3.65	3.70	0.26
Entropy_index	3.84	3.98	0.94	3.76	3.91	0.94	3.95	4.22	0.93
Number_of_firms	0.36	0.28	0.18	0.37	0.29	0.19	0.34	0.28	0.17
Concentration4	5.02	5.05	0.82	4.92	4.99	0.80	5.15	5.31	0.83
Size	21.73	21.56	1.23	22.11	21.90	1.29	21.27	21.14	0.96
Inventory	0.16	0.13	0.15	0.16	0.13	0.14	0.17	0.13	0.16
ROE	0.07	0.08	0.13	0.07	0.07	0.14	0.08	0.08	0.11
Growth	0.24	0.14	0.63	0.23	0.14	0.60	0.25	0.15	0.67
Lage	2.06	2.30	0.76	2.32	2.48	0.56	1.74	1.79	0.83
Bsegment	2.52	1.00	2.23	2.78	2.00	2.41	2.20	1.00	1.93
Big4	0.06	0.00	0.23	0.08	0.00	0.28	0.03	0.00	0.16
Export	0.04	0.00	0.20	0.03	0.00	0.18	0.05	0.00	0.21
M&A	0.47	0.00	0.50	0.46	0.00	0.50	0.48	0.00	0.50
Restructuring	0.26	0.00	0.44	0.25	0.00	0.44	0.26	0.00	0.44

Subsample comparison of coefficients on main variables

	T-test (Mean)	Wilcoxon test (Median)
IC_quality	−1.86**	−2.07**
Entropy_index	−10.04***	−13.03***
Number_of_firms	−13.74***	−15.86***
Concentration4	8.43***	9.82***

Notes: (1) We conduct t-tests (Wilcoxon tests) to compare the mean (median) of internal control quality (IC_quality) and the three product market competition proxies (Entropy_index, Number_of_firms and Concentration4) in the state owned firms and the non-state owned firms respectively and find that the mean (median) of internal control quality and product market competition all have significant difference in the two samples. (2) *, **, and *** indicate statistical significance at the 10, 5, and 1% levels, respectively.

compare the mean (median) of *IC_quality* in the state owned firms sample and the non-state owned firms sample and find that, not considering the effect of other factors, the mean (median) of *IC_quality* is significantly smaller in the state owned firms than in the non-state owned firms.

In terms of product market competition, the mean (median) of *Entropy_index* and *Number_of_firms* are significantly smaller in the state owned firms than in the non-state owned firms and the mean (median) of *Concentration4* is significantly larger in the state owned firms than that in the non-state owned firms after we conducted the *t*-test (Wilcoxon test). The results suggest that the product market competition is less intense in state owned firms than in non-state owned firms.

4.2. Correlation analysis

Table 4 presents the correlation matrix for the main variables. The correlation between *Entropy_index* and *IC_quality* and the correlation between *Number_of_firms* and *IC_quality* is both significantly positive, indicating that the more intense the product market competition is, the higher the internal control quality. The correlation between *Concentration4* and *IC_quality* is not significant. The correlation between *State_ownership* and *IC_quality* is significantly negative at the 10% level, indicating that, not considering the effect of other factors, the internal control quality of the non-state owned firms is higher than the state owned firms. As for the control variables, they are all significantly correlated with *IC_quality*, except *Inventroy*. The correlation coefficient matrix shows that the coefficients among the main variables are not large. Therefore, our multivariate analyses are not subject to multicollinearity concerns.

Table 4. Correlation matrix for the main variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. IC_quality	1														
2. Entropy_index	0.037***	1													
3. Number_of_firms	0.129***	0.843***	1												
4. Concentration4	0.002	−0.960***	−0.724***	1											
5. State_ownership	−0.019*	−0.103***	−0.140***	0.086***	1										
6. Size	0.269***	−0.114***	−0.076***	0.120***	0.342***	1									
7. Inventory	−0.016	0.050***	0.009	−0.049***	−0.022**	0.075***	1								
8. ROE	0.154***	−0.048***	−0.006	0.065***	−0.041***	0.130***	0.008	1							
9. Growth	−0.037***	−0.043***	−0.034***	0.054***	−0.015	0.026**	0.006	0.200***	1						
10. Lage	−0.151***	−0.016	−0.104***	−0.011	0.381***	0.252***	0.178***	−0.053***	0.010	1					
11. Bsegment	−0.078***	−0.140***	−0.207***	0.127***	0.129***	0.190***	0.082***	0.036***	0.041***	0.249***	1				
12. Big4	0.139***	−0.061***	−0.034***	0.064***	0.125***	0.400***	−0.040***	0.057***	−0.012	0.041***	0.082***	1			
13. Export	0.041***	0.025**	0.024**	−0.021**	−0.040***	−0.002	0.006	0.019*	0.014	−0.070***	0.004	0.001	1		
14. M&A	0.035***	−0.041***	−0.035***	0.049***	−0.017	0.157***	0.055***	0.111***	0.099***	0.014	0.085***	0.028***	−0.011	1	
15. Restructuring	−0.075***	0.018*	0.006	−0.027**	−0.002	−0.107***	−0.001	−0.110***	−0.054***	0.083***	−0.005	−0.041***	−0.016	−0.548***	1

Notes: *, **, and *** indicate statistical significance at the 10, 5, and 1% levels, respectively.

4.3. Multivariate analyses

4.3.1. Product market competition and internal control quality

Table 5 reports the regression results for the association between product market competition and internal control quality. In columns (1), (2) and (3), we do not control *State_ownership* and find that the coefficients of *Entropy_index* and *Number_of_firms* are significantly positive at the 5% level and the coefficient of *Concentration4* is significantly negative at the 5% level, indicating that product market competition has a significant effect on internal control quality: the more intense the product market competition is, the higher the internal control quality. In columns (4), (5) and (6), we control *State_ownership* and find that the coefficients of *Entropy_index*, *Number_of_firms* and *Concentration4* have no significant change. The coefficients of *State_ownership* are significantly positive at the 1% level, suggesting that the internal control quality of non-state owned firms is significantly lower than that of state owned firms. This result seems to conflict with the results of the descriptive statistics and correlation analysis. The reason may be that in the descriptive statistics and correlation analysis, we do not control the effect of control variables and the year fixed effect. Actually, since the release of *The Basic Standards of Enterprise Internal Control* in June 2006, and *Supplemental Guidelines of Firms' Internal Controls* in April 2010, we have been able to see that the internal control quality of the state owned firms and the non-state owned firms have changed year after year. As the state owned firms are forced to comply with *The Basic Standards of Enterprise Internal Control,* their internal control quality has improved greatly over time and has gradually exceeded that of the non-state owned firms.[8] It is the year fixed effect that leads to conflicting results. To verify our conclusion, in columns (7), (8) and (9), we do not control the year fixed effect and find that the coefficients of *Entropy_index*, *Number_of_firms* and *Concentration4* have no significant change. However, the coefficients of *State_ownership* become significantly negative, at least at the 5% level, consistent with the results from the descriptive statistics and correlation analysis.

In terms of the control variables, from the results in columns (4), (5) and (6), we find that the coefficients of *Size, ROE, Big4* and *Export* are significantly positive, at least at the 1% level, and the coefficients of *Growth* and *Lage* are significantly negative at least at the 1% level, indicating that firms with higher internal control quality are larger, with better performance, audited by Big4 audit firms and have oversea business. Firms with lower internal control quality are those with rapid growth and listed at Exchange Stocks longer. The coefficients of *Inventory, Bsegment*, *M&A* and *Restructuring* are not significant.

4.3.2. Product market competition, state ownership and internal control quality

As the analysis above indicates, product market competition has significant effect on internal control quality. However, does the effect vary in firms with different ownership? We divide our sample into two groups, the state owned firms group and the non-state owned firms group, to study the effect of product market competition on internal control quality in the two groups.

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[8]According to the requirements of China Securities Regulatory Commission, 68 firms were dual-listed on stock exchanges and 216 pilot firms complied with *The Basic Standards of Enterprise Internal Control* in 2011. Among these firms, 207 were state owned firms. The number of firms complying with *The Basic Standards of Enterprise Internal Control* was 853 in 2012 with 777 firms being state owned. So most of the firms complying with *The Basic Standards of Enterprise Internal Control* are state owned firms.

Table 5. Product market competition and internal control quality.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Entropy_index	0.010** (2.43)			0.010*** (2.64)			0.017*** (4.21)		
Number_of_firms		0.010** (2.26)			0.011** (2.45)			0.038*** (7.91)	
Concentration4			-0.043** (-2.08)			-0.047** (-2.31)			-0.045** (-2.09)
State_ownership				0.028*** (3.17)	0.028*** (3.16)	0.028*** (3.16)	-0.024*** (-2.66)	-0.020** (-2.19)	-0.025*** (-2.83)
Size	0.054*** (15.74)	0.054*** (15.69)	0.054*** (15.69)	0.051*** (14.22)	0.050*** (14.16)	0.051*** (14.18)	0.074*** (20.23)	0.073*** (20.06)	0.073*** (20.05)
Inventory	0.001 (0.02)	0.002 (0.08)	0.001 (0.05)	0.009 (0.32)	0.011 (0.38)	0.010 (0.35)	-0.006 (-0.20)	-0.005 (-0.19)	-0.003 (-0.09)
ROE	0.256*** (10.18)	0.254*** (10.11)	0.256*** (10.20)	0.262*** (10.40)	0.260*** (10.32)	0.262*** (10.42)	0.247*** (8.93)	0.243*** (8.79)	0.246*** (8.88)
Growth	-0.019*** (-4.48)	-0.019*** (-4.51)	-0.019*** (-4.47)	-0.019*** (-4.44)	-0.019*** (-4.47)	-0.019*** (-4.43)	-0.026*** (-5.69)	-0.026*** (-5.61)	-0.026*** (-5.74)
Lage	-0.064*** (-14.63)	-0.063*** (-14.38)	-0.064*** (-14.66)	-0.070*** (-14.56)	-0.069*** (-14.34)	-0.070*** (-14.58)	-0.067*** (-13.50)	-0.065*** (-13.03)	-0.066*** (-13.41)
Bsegment	-0.002 (-1.48)	-0.002 (-1.39)	-0.002 (-1.53)	-0.002 (-1.44)	-0.002 (-1.33)	-0.002 (-1.48)	-0.010*** (-5.87)	-0.008*** (-4.85)	-0.011*** (-6.16)
Big4	0.059*** (3.57)	0.058*** (3.53)	0.059*** (3.57)	0.059*** (3.61)	0.059*** (3.57)	0.060*** (3.61)	0.025 (1.44)	0.025 (1.45)	0.025 (1.41)
Export	0.038*** (2.89)	0.039*** (2.92)	0.039*** (2.90)	0.040*** (2.95)	0.040*** (2.98)	0.040*** (2.96)	0.033** (2.39)	0.032** (2.34)	0.034** (2.48)
M&A	-0.004 (-0.62)	-0.004 (-0.65)	-0.004 (-0.60)	-0.001 (-0.19)	-0.001 (-0.23)	-0.001 (-0.17)	-0.017** (-2.37)	-0.016** (-2.27)	-0.017** (-2.42)
Restructuring	-0.011 (-1.57)	-0.011 (-1.62)	-0.010 (-1.57)	-0.009 (-1.29)	-0.009 (-1.34)	-0.009 (-1.28)	-0.020*** (-2.61)	-0.020*** (-2.61)	-0.020*** (-2.64)
Constant	2.253*** (30.46)	2.244*** (29.40)	2.306*** (32.86)	2.313*** (30.52)	2.303*** (29.54)	2.370*** (32.69)	2.155*** (27.49)	2.043*** (25.58)	2.245*** (29.85)
Year	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
N	9,475	9,475	9,475	9,475	9,475	9,475	9,475	9,475	9,475
Adj. R²	0.368	0.368	0.367	0.37	0.369	0.369	0.151	0.160	0.149

Notes: (1) The *t*-statistics, reported in parentheses, are based on robust standard errors clustered at the firm level. (2) *, **, and *** indicate statistical significance at the 10, 5, and 1% levels, respectively.

Table 6. Product market competition, state ownership and internal control quality.

	State owned firms			Non-state owned firms		
	(1)	(2)	(3)	(4)	(5)	(6)
Entropy_index	0.006			0.014***		
	(1.16)			(2.67)		
Number_of_firms		0.011			0.012**	
		(1.61)			(1.97)	
Concentration4			−0.018			−0.076***
			(−0.66)			(−2.66)
Size	0.051***	0.051***	0.051***	0.051***	0.051***	0.051***
	(11.82)	(11.88)	(11.74)	(7.83)	(7.90)	(7.82)
Inventory	0.045	0.044	0.047	−0.026	−0.023	−0.026
	(1.26)	(1.22)	(1.30)	(−0.63)	(−0.56)	(−0.62)
ROE	0.210***	0.209***	0.210***	0.333***	0.331***	0.334***
	(6.81)	(6.78)	(6.79)	(8.08)	(8.04)	(8.10)
Growth	−0.015***	−0.015***	−0.015***	−0.021***	−0.021***	−0.021***
	(−3.05)	(−3.06)	(−3.05)	(−3.22)	(−3.25)	(−3.20)
Lage	−0.058***	−0.057***	−0.057***	−0.080***	−0.080***	−0.080***
	(−7.14)	(−7.10)	(−7.09)	(−12.48)	(−12.32)	(−12.51)
Bsegment	−0.002	−0.001	−0.002	−0.004	−0.004	−0.004
	(−0.80)	(−0.63)	(−0.88)	(−1.57)	(−1.53)	(−1.59)
Big4	0.053***	0.053***	0.054***	0.072**	0.072**	0.071**
	(2.79)	(2.77)	(2.78)	(2.29)	(2.32)	(2.25)
Export	0.023	0.023	0.024	0.050***	0.051***	0.050***
	(1.12)	(1.09)	(1.14)	(2.92)	(3.02)	(2.92)
M&A	0.011	0.011	0.011	−0.014	−0.014	−0.013
	(1.30)	(1.30)	(1.29)	(−1.57)	(−1.64)	(−1.52)
Restructuring	0.000	0.000	0.000	−0.017*	−0.017*	−0.017*
	(0.00)	(−0.03)	(0.01)	(−1.76)	(−1.78)	(−1.78)
Constant	2.298***	2.276***	2.334***	2.350***	2.333***	2.433***
	(22.80)	(22.02)	(24.74)	(17.93)	(17.45)	(18.66)
Year	Yes	Yes	Yes	Yes	Yes	Yes
N	5,149	5,149	5,149	4,326	4,326	4,326
Adj. R^2	0.412	0.413	0.412	0.341	0.34	0.341

Notes: (1) The *t*-statistics, reported in parentheses, are based on robust standard errors clustered at the firm level. (2) *, **, and *** indicate statistical significance at the 10, 5, and 1% levels, respectively.

Table 6 presents the regression results. Columns (1), (2) and (3) present the results from the state owned firms group. We find that the coefficients of the three product market competition variables *(Entropy_index, Number_of_firms* and *Concentration4*) are not significant. But in columns (4), (5) and (6), the non-state owned firms group, the coefficients of *Entropy_index* and *Number_of_firms* are significantly positive, and the coefficient of *Concentration4* is significantly negative. These results suggest that the positive effect of product market competition on internal control quality is only significant in the non-state owned firms, but not in the state owned firms.

The above findings support our hypothesis that product market competition has a positive effect on internal control quality: the more intense the product market competition is, the higher the internal control quality will be. However, the effect is more significant in the non-state owned firms than in the state owned firms.

4.3.3. Discussion of the endogeneity problem

There may be some doubts in our main result about the association between product market competition and internal control quality. For one thing, there is maybe a reverse causality between product market competition and internal control quality. For another, there are

maybe omitted correlated variables that affect both product market competition and internal control quality and, as a result, lead to our main conclusion. As for the reverse causality problem, we employ a lagged variable analysis, using the lagged value of product market competition and control variables to re-estimate our model. As for the omitted correlated variables concern, we conduct a change analysis, using the changes in all the variables to re-estimate our model.

In the lagged variable analysis, the internal control data is from 2007 to 2012, and data of the three product market competition proxies and control variables is from 2006 to 2011. Excluding the missing data, we have 8,767 firm-year observations, which are 708 firm-year observations less than the sample used in the main analysis.

Table 7 presents the regression results. Consistent with our main results, the coefficients of the three product market competition proxies are not significant in state owned firms but are significant, at least at the 5% level, in non-state owned firms.

In the change analysis, we first get the decile ranks of the internal control index constructed by Chen et al. (2013) and quintile ranks of the three product market competition proxies and all the continuous control variables in each year. And then take the change of these new variables from year $t-1$ to t as the new analysis variables and perform orderly

Table 7. Lagged variable analysis.

	State owned firms			Non-state owned firms		
	(1)	(2)	(3)	(4)	(5)	(6)
Entropy_index	0.001			0.014***		
	(0.25)			(2.94)		
Number_of_firms		0.002			0.015***	
		(0.48)			(3.14)	
Concentration4			0.003			−0.071**
			(0.11)			(−2.29)
Size	0.049***	0.049***	0.049***	0.045***	0.045***	0.045***
	(11.17)	(11.21)	(11.15)	(6.44)	(6.45)	(6.44)
Inventory	0.071**	0.070**	0.073**	0.023	0.024	0.022
	(2.12)	(2.09)	(2.17)	(0.59)	(0.62)	(0.57)
ROE	0.268***	0.268***	0.267***	0.335***	0.333***	0.336***
	(6.53)	(6.53)	(6.51)	(6.51)	(6.48)	(6.50)
Growth	−0.011***	−0.011***	−0.012***	−0.006**	−0.006**	−0.006**
	(−4.85)	(−4.81)	(−4.91)	(−2.19)	(−2.15)	(−2.32)
Lage	−0.069***	−0.069***	−0.069***	−0.112***	−0.111***	−0.113***
	(−6.48)	(−6.49)	(−6.47)	(−11.88)	(−11.79)	(−11.96)
Bsegment	0.000	0.001	0.000	0.002	0.002	0.002
	(0.22)	(0.30)	(0.11)	(0.86)	(0.94)	(0.69)
Big4	0.064***	0.064***	0.065***	0.082**	0.082**	0.083**
	(3.30)	(3.30)	(3.31)	(2.47)	(2.46)	(2.51)
Export	0.020*	0.019*	0.021**	0.017	0.016	0.019*
	(1.88)	(1.81)	(1.99)	(1.53)	(1.50)	(1.78)
M&A	0.021***	0.021***	0.021***	0.009	0.009	0.009
	(2.70)	(2.71)	(2.68)	(1.00)	(0.98)	(0.97)
Restructuring	−0.002	−0.002	−0.002	−0.001	−0.001	−0.002
	(−0.32)	(−0.31)	(−0.34)	(−0.15)	(−0.14)	(−0.21)
Constant	2.390***	2.382***	2.396***	2.499***	2.479***	2.583***
	(22.99)	(22.73)	(24.52)	(17.66)	(17.42)	(18.54)
Year	Yes	Yes	Yes	Yes	Yes	Yes
N	5,017	5,017	5,017	3,750	3,750	3,750
Adj. R^2	0.423	0.423	0.423	0.352	0.352	0.350

Notes: (1) The *t*-statistics, reported in parentheses, are based on robust standard errors clustered at the firm level. (2) *, **, and *** indicate statistical significance at the 10, 5, and 1% levels, respectively.

Table 8. Change analysis.

	Dependent variable: ΔICrank					
	State owned firms			Non-state owned firms		
	(1)	(2)	(3)	(4)	(5)	(6)
ΔEntropy_index_rank	−0.051			0.192*		
	(−0.63)			(1.80)		
ΔNumber_of_firms_rank		−0.049			0.198*	
		(−0.43)			(1.85)	
ΔConcentration4_rank			−0.056			0.018
			(−1.26)			(0.38)
ΔSize_rank	0.084	0.084	0.085	0.105	0.105	0.111
	(1.41)	(1.40)	(1.41)	(1.47)	(1.47)	(1.57)
ΔInventory_rank	−0.025	−0.025	−0.024	−0.003	−0.005	−0.003
	(−0.54)	(−0.56)	(−0.52)	(−0.06)	(−0.10)	(−0.07)
ΔROE_rank	0.020	0.020	0.021	−0.026	−0.026	−0.027
	(0.73)	(0.75)	(0.75)	(−0.84)	(−0.85)	(−0.90)
ΔGrowth_rank	−0.020	−0.019	−0.019	0.015	0.015	0.015
	(−1.13)	(−1.10)	(−1.08)	(0.76)	(0.76)	(0.77)
ΔLage	−0.906***	−0.912***	−0.911***	−0.511***	−0.492***	−0.480***
	(−3.30)	(−3.33)	(−3.32)	(−2.93)	(−2.87)	(−2.80)
ΔBsegment_rank	−0.031	−0.032	−0.031	−0.091*	−0.092*	−0.093*
	(−0.76)	(−0.78)	(−0.76)	(−1.73)	(−1.74)	(−1.76)
ΔBig4	−0.097	−0.100	−0.092	−0.174	−0.165	−0.188
	(−0.39)	(−0.40)	(−0.37)	(−0.26)	(−0.25)	(−0.29)
ΔExport	0.062	0.061	0.064	−0.011	−0.015	−0.011
	(0.35)	(0.34)	(0.36)	(−0.06)	(−0.07)	(−0.06)
ΔM&A	−0.050	−0.051	−0.051	−0.071	−0.069	−0.073
	(−0.86)	(−0.88)	(−0.88)	(−1.04)	(−1.01)	(−1.07)
ΔRestructuring	−0.036	−0.037	−0.036	0.050	0.054	0.051
	(−0.58)	(−0.58)	(−0.57)	(0.70)	(0.75)	(0.71)
Year	Yes	Yes	Yes	Yes	Yes	Yes
N	4,079	4,079	4,079	3,011	3,011	3,011
Pseudo R^2	0.005	0.005	0.005	0.003	0.003	0.003

Notes: (1) The *t*-statistics, reported in parentheses, are based on robust standard errors clustered at the firm level. (2) *, **, and *** indicate statistical significance at the 10, 5, and 1% levels, respectively.

logistic regressions. The analysis period is still between 2007 and 2012. Excluding the missing data, we get 7090 firm-year observations.

Table 8 presents the regression results. The coefficients of the three product market competition proxies are not significant in state owned firms. But in non-state owned firms, the coefficients of ΔEntropy_index_rank and ΔNumber_of_firms_rank are significantly positive, though the coefficient of ΔConcentration4_rank is not significant. Taken together, the results are consistent with those reported in Table 6.

4.4. Additional analysis

Does high quality internal control improve product market competition advantage? As the analysis set forth in the hypothesis development indicates, the strong motivation of firms to construct internal control systems and to improve internal control quality is due to the expectation that high quality internal control can improve a firm's product market competition advantage. Though many studies have found that effective internal control can inhibit ineffective investment (Cheng et al., 2013; Li et al., 2011), improve the value of cash holdings (Zhang & Wu, 2014), enhance M&A performance (Yang, Zhang, & Chen, 2014), and improve operational efficiency (Cheng et al., 2014; Feng et al., 2015), studies on the effects of internal

control on product market competition advantage are rare. It is therefore vital to our core findings that this question be answered. If internal control does improve a firm's product market competition advantage, management will have strong incentive to raise internal control quality to improve its product market competition advantage and to cope with intense product market competition.

Before examining the effect of internal control quality on product market competition advantage, we should consider the endogeneity problem. Firms with product market competition advantage may have more resources to invest in the construction of their internal control system and as a result their internal control quality is higher. At the meantime, firms with good corporate governance always have high quality internal control and product market competition advantage, so the association between internal control quality and product market competition advantage may be caused by omitted correlated variables. Therefore, we follow Ye, Cao, and Wang (2015) to employ the Heckman Selection Model to mitigate the endogeneity problem. Specially, we use the lagged value of the independent variables and control variables to perform the regression.

At the first stage of the Heckman Selection Model, we employ a probit model to calculate the Inverse Mill's Ratio (IMR).

$$
\begin{aligned}
ICdum = {} & \beta_0 + \beta_1\, Size + \beta_2\, Inventory + \beta_3\, ROE + \beta_4\, Growth + \beta_5\, Lage + \beta_6\, Bsegment \\
& + \beta_7\, Big4 + \beta_8\, Export + \beta_9\, M\&A + \beta_{10}\, \text{Restructuring} + \sum YEAR + \sum IND + \varepsilon
\end{aligned}
\tag{2}
$$

where $ICdum$ is a dummy variable of internal control quality, which takes a value of one if a firm's internal control quality is higher than its industry-year median, and zero otherwise. Other variables in Equation (2) are all determinants of internal control quality, which are the same with the control variables in Equation (1). Year and industry dummies are also included in the model. Through the model, we get three IMRs, IMR_all for the full sample, IMR_1 for the state owned firms sample, and IMR_0 for the non-state owned firms sample.

At the second stage of the Heckman Selection Model, following Zhang and Wu (2012) and Zhou, Fang, and Liu (2009), we estimate the following model to study how internal control affects product market competition advantage.

$$
Competition\_advantage = \beta_0 + \beta_1 ICdum + \beta_2 IMR_i + \beta_i Controls + \varepsilon
\tag{3}
$$

where $Competition\_advantage$ is product market competition advantage measured by excess price-cost margin (henceforth, EPCM). Following Gaspar and Massa (2006) and Peress (2010), we define EPCM as the difference between a firm's price-cost margin (henceforth, PCM) and the average PCM of its industry. PCM is defined as operating profits (calculated as sales minus cost of goods sold, selling costs, and general and administrative expenses) over sales. $ICdum$ is a dummy variable of internal control quality; $Controls$ is a series of control variables. We control the following variables in the model: $State\_ownership$ is an indicator variable for state owned firms with a value of one if the firm is a state owned firm, and zero otherwise; $Cash$ is free cash flow scaled by total assets; $Size$ is the natural logarithm of the mean of a firm's total assets at the fiscal year end plus the lagged total assets; $Growth$ is the operating income growth rate measured by the ratio of operating income to the lagged operating income minus one; $Leverage$ is a firm's leverage measured as long-term debt scaled by total assets; $Unique$ is product uniqueness measured as the sum of cost of goods sold and administrative expenses to sales; $Lage$ is the natural logarithm of one plus the number

Table 9. Internal control quality and product market competition advantage.

	(1)	(2)	(3)
	All firms	State owned firms	Non-state owned firms
ICdum	0.030***	0.028***	0.030***
	(6.09)	(4.11)	(3.75)
State_ownership	−0.004		
	(−0.53)		
Cash	0.523***	0.457***	0.586***
	(9.47)	(7.97)	(6.27)
Size	0.016***	0.007	0.034***
	(3.95)	(1.61)	(4.35)
Growth	0.008	0.022***	−0.004
	(0.99)	(3.51)	(−0.25)
Leverage	−0.134***	−0.136***	−0.119**
	(−4.91)	(−6.10)	(−2.12)
Unique	−1.210***	−1.184***	−1.210***
	(−12.42)	(−9.52)	(−9.51)
Lage	−0.037***	−0.023***	−0.045***
	(−7.56)	(−3.41)	(−5.39)
Export	0.000	0.009	−0.014
	(−0.01)	(0.71)	(−0.97)
Inventory	−0.049	0.034	−0.122
	(−0.56)	(0.48)	(−0.88)
IMR_all	0.070***		
	(4.56)		
IMR_1		0.037***	
		(2.89)	
IMR_0			0.063***
			(2.76)
Constant	−0.115	−0.001	−0.439**
	(−1.15)	(−0.01)	(−2.52)
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
N	9,465	5,142	4,323
Adj. R^2	0.293	0.296	0.300

of years since a firm was first listed on a Stock Exchange; *Export* is an indicator variable that takes a value of one if a firm has foreign sales for fiscal year t, and zero otherwise; *Inventory* is inventory valued at cost divided by total assets. Industry and year fixed effects are also controlled. *IMRi* represents *IMR_all* for the full sample, *IMR_1* for the state owned firms sample, and *IMR_0* for the non-state owned firms sample, respectively. We use a sample of Chinese A-share listed firms between 2007 and 2013, with 9,106 firm year observations. The data of product market competition advantage is from 2008 to 2013, and the data of lagged internal control quality and control variables is from 2007 to 2012.

Table 9 presents the regression results. The coefficients of *ICdum* are significantly positive at the 1% level in the full sample, the state owned firms group and the non-state owned firms group, indicating that internal control has a significant positive effect on product market competition advantage both in state owned firms and non-state owned firms: the higher internal control quality is, the greater the product market competition advantage will be. The results support our conclusion that because internal control does improve a firm's product market competition advantage, management has strong incentive to improve internal control quality to improve their product market competition advantage and to cope with intense product market competition.

Existing studies (Chow, Huang, & Liu, 2008; Zhang et al., 2013; Zhou et al., 2009) measure competition advantage by a firm's performance. When a firm's performance exceeds the

average value of its industry, the firm gains competition advantage. Specifically, we use industry adjusted ROA and ROE to measure product market competition advantage to study the effect of internal control quality on product market competition advantage. In addition, we also use PCM to measure product market competition advantage for robustness test. All the results are similar with those in Table 9, indicating the robustness of our conclusion.

5. Robustness tests

5.1. Alternative proxies for product market competition

As we cannot precisely measure product market competition, we use another three variables to measure product market competition to lower potential errors in our main findings. Specially, the three measures of product market competition are the following.

Herfindahl index. The Herfindahl Index (*Herfindahl_index)* is computed as the sum of squared market shares in a specific industry.

$$Herfindahl\_index = \sum_f \left(x_j / \sum x_j \right)^2 \qquad (4)$$

where x_f is the sale of firm f. The smaller the score of *Herfindahl_index* is, the lower the industry concentration is and the more intense the competition is.

Number of large firms in an industry. We use the logarithm of the number of firms whose total assets are larger than 100 million in an industry (*Number_of_large_firms*) as an alternative proxy for competition.

Similarity of operations. Similarity of Operations (*Similarity_of_operations*) is calculated as the absolute value of the difference between a firm's ratio of net plant and equipment per employee and the median ratio in its industry. To make this difference comparable across industries, the difference is then scaled by the industry range of the capital-to-labor ratio.

$$Similarity\_of\_operations_{f,i,y} = \frac{|(K/L)_{f,i,y} - median_{i,y,-f}(K/L)|}{range\{(K/L)_{f,i,y} - median_{i,y,-f}(K/L)\}} \qquad (5)$$

where f stands for firm, i for industry, and y for year. K/L is the ratio of net plant and equipment per employee. Smaller values of *Similarity_of_operations* indicate a greater similarity of a firm's operations with industry counterparts and therefore more interdependence of investment opportunities and more intense competition with other firms.

Table 10 presents the regression results. Consistent with our main results, the coefficients of the three new product market competition proxies are not significant in the state owned firms but are significant, at least at the 10% level, in the non-state owned firms. The coefficients of *Herfindahl_index* and *Similarity_of_operations* are significantly negative, and the coefficient of *Number_of_large_firms* is significantly positive. These results suggest that the positive effect of product market competition on internal control quality is only significant in the non-state owned firms, but not in the state owned firms. In the non-state owned firms, the more intense the product market competition is, the higher the internal control quality is.

Table 10. Alternative proxies for product market competition.

	State owned firms			Non-state owned firms		
	(1)	(2)	(3)	(4)	(5)	(6)
Herfindahl_index	0.026			−0.100**		
	(0.55)			(−2.25)		
Number_of_large_firms		0.010			0.012*	
		(1.48)			(1.86)	
Similarity_of_operations			−0.024			−0.074*
			(−0.64)			(−1.86)
Size	0.051***	0.051***	0.054***	0.050***	0.051***	0.050***
	(11.74)	(11.86)	(11.73)	(7.74)	(7.89)	(7.86)
Inventory	0.051	0.045	0.130***	−0.033	−0.023	−0.035
	(1.40)	(1.25)	(2.59)	(−0.80)	(−0.56)	(−0.75)
ROE	0.207***	0.209***	0.204***	0.337***	0.331***	0.335***
	(6.72)	(6.78)	(6.74)	(8.21)	(8.04)	(8.22)
Growth	−0.016***	−0.015***	−0.014***	−0.022***	−0.021***	−0.019***
	(−3.09)	(−3.07)	(−2.74)	(−3.31)	(−3.26)	(−3.02)
Lage	−0.056***	−0.057***	−0.055***	−0.081***	−0.080***	−0.067***
	(−6.91)	(−7.09)	(−6.80)	(−12.56)	(−12.33)	(−9.80)
Bsegment	−0.002	−0.001	−0.002	−0.005*	−0.004	−0.002
	(−1.02)	(−0.66)	(−0.79)	(−1.74)	(−1.54)	(−0.73)
Big4	0.054***	0.053***	0.053***	0.073**	0.072**	0.076**
	(2.77)	(2.77)	(2.73)	(2.28)	(2.32)	(2.47)
Export	0.024	0.023	0.024	0.051***	0.051***	0.042**
	(1.18)	(1.09)	(1.12)	(2.96)	(3.01)	(2.45)
M&A	0.011	0.011	0.012	−0.013	−0.014	−0.011
	(1.25)	(1.30)	(1.47)	(−1.53)	(−1.64)	(−1.28)
Restructuring	0.000	0.000	0.000	−0.017*	−0.017*	−0.017*
	(−0.02)	(−0.03)	(0.01)	(−1.74)	(−1.78)	(−1.86)
Constant	2.336***	2.284***	2.174***	2.427***	2.339***	2.430***
	(24.76)	(22.27)	(19.46)	(18.63)	(17.54)	(18.30)
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	No	No	Yes	No	No	Yes
N	5,149	5,149	5,149	4,326	4,326	4,323
Adj. R^2	0.412	0.413	0.418	0.340	0.339	0.359

Notes: (1) The *t*-statistics, reported in parentheses, are based on robust standard errors clustered at the firm level. (2) *, **, and *** indicate statistical significance at the 10, 5, and 1% levels, respectively.

5.2. New sample excluding firms forced to comply with The Basic Standards of Enterprise Internal Control

According to the *Notice of China Securities Regulatory Commission on Doing a Good Job for Pilot Companies to Comply with The Basic Standards of Enterprise Internal Control,* 69 firms that dual-listed on stock exchanges and 216 pilot firms should comply with *The Basic Standards of Enterprise Internal Control* in 2011. According to the *Notice of the General Office of the Ministry of Finance and the General Office of the China Securities Regulatory Commission on the Implementation of the Normative System of Enterprise Internal Control by Companies Listed on the Main Board under Different Categories and Groups of 2012,* the number of firms that should comply with *The Basic Standards of Enterprise Internal Control* became 853 in 2012, with 76 firms dual-listed on stock exchanges and 777 state owned firms listed on the main board. As these firms are forced to comply with *The Basic Standards of Enterprise Internal Control,* including these firms in our sample may lead to errors in our main findings. Accordingly, we exclude these firms from our sample to re-estimate our model.

Table 11 presents the regression results. Consistent with our main results, the coefficients of the three product market competition proxies (*Entropy_index, Number_of_firms,* and *Concentration4*) are not significant in the state owned firms but are significant, at least at

Table 11. New sample excluding firms forced to comply with *The Basic Standards of Enterprise Internal Control*.

	State owned firms			Non-state owned firms		
	(1)	(2)	(3)	(4)	(5)	(6)
Entropy_index	0.006			0.015***		
	(1.03)			(2.77)		
Number_of_firms		0.010			0.013**	
		(1.29)			(2.01)	
Concentration4			−0.016			−0.078***
			(−0.53)			(−2.75)
Size	0.048***	0.048***	0.048***	0.051***	0.052***	0.051***
	(9.54)	(9.54)	(9.47)	(7.92)	(8.00)	(7.91)
Inventory	0.054	0.053	0.056	−0.030	−0.027	−0.030
	(1.33)	(1.31)	(1.38)	(−0.74)	(−0.66)	(−0.73)
ROE	0.236***	0.234***	0.236***	0.328***	0.326***	0.329***
	(7.11)	(7.08)	(7.10)	(7.94)	(7.89)	(7.97)
Growth	−0.017***	−0.017***	−0.017***	−0.020***	−0.020***	−0.020***
	(−2.94)	(−2.96)	(−2.94)	(−3.04)	(−3.07)	(−3.01)
Lage	−0.076***	−0.076***	−0.076***	−0.083***	−0.082***	−0.083***
	(−8.65)	(−8.59)	(−8.60)	(−12.84)	(−12.67)	(−12.87)
Bsegment	−0.002	−0.002	−0.002	−0.004	−0.004	−0.004*
	(−0.89)	(−0.79)	(−0.97)	(−1.64)	(−1.60)	(−1.66)
Big4	0.063***	0.062***	0.063***	0.069**	0.070**	0.068**
	(2.76)	(2.74)	(2.76)	(2.18)	(2.20)	(2.13)
Export	0.029	0.029	0.029	0.048***	0.049***	0.048***
	(1.28)	(1.26)	(1.30)	(2.92)	(3.02)	(2.92)
M&A	0.013	0.013	0.013	−0.014	−0.014	−0.013
	(1.32)	(1.31)	(1.31)	(−1.54)	(−1.62)	(−1.50)
Restructuring	0.000	0.000	0.000	−0.016*	−0.016*	−0.016*
	(0.04)	(0.02)	(0.04)	(−1.65)	(−1.67)	(−1.67)
Constant	2.406***	2.389***	2.441***	2.349***	2.332***	2.435***
	(21.01)	(20.38)	(22.51)	(18.06)	(17.55)	(18.81)
Year	Yes	Yes	Yes	Yes	Yes	Yes
N	4,139	4,139	4,139	4,261	4,261	4,261
Adj. R^2	0.347	0.347	0.347	0.340	0.339	0.340

Notes: (1) The *t*-statistics, reported in parentheses, are based on robust standard errors clustered at the firm level. (2) *, **, and *** indicate statistical significance at the 10, 5, and 1% levels, respectively.

the 5% level, in the non-state owned firms. These results suggest that firms forced to comply with *The Basic Standards of Enterprise Internal Control* do not significantly affect our findings.

5.3. New sample with industrial enterprises above designated size

The proxies for product market competition are all based on the number or the market shares of listed firms. However, as there are many firms not listed on any stock exchanges, product market competition measured using listed firms in an industry may be biased. So we re-measure product market competition using data of *Industrial Enterprises above Designated Size* from *China Statistical Yearbook* (2008–2013) and test the robustness of our main results. The *Industrial Enterprises above Designated Size* (abbreviated hereafter as IEADS) not only include listed firms, but also include firms not listed at stock exchanges, which provide us a chance to measure the real degree of competition in an industry.[9] As we can

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[9]According to the *National Bureau of Statistics of the People's Republic of China*, the industrial enterprises above designated size (IEADS) refers to all state owned firms and non-state owned firms with yearly sales revenue of $5 million or more during the period of 1998 to 2006; it refers to industrial enterprises with yearly sales revenue of $5 million or more during the period of 2007 to 2010; and it refers to industrial enterprises with yearly sales revenue of $20 million or more since 2011.

Table 12. New sample with industrial enterprises above designated size (IEADS).

	State owned firms		Non-state owned firms	
	(1)	(2)	(3)	(4)
Number_of_IEADS	0.006		0.042***	
	(0.67)		(3.02)	
Concentration4_ IEADS		−0.116		−1.917***
		(−0.37)		(−4.30)
Size	0.047***	0.047***	0.042***	0.042***
	(8.36)	(8.35)	(4.98)	(4.99)
Inventory	0.077	0.082	0.015	0.003
	(1.05)	(1.12)	(0.19)	(0.04)
ROE	0.225***	0.225***	0.298***	0.296***
	(6.17)	(6.18)	(5.89)	(5.85)
Growth	−0.010	−0.010	−0.026***	−0.026***
	(−1.64)	(−1.63)	(−2.66)	(−2.64)
Lage	−0.042***	−0.042***	−0.067***	−0.068***
	(−3.99)	(−4.01)	(−7.98)	(−8.20)
Bsegment	0.001	0.000	−0.002	−0.003
	(0.23)	(0.16)	(−0.62)	(−0.82)
Big4	0.072***	0.072***	0.060	0.059
	(2.85)	(2.87)	(1.54)	(1.54)
Export	0.027	0.028	0.039**	0.036**
	(1.21)	(1.24)	(2.22)	(1.98)
M&A	0.022*	0.022*	−0.017*	−0.017
	(1.96)	(1.96)	(−1.68)	(−1.59)
Restructuring	0.008	0.008	−0.024**	−0.023**
	(0.67)	(0.67)	(−2.14)	(−2.09)
Constant	2.294***	2.365***	2.125***	2.630***
	(13.84)	(19.27)	(9.93)	(15.19)
Year	Yes	Yes	Yes	Yes
N	2,950	2,950	3,009	3,009
Adj. R^2	0.410	0.410	0.297	0.300

Notes: (1) The *t*-statistics, reported in parentheses, are based on robust standard errors clustered at the firm level. (2) *, **, and *** indicate statistical significance at the 10, 5, and 1% levels, respectively.

get the number and sales revenue of these larger manufacturing firms in 41 industries, we use the logarithm of the number of firms (*Number_of_IEADS*) and the four-firm concentration ratio (*Concentration4_ IEADS*) in an industry as the proxy for the product market competition. The sample period is still between 2007 and 2012 and we finally get 5959 firm-year observations.

Table 12 presents the regression results. Consistent with our main results, the coefficients of the two product market competition proxies (*Number_of_IEADS* and *Concentration4_ IEADS*) are not significant in the state owned firms but are significant, at least at the 1% level, in the non-state owned firms. These results suggest that the product market competition measured using listed firms, to a certain extent, can represent the degree of competition in its industry. And the results of our main tests are robust.

6. Conclusion

Based on a sample of Chinese A-share listed firms from the Shenzhen Stock Exchange and Shanghai Stock Exchange between 2007 and 2012, and using the internal control index constructed by Chen et al. (2013) as the proxy for internal control quality, we examine the effect of product market competition on the internal control quality of Chinese listed firms and the difference this effect has on state-owned firms and

non-state owned firms. We find that product market competition has a significant effect on the internal control quality of Chinese listed firms: the more intense the product market competition is, the higher the internal control quality will be. However, the effect is only significant for non-state owned firms, not for state owned firms. Further, we find that high quality internal control can improve product market competition advantage, which explains why firms in industries with intense product market competition have incentives to improve their internal control quality, thereby providing support for our main findings.

Our findings will enlighten relative regulators, firms and scholars. In promoting the construction of internal control systems and modern enterprise systems, related departments and regulatory agencies should pay attention to the optimisation and upgrading of China's industrial structure and give full play to the external governance role of product market competition. The management of firms should change their skeptical attitudes toward the positive effect of internal control systems, recognise the importance of strengthening the internal control, and give full play to the role of internal control in promotion of enterprise development strategy. Scholars in China should undertake studies on the costs and benefits of internal control from the perspective of operational efficiency and development strategy, and provide references for the construction of internal control systems and modern enterprise systems.

Despite the benefits, there are still some shortcomings involved with measuring product market competition and endogeneity problem. As there are many firms not listed at stock exchanges, product market competition measured only using listed firms in an industry may be biased. Nonetheless, we measure product market competition using many indexes, which to some extent can ensure the reliability of our conclusions. Meanwhile, we re-measure product market competition using data of industrial enterprises above a designated size which covers both the listed and non-listed firms in an industry, and find that the effect of the new product market competition on internal control quality is similar with that of product market competition measured only using listed firms. The results to some extent justify the validity of the product market competition proxies. In terms of the endogeneity problem, both the association between product market competition and internal control quality and the association between internal control quality and product market competition advantage may be influenced by endogeneity problem. Limited by data and real situation, we cannot find a perfect method to solve the endogeneity problem, but we use lagged data analysis, change analysis and Heckman Selection Model to mitigate the effect of endogeneity problem and to ensure the reliability of our conclusions.

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