First draft: September 21st 2006
This version: January 28th, 2007

Institutional Determinants of Vertical Integration: Evidence from China

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Abstract

In a world with no transaction costs, vertical integration is intrinsically inefficient because it reduces specialization and thus the exercise of comparative advantage among firm units. However, in reality transactions between separate units carrying out vertically related activities have transaction difficulties stemming from weak property rights protection, information asymmetry, or agency behavior, all of which lead to anticipated opportunistic behavior and ex ante distortions in investment. If these transaction difficulties cannot be overcome by contracting, because of weak institutions or insufficient market disciplinary forces, vertical integration can be a solution. At the same time, in such environments, local corporate insiders with political connections can use vertical integration to enhance their rent-seeking returns and yet it is doubtful if outside shareholder can capture any of the gains.

Empirical validation of these hypotheses is most likely in emerging economies, where legal and market institutions are often weak despite substantial variation across sub-regions. Using Chinese data, we find that vertical integration is indeed importantly affected by institutional factors – it is more common in Chinese regions with weaker property rights protection, poorer local government quality, and stricter local regulation of market trades (which hampers market forces). Moreover, companies led by insiders with political connections are more likely to be vertically integrated.

Vertical integration has a varying relationship with share value. Vertical integration is negatively associated with share value if the top corporate insider is politically connected. Vertical integration is positive associated with share value if the firm is independently audited. If firm has a politically connected insider and is independently audited, the combined effect is large and positive.

JEL Classification: L22; P14; G38; P16

Key Words: Vertical Integration; Rent seeking; Property rights; Government quality

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1. Introduction

This paper examines the determinants and the effects of vertical integration, the extent to which adjacent production stages are controlled by a common insider. In a perfect market with no transaction costs, vertical integration is intrinsically inefficient because it prevents specialization and thus the exercise of comparative advantage among firm units. However, transactions between separate units carrying out vertically related activities can be difficult under some circumstances. These transaction difficulties arise from weak property rights, information asymmetries, or agency problems, any or all of which lead to anticipated opportunistic behavior and investment distortions. If weak institutions and weak market disciplinary forces prevent parties from contracting around such transaction difficulties, vertical integration is a possible solution (Williamson, 1975; Klein, Crawford and Alchian, 1978). Yet, corporate insiders with political connections could, under these conditions, use vertical integration to magnify the returns to political rent-seeking. Also, rent seeking insiders might use vertical integration to facilitate tunneling to benefit them and enrich their connections.

The premise that transactions cost predicts firm vertical integration relies on that a country's institutions and legal property right systems affect the relative costs of market and in-house exchanges, and hence influence firm vertical integration decisions. Empirical validation of this idea is best sought in data from emerging economies where both legal and market institutions are often weak, and yet exhibit large cross-sectional variation. However, we are aware of only one such cross-country study, which finds some support for these predictions (Acemoglu, Johnson, and Mitton, 2005). They find vertical integration is more prevalent in

countries with greater contracting costs, more credit market imperfections and entry barriers. But these correlations almost disappear after controlling for industrial composition. It is shown that countries with underdeveloped financial market, higher contracting costs or greater entry barriers are concentrated in industries that are naturally vertically integrated.

We provide a complementary study examining the effects of different institutional factors on firm vertical integration in different parts of one country – China. China's transitional economy provides a natural setting. Ample evidences indicate that, in China, respect to property rights is rare, bureaucrats' rent-seeking is prevalent, and substantial resources remain under State control (Montinola, Qian and Weingast, 1995; Che and Qian, 1998; Allen, Qian and Qian, 2005; Cull and Xu, 2005; Fan, Wong and Zhang, forthcoming). Focusing on one country avoids spurious relations induced by unobserved country factors, such as language, culture and custom, rendering our conclusions more credible. China, because of its size and decentralized economic and political systems (Qian and Weingast, 1996, 1997), exhibits wide variation in institutional quality across its various regions and industries. This variation facilitates empirical investigation of the association of institutional quality with firm vertical integration.

Measuring the prevalence of vertical integration is difficult. Due to methodological and/or data problems, the existing literature mainly consists of case studies and single-industry studies (see, e.g., Monteverde and Teece, 1982; Masten, 1984; Mulherin, 1986; Joskow, 1987; Chipty, 2001). Our investigation uses almost all publicly listed firms (almost 1,000) from China's various regions and industry sectors. We utilize the commodity flow information in the Chinese input-output (IO) table to measure firms' vertical integration, a method developed by Fan and Lang (2000), and since then adopted in several other empirical studies (e.g., Acemoglu et al.,

2004; Acemoglu, Johnson and Mitton, 2005; Fan and Goyal, 2006).

Controlling for other potentially influential factors, we find the prevalence of vertical integration significantly related to institutional factors. Vertical integration is more common in regions with weaker property rights protection, worse local government quality, and stricter local regulation of market trades (which restricts the market forces). Also, companies run by insiders with political connections are more likely to be vertically integrated.

The link between a firm's vertical integration and its market valuation, as reflected by its market to book ratio, depends on the setting. Vertical integration is negatively associated with firm value if its insiders are politically connected. But, the association turns positive if the firm's insiders are subject to monitoring and/or if their incentives are aligned with the firm's public shareholders. Finally, vertical integration is most strongly positively linked to elevated firm market value if the firm has a politically connected insider whose incentives are aligned with public shareholders. These results are consistent with vertical integration being a response to weak institutions, but raising or lowering public shareholder wealth depending on whether or not insiders' incentives are aligned with public shareholders.

The remainder of the paper proceeds as follows. Section 2 develops our hypotheses. Section 3 describes the sample, discusses empirical measures, and provides descriptive statistics. The empirical results are reported in section 4. Section 5 investigates how firm performance correlates with vertical integration. Several conclusions are drawn in Section 6.

2. Hypotheses development

In this section, we discuss likely determinants of vertical integration and its impact on firm value.

2.1. Transaction costs and vertical integration

By vertical integration, we do not mean the simple integration of closely related production activities, e.g., the washing and then the pressing of clothes. Rather, we mean the integration of activities that belong to distinctly identifiable separate industries. To illustrate, consider Weiqiao Group, the largest textile company in China. The group's primary business is producing textiles. It has a highly integrated production process, in which it grows its own cotton, makes the cotton into yarn, weaves and fabricates the yarn into textiles, and imprints the textiles with colors before selling them to customers. The group also operates a power plant that generates electricity for its textiles operation. Weiqiao exemplifies a commonplace Chinese phenomenon – the highly vertically integrated firm or business group. The past decade witnessed numerous State owned and entrepreneur owned firms in China shaping themselves into such vertically integrated structures.

Such extensive vertical integration might at first seem highly inefficient. Widespread vertical integration dilutes a firm's management's focus and creates "territorial" political conflicts inside the company (Milgrom and Roberts, 1988). In contrast, the basic marker of a modern exchange economy is *specialization*. Intuitively, exercising comparative advantage allows each firm to be more efficient in its current core production and in its investment in technology and future capability.

This argument must be reconsidered in the presence of transaction costs. A vast literature suggests that transaction difficulties lead to vertical integration. Coase (1937) posits that transactions occur inside a firm (vertical integration) if the cost of arm's-length market transactions exceeds that of coordinating the transactions within the firm. Coase's insight triggered a series of writings (e.g., Williamson, 1973, 1975; Klein, Crawford and Alchian, 1978; Lucas, 1978; and many others), which lead to the recognition that transaction costs between units can make their integration optimal.

As Klein, Crawford, and Alchian (1978) and Williamson (1979) point out, transaction costs can be due to anticipated opportunistic behavior stemming from asset specificity, low transactions frequency, and uncertainty associated with the transactions in question. The case they consider typically involves vertically related units engaging in upstream and downstream production. Each unit has to make specialized investment in period one to prepare for production in period two. Once the investment is made, however, the resulting asset cannot be easily diverted to other uses without losing a substantial amount of its value. Under these circumstances, a transacting party has an incentive to extract rents ex post, e.g., to demand a change in the terms of the transaction to its favor. Such opportunistic behavior is facilitated by information asymmetry around the transaction, whether due to genuinely exogenous unanticipated changes or to calculated rent-extraction. The anticipated time inconsistent behavior negatively reduces the value of specialized investment, and therefore curtails it, resulting in a deadweight loss to society.

This sort of contractual holdup precipitates other problems. Two vertically related units could find that the values of their respective activities are negatively affected by the quality of the effort put forth by the other unit. For example, incompetence by a production unit reduces the value of a design unit's proposal. Likewise, inconsistent design can reduce the learning intrinsic in production runs. In a similar vein, inadequate information sharing between vertically related units can reduce their ability to contain current costs. It can also lead to erroneous expectations of future market changes and thus poor investment decisions. These examples show how agency problems and limited cooperation become more likely if units are separately owned, a situation under which the gains from effort are not fully appropriable while its cost is solely borne.

Another source of inefficiency is poor property rights enforcement. Consider

again a designer working with an independent producer. After mastering the production processes required by the designer, the production unit can make extra production runs and sell the product as inexpensive knock offs. Equipped with knowledge acquired through working with the original designer, it could also build up its own design unit or share its knowledge with other designers to gain more business. All these could harm the original designer's business. Likewise, the designer, after working with the producer, may have learned much about production and other trade secrets, and might sell this information to another producer. The buyer enjoys the full benefit of the information and so reduces its production cost. The price divides the gains between the designer and the second producer. The producer faces tougher competition and is less able to recover its investment in enhanced production capabilities. Hence, it is keen on protecting its property rights.

However, many of these anticipated transaction difficulties can be countered with legal contracts between the units and by market forces that discipline the two units – rendering vertical integration unnecessary.

First, well specified and well enforced legal contracts can mitigate opportunistic behavior and protect property rights. Legal clauses can substantially reduce the feasibility and gains from ex post bargaining to extract rents. Detailed contractual clauses can reduce shirking and stipulate effort and information sharing and cooperation. Carefully drafted legal clauses can precisely stipulate property rights and prohibit their infringement.

Second, a free market serves as a disciplinary force. If transactions are carried out in the open by more than just one or two independent firms, their behavior provides information. Importunate shirking, inadequate performance, and disdain for property rights all inform subsequent potential business partners about the firm's likely behavior. While some transactions may be idiosyncratic or subject to asset

specific issues, a free market makes firms on-going concerns whose reputations as a non-opportunistic players (Klein and Leffler, 1981) determine their future business opportunities.

Legal and the market remedies are mutually reinforcing. Given costly public enforcement of laws and non-trivial uncertainties rendering detailed contingent contracts implausible, a mixed contract partially enforced by laws and partially by market mechanisms might be more effective than reliance on one or the other alone. By the same token, the effectiveness of market forces depends on how fully the contracting parties can anticipate each other's behavior. The law and its enforcement makes their future non-opportunistic behavior easier to anticipate, and thus expands their investment opportunities.

2.2 Determinants of Vertical Integration

The above suggests that vertical integration is more likely if holdup and property rights concerns are heightened[1] but the legal system and the market forces are too weak to enforce implicit, or even explicit, contracts. Our argument is in line with the argument that firms can form international markets to overcome poor institutions, see, Khanna and Palepu (1999).

Below, we develop several hypotheses by applying this logic to China. China provides a natural testing ground because of substantial variation in the strength of market forces and the quality of institutions across its regions. Most prior studies on firm vertical integration focus on firm or industry level determinants. The large variation in China's institutional settings against a similar cultural background provides a unique opportunity to examine the roles of market and legal institutions in

[1] Another concern is the intrinsic importance of information sharing and general cooperation among vertically related units. This intrinsic relatedness is fundamentally an industry effect. Because this factor is not a central focus of the paper, we control for it using industry dummies.

firm vertical integration decisions.

2.2.1. Asset specificity and uncertainty

A basic premise of the transaction cost theory is that high potential holdup costs induce vertical integration. To capture potential holdup costs we use the transportation infrastructure available to a firm in a region (province). Poor transportation infrastructure limits the firm's alternative business partners, and so creates post-contract bilateral bargaining problems. Holdup problems intrinsic to this situation induce vertical integration. However, poor infrastructure alone is not a sufficient condition for vertical integration, for the associated holdup problem can be mitigated easily in a legal contract. Contractual difficulties arise if the firms face non-trivial uncertainty as to the contract's enforcement (see, e.g., Carlton, 1979).

Hence, our starting point is that, *ceteris paribus*, *a firm is likely to be more vertically integrated if its transactions are subject to high performance uncertainty and it is located in a region with poor transportation infrastructure*.

2.2.2. Institutional factors

The general discussion in section 2.1 points to that vertical integration is more prevalent in locations where legal protection for property rights is poor and markets are underdeveloped and exert feeble disciplinary forces. Along these lines we identify determinants that raise Chinese firms' tendency to integrate vertically.

Our first, simplest, and perhaps most obvious hypothesis is:

Vertical integration is more extensive if a firm is located in a region with poor legal protection of property rights.

Generally, the right to operate a business in China is heavily regulated. This

leads to several important considerations. First, bureaucrats' power to allocate these rights and to interfere in businesses' operations foster a specialized class of rent seeking firms, which gain business opportunities by lobbying the bureaucrats, by having corporate insiders serve as bureaucrats, or by advancing insiders' relatives within the bureaucracy. These rent seeking firms often become localized monopolies. These local monopolists would opt for vertical integration to avoid "double marginalization" especially where contractual options are limited (see, e.g., Cabral, 2000). In addition, self-interested bureaucrats, as well as public minded bureaucrats who pursue social engineering goals, need trusted firms to aid them in these endeavors.

Therefore, our second hypothesis is:

The more deeply a firm is connected with government bureaucrats, the more vertically integrated is the firm's business structure.

China's ubiquitous government intervention is likely to induce vertical integration, even among firms lacking deep political connections. An illustration clarifies. In the earlier example, Weiqiao Group had to generate its own power to ensure the smooth operation of its textile plants. The reason is that heavy entry and price regulations discourage entry and protect inefficient State owned electricity firms. Interestingly, Weiqiao found that it generated more electricity than it needed. With no right to sell electricity, Weiqiao began refining aluminum to make use of its excess electricity – an activity not obviously related to its core textiles operations.

Heavy regulation raises transactions costs, even for very standard transactions (Stigler, 1951) and, needless to say, also prevents strong market disciplinary forces from developing. As explained in the previous section, the market's disciplinary forces are a mechanism to mitigate opportunistic behavior.

Hence, our third hypothesis is:

A *firm is more likely to adopt vertical integration strategy where its associated input and/or product markets are heavily regulated and/or underdeveloped*.

At a more general level, what matters is not regulation *per se*, but the quality of government. A poor quality government is rife with bureaucrats' intent on extracting rents, collecting bribes, and even explicitly expropriating private property. In such environments, for reasons discussed above, firms connected with government bureaucrats would vertically integrate to enhance their rent-extraction, while unconnected firms must do the same to shield themselves from rent extraction.

Hence, another hypothesis is thus:

Firms are more likely to integrate vertically in regions with low quality government.

In summary, we expect a firm to be more vertically integrated if its managers are politically connected and if it lies in a Chinese province or special district characterized by poor quality government, weak property rights protection, and/or ill developed markets.[2]

2.3 Vertical integration and firm value

Our discussion points to poor institutions of sorts described above inducing vertical integration, but the strategy could also reflect either efficiency enhancement

[2] Khanna and Oberholzer-Gee (2006) show evidence that government interference within each province is correlated with the existence of large firms. They argue that the interference can either protect incumbent or that incumbent have to acquire a certain size to combat interference.

or rent-seeking. In the former case, while vertically integrated firms may generate higher cash flows, their insiders and their connected parties likely appropriate most of these gains. As a consequence, the public shareholders of listed firms of this sort should see few benefits. Indeed, vertically related transactions may facilitate insiders' aggressive tunneling, rendering public shareholder wealth negatively related to vertical integration. On the other hand, these firms' insiders could still subject themselves to proper incentive alignments and monitoring device, either voluntarily or involuntarily, so that outside shareholders can still capture form of the vertical integration benefits.

We therefore expect that

1. *Firm value is negatively related to vertical integration if the firm is controlled by a rent extracting insider,*

and

2. *Firm value is positively related to vertical integration if incentive and monitoring devices prevent looting by insiders and bureaucrats*.

We need to clarify a concern. Our hypotheses point to that the politically connected and privileged insiders vertically expand their firms, for their own benefits, in locations where government bureaucratic influence is high, legal property rights protection is low, and market disciplinary forces are feeble. The concern is that these insiders could organize the vertical expansion in the form of vertical integration within one single firm, or a group of vertically related firms all controlled by them. Possibly, both are happening. Indeed, many of our vertically integrated firms controlled by these insiders could be a part of a firm group with connected ownerships, e.g., a pyramid.[3] We currently do not have sufficient information in our sample to

[3] Generally, it is interesting to find out the factors that influence an insider's choice: vertical integration inside one single firm, non-integrated firms that are arranged as a firm group with a common dominant control, and a mixture of both. We relegate these inquires for future research

differentiate whether vertical integration is achieved within a stand alone firm or between two firms within a firm group. Note that this would make it less likely for us to find supports for our empirical hypotheses.

3. Data, measurement, and basic statistics

This section describes the sample and measure of vertical integration, and then explores patterns of firm vertical integration.

3.1. The Sample

Our sample includes most companies listed on the Shanghai and Shenzhen stock exchanges from 2001 to 2003. The China Securities Regulatory Commission requires that public traded companies disclose segment information for all business segments comprising more than 10% of consolidated sales, assets or profits. Disclosed information about a given segment typically includes an industry name, a description of products or services, and segment sales, costs and profits. We manually collect these data from annual reports starting in 2001, since by then their coverage and reporting quality are substantially improved.

Companies reporting non-positive sales or incomplete segment sales and industry sector information are excluded from the sample. Financial firms are excluded because their financial statements are not comparable to those of manufacturing firms. Firms primarily in the public utility sectors are excluded because their business decisions are strictly regulated. Our final sample thus consists of almost 1,000 firms and 2,765 firm-year observations.

Table 1 describes the sample by year and industry. The sample firms account for almost 80 percent of all public listed companies. We classify firms by their largest segment's broad industry affiliation. Their primary industries span the whole

effort.

economy, with the most common being the machinery, equipment, and instrument sector, followed by the commerce (trade) sector, the petroleum and chemicals sector, and the glass, minerals and metals sector.

[Table 1 about here]

3.2.Vertical integration measures

We modify the methodology of Fan and Lang (2000) for measuring firm vertical integration. This methodology utilizes commodity flow information in the national economy's input-output matrix. The construction of the vertical integration measure involves two steps.

In the first step, we create two matrices of inter-industry vertical relatedness coefficients. This involves computing the coefficients between each pair of 124 industries defined in the 1997 Chinese input-output table. The table reports, for each pair of industries *i* and *j*, the dollar value input from industry *i* in producing industry *j*'s total output. We denote this fraction v_{ij}. If v_{ij} is large, this suggests an opportunity for *i* to forward integrate into *j*. Conversely, a high v_{ji} suggests an opportunity for *i* to backward integrate into *j*. We define the vertical relatedness coefficient between industries i and j as $V_{ij}=(v_{ij}+v_{ji})/2$, or alternatively, $V_{ij}=\max(v_{ij},v_{ji})$.

In the second step, a firm-level vertical integration measure is constructed by computing the weighted average vertical relatedness coefficients of each pair of its segments, excluding same-segment pairs. The firm vertical integration measure is defined as $V=\frac{1}{n-1}\sum_{i=1}^{n}w_i\sum_{j\neq i}V_{ij}$, where w_i is the sales weight of segment *i*. The sum of the sales weighted vertical relatedness coefficients is divided by *n* - 1 to account for the effect that the weighted sum increases with the number of segments. For example, consider a three-segment firm with equal sales weight (1/3). Assuming the

vertical relatedness coefficients for pairs of the segments are all 1. Then the weighted sum of the vertical coefficients is 2. Dividing the weighted sum by 2 (3-1) will scale back the vertical measure to 1. Unadjusted, the sum would rise with the number of segments. We then define V_{mean} and V_{max} to differentiate whether the mean or maximum of v_{ij} and v_{ji} is used to calculate V_{ij}. For a one-industry firm (i.e., n = 1), we set the value of both V_{mean} and V_{max} as zero.

In other words, a firm's level of vertical integration is the weighted average of the vertical relatedness coefficients of all pairs of industries in which the firm operates. It reflects a firm's overall opportunity for vertical integration between all its lines of business.

An example illustrates. Huangshan Tourism Development Co., Ltd has three segments: tour operation, hotels, and transportation, accounting for 51%, 24%, and 25% of firm sales, respectively. Using the input-output table, we estimate that tour operation employs 0.0700 yuan of hotel services to produce one yuan of output, and conversely hotels consume 0.0020 yuan of tour operation products for every yuan of output generated. The inter-industry relatedness coefficient of tour operation with hotels (V_{ij}) is thus estimated as 0.0360, the average of the two input requirement ratios. Similarly, the coefficient of hotels with transportation is 0.0023, and that of tour operation with transportation is 0.0233. The equation above then lets us estimate the overall extent of vertical integration of the firm, V_{mean}, equal to $\frac{1}{2}\times$[51%$\times$ (0.0360+0.0233)+ 24%$\times$(0.0023+0.0360)+25%$\times$(0.0233+0.0023)], as 0.0229.

We calculate V_{mean} and V_{max} for each firm each year. Table 2 summarizes these vertical integration measures. Panels A and B report the mean, median, standard deviation, minimum and maximum of V_{mean} and V_{max}, respectively. The sample averages of V_{mean} and V_{max} are 0.014 and 0.025, respectively. That is, the firms

potentially could transact 1.4 or 2.4 fen, depending on which measure is used, of its business dealings with in-house affiliates, for every yuan of output the firm produces. The average degree of vertical integration does not change significantly in terms of both V_{mean} and V_{max} from 2001 to 2003. Across the 15 broad industries, vertical integration potential is most pronounced in mining; agriculture, forestry and fishing; textile, apparel and leather; and glass, minerals, and metals. Vertical integration potential is lowest in real estate; medicine and biological products; and publishing, motion pictures and arts.

[Table 2 about here]

3.3. Focal Independent variables

This section describes our focal independent variables, which capture determinants of vertical integration.

Asset specificity and uncertainty

Vertical integration is a response to asset specificity and uncertainty associated with transactions. Asset specificity can reflect industry characteristics or characteristics of the broader environment. We capture the former with industry fixed effects. We capture the latter with a key institutional feature – the quality of the regional ***transportation infrastructure,*** the total length of railways, waterways, and highways in the province divided by its total geographic area. Poor regional transportation infrastructure restricts parties' ability to find alternative business partners, and so heightens asset specificity problems, aggravating potential holdup problems, and so elevating the costs of market transactions.

We gauge performance uncertainty by input ***price uncertainty***, as in Lieberman (1991) and Fan (2000). This variable is the standard error of the residual of an industry segment's annual inflation adjusted primary input price index regressed on a time trend from 1980 to 2001. Higher price uncertainty should make vertical

integration more likely because this too raises arm's length transactions costs. All else equal, this effect should be more pronounced where asset specificity holdup problems are also severe. That is, high price uncertainty and poor transportation infrastructure together should induce even more vertical integration.

Institutional factors

Section 2 hypothesizes that vertical integration is affected by several institutional factors – the extent of legal property rights protection, government quality, and market development.

We measure local ***legal property rights protection*** using a province-level index developed by Fan and Wang (2001, 2002, 2003), reflecting the frequency of lawsuits and efficiency of courts in each province or special district. The frequency of lawsuits is defined as the number of business or economic lawsuits scaled by a location's GDP in constant "yuan." The court efficiency is the number of economic or business lawsuits concluded by the court in a year divided by number of cases filed in the year.

Our measure of local ***government quality*** is an index of government service quality available in *The Annual Report of Urban Competitiveness in China*. The index grades local government service quality based on three criteria: the level of bureaucratization, the frequency of government expropriations, and the level of citizen satisfaction. This index is constructed at the city level, so we aggregate it to the province level index by taking an average across all cities in province.

Finally, for ***market development*** we use an index, constructed to be inversely related to a local government's fiscal expenditure scaled by GDP, that captures the extent to which a province's resources are allocated by markets (Fan and Wang, 2001, 2002, 2003). In China's communist regime, governments traditionally play an important role of allocating resources, which is beyond just spending on education,

infrastructure, social securities, and provision of other public goods like policing and defense. A government's activeness in allocating resources, is largely reflected in their fiscal spending statistics. The higher is the fiscal spending of a local government, the lower is the role markets in allocating resources in the province.

Rent-seeking potential

Section 2 also points out that vertical integration might be motivated by rent-seeking. We construct a set of variables to capture firm rent seeking potential.

Following Fan, Wong, and Zhang (2006), our first variable is ***CEO affiliation***, an indicator variable equal to one if the firm's CEO is (or has been) a bureaucrat with the central government, a local government, or an industry bureau. Our second measure, ***business privilege*** is also an indicator variable, here equal to one if one of the firm's business line is a heavily regulated industry (electricity, communication, transportation, mining, metal, or petroleum industry) and to zero otherwise. In China, the right to operate in these industries is highly restrictive and granted by the State. Assuming corporate insiders with government backgrounds, or who have obtained the right to operate in a heavily regulated industry, are likely to be politically connected, we take these two variables as reflecting political rent seeking ability. We assume such ability opens further political rent seeking opportunities, and hence creates superior access to business opportunities.

Our third measure of rent seeking is long-term financial leverage, measured by long-term debt over total assets. Politically favored firms typically have greater access to long-term bank loans (Fan, Rui and Zhao, 2006). We employ a variable ***financial leverage*** to measure such superior access, which equals to one if a firm's financial leverage is above the median leverage of all firms in the same province.

Firm level monitoring

The relationship of vertical integration with firm value is affected by the

extents to which insiders are monitored and their incentives are aligned with public shareholder value. To captures monitoring and incentive alignment, we use an indicator variable denoted ***auditor***, set to one if the firm's external auditor is from the international "big-four", and to zero otherwise. Evidence from the accounting literature suggests that emerging market firms with "big-four" auditors are more transparent to investors and have lower costs of capital than firms with other auditors (e.g., Fan and Wong, 2005). We expect that insiders scrutinized by "big four" auditors are less likely to appropriate wealth from their firms, including wealth accumulated via political rent seeking. Note that this variable could reflect self-selection, rather than auditing effectiveness.

Other controls

Several additional variables are considered as control variables. A firm might be more likely to integrate upstream or downstream if its scale of operation is larger. Firm scale is therefore measured as the natural logarithm of firm assets, denoted ***size***. To mitigate potential endogeneity problem, we use the average scale of the firm's primary industry to proxy for the firm's scale. An already highly horizontally diversified firm might not integrate vertically as well because of already binding managerial or organizational capacity constraints. Overall diversification is measured as the total number of the firm's business segments, denoted ***diversification***. New firms might be less vertically integrated than old firms simply because it takes time to build up vertical integration. We capture this by the number of years during which the firm was listed, denoted ***years listed***.

Finally, we include provincial *per capita* gross domestic product (GDP) to account for the effects of regional economic conditions on firm organizational structure. This control also mitigates the possibility that our transportation infrastructure and institutional variables might proxy for general development.

The Appendix summarizes the definitions and data sources of the variables employed. Table 3 reports basic statistics on pooled firm-year or province-year data. The number of observations differs across variables, mainly because some are at the province level while others at the firm level. The government quality variable has a smaller number of observations than other regional level variables because it is available only in 2003. Substantial variation in institutional quality across China's regions is confirmed by the substantial variation in provincial level institutional variables.[4]

[Table 3 about here]

Table 4 provides Pearson correlation coefficients. The institution and control variables are generally not highly correlated, so their inclusion as controls in the regressions below ought not to induce multicollinearity problems. However, multicollinearity must be reconsidered in evaluating regression coefficients of the transportation infrastructure variable, with its correlation coefficients of 50 percent with the property rights index and 91 percent with GDP *per capita*.

[Table 4 about here]

4. Vertical integration and its determinants

This section empirically examines the roles of the institutional factors in promoting vertical integration. We begin by examining Person correlation coefficients of vertical integration measures with the institutional and firm variables in Table 4. Vertical integration, whether measured by V_{mean} or V_{max}, is significantly negatively correlated with *legal property rights*, *government quality*, and *market development*. The rent seeking variables – CEO's political affiliation, rights to operate in heavily

[4] The minimum of market allocation seems to be an outliner. We winsorize it later in the regressions, and the results remain qualitatively similar.

regulated sectors, and access to long-term debt – all correlate positively with V_{mean} and V_{max}. Vertical integration correlates positively with *price uncertainty* but negatively with *transportation infrastructure*. Finally, vertical integration is positively correlated with firm *size* and *diversification*, but negatively correlated with *years listed*. These correlations are generally consistent with our hypotheses. An exception is the positive correlation between vertical integration and diversification, which is likely due to that the value of the vertical integration measures is always zero for one industry firms while greater than zero for multi-industry firms. As expected, if one-industry firms are excluded, the correlation between diversification and either of the vertical integration measures becomes significantly negative.

Table 5 reports the differences in mean and median vertical integration levels between firms with high versus low rent seeking potential. We alternately use CEO connections with bureaucrats, rights to operate in regulated industries, and access to long-term bank loans to identify high rent seeking potential firms. The table clearly confirms that firms led by politically connected CEOs, operating in heavily regulated sectors, or with superior access to long-term bank loans exhibit greater degrees of vertical integration than other firms. These results of the bivariate comparisons are consistent with the correlations in Table 4, and with the hypothesis that vertical integration in China is influenced by rent seeking as well as transactions costs.

[Table 5 about here]

Confirming this requires multiple regression analysis to control for other factors that might affect vertical integration. We run OLS regressions on pooled firm-year data. Our province level variables exhibit no variation across firms within each province, and several firm variables have only small variations over time. To avoid upward biased t-statistics, we calculate Huber-White (clustered) standard errors by year and by firm, as recommended by Petersen (2005). Since firms whose gains

from potential vertical integration are outweighed by its cost all fail to integrate vertically, our data on V_{mean} and V_{max} are truncated at zero. We therefore also include a standard Heckman correction in all our regressions. The Heckman procedure involves two stages. In the first stage a probit regression is run to address whether a firm choose to be a one-industry firm and hence vertically non-integrated. The dependent variable is a binary variable equal to one if a firm is a multi-industry firm. The independent variables include firm size, market to book equity ratio, the percentage of state ownership, years listed, and industry and year dummy variables. The results of the first-stage regression are reported in Panel A of Table 6. In the second stage, the vertical integration model is estimated using the OLS method while accounting for the selection bias captured by an inverse Mill's ratio estimated from the first stage, denoted as *lambda*.

Panel B of Table 6 reports regressions explaining V_{mean}. Regressions explaining V_{max} generate very similar results, and so are not shown. Column (1) reports coefficients of a basic model including *price uncertainty*, *transportation infrastructure*, the interaction between these two variables, firm *size*, *diversification* level, *lambda*, *years listed*, GDP *per capita*, and industry and year fixed effects.[5]

The results show vertical integration positively related to *price uncertainty*, unrelated to *transportation infrastructure*, and negatively related to the interaction between the two variables. These results are consistent with the transaction cost theory; that is, with high price uncertainty raising transactions costs, and hence induces firm to integrate vertically to bypass the costly market transactions. The interaction term result is consistent with weak transportation infrastructure, when coupled with uncertainty, inducing further vertical integration.

[Table 6 about here]

[5] Use use heteroskedasticity-consistent *t's* allowing for firm and year clustering.

Vertical integration is unrelated to firm *size* and GDP per capita, but is significantly positively related to number of firm segments and negatively related to years listed.

Column (2) of Table 6 shows vertical integration negatively associated with the quality of local legal property rights protection, local government quality, and local market development. These effects of institutions are economically significant. For example, setting all the independent variables at their mean values, a 10 percent improvement in the local property rights level reduces the extent of vertical integration (V_{mean}) by 4 percent, almost 1.6 times larger than the standard deviation of the vertical integration measure. The remaining independent variables exhibit the same pattern as before.

Columns (3) through (5) further include the three firm-level variables proxying for rent seeking. Vertically integration is more evident in firms whose CEOs are politically connected, that possess rights to operate in highly regulated industries, and that have superior access to long-term loans. The coefficients of the other independent variables remain qualitatively unchanged.

As robustness checks, we rerun our regressions as tobits, and generate qualitatively similar results – by which we mean patterns of signs and significance similar to those in the tables. As a further robustness check, we apply an approximate inverse logistic function, transforming V_{mean} into $V' = \ln[1/(1 - V_{mean})]$,. We then run Tobit regressions and alternatively OLS regressions with Heckman correction, and again, this generates similar results to those shown. Rerunning the regressions without clustering also generates qualitatively similar results.

Overall, Table 6 is consistent with vertical integration being an important organizational response to weak institutions. If the institutional environment improves, arm's length market transactions become relatively more attractive, and so reduce the

net benefits of vertical integration. The results are also consistent with vertical integration being associated with political rent seeking. Rent seeking firms capitalize on their political connections by obtaining permission from bureaucrats or regulators to extend their operations into upstream or downstream industries.

5. Vertical integration and firm value

This section examines the relationship between vertical integration and firm performance, as measured by firm market-to-book ratios, which we take as proxying for Tobin's *average q*. Specifically, we define this as the sum of the market value of tradable equity, the book value of untradable equity, and the book value of debt, all divided by total assets. Because a substantial part of the equity of a typical Chinese listed state controlled company is untradable classes of shares held by various state organs, we take these at book value. The value of tradable shares is estimated as the fiscal year-end closing price per share times the number of tradable shares.

In a basic model, Tobin's *average q* ratio is regressed on V_{mean}[6] and a set of control variables, including firm *diversification* level, firm *size*, *debt*, *growth*, *state ownership*, *years listed*, and industry and year fixed effects. *Diversification*, *size*, and *years listed* are defined as above. We measure *debt* as total debt divided by total assets. *Growth* is the percentage of annual growth in sales from the previous to the current year. *State ownership* is the percentage of common shares owned by governments directly or through State organs. The regressions are OLS, permitting year and firm clustering, as recommended by Petersen (2005). As before, we apply the Heckman procedure, and include the inverse Mill's ratio, *lambda*, in the second stage regressions to mitigate potential selection bias of vertical integration. The result of the first stage regression for vertical integration has been reported previously in Panel A

[6] Using V_{max} as the dependent variable generates results qualitatively similar to those in the table.

of Table 6.

Panel B of Table 7 reports the results of the second stage regressions. Column (1) shows vertical integration unrelated to *average q*, though several control variables are significant. Specifically, *diversification*, *state ownership* and *size* are negative, but *debt* and *years listed* are positive.

[Table 7 about here]

We next see if vertical integration associated with rent seeking has different performance implications. To do this, we modify the basic regression by including each of the three rent seeking variables in columns (2) through (4), along with its interaction with V_{mean}.

Average q remains unrelated to V_{mean}. The coefficients of the rent seeking variables bear different relations with *Average q*. *CEO affiliation* is insignificantly related to *Average q*. *Business privilege* is significantly positively related to Average q, consistent with the view that monopoly rights in heavily regulated sectors add value. By contrast, financial leverage is weakly negatively related to Average q, consistent with that most Chinese firms are overly leveraged – additional access to loans do not benefit but hurt shareholders.

Through column (2) to column (4), the coefficients of interactions between V_{mean} and rent seeking are significantly negative whenever we use *CEO affiliation*, *business privilege* or *financial leverage* to proxy firms' political connection. These results are consistent with vertical integration motivated by political rent seeking adversely affecting firm performance. At first glance, this seems inconsistent with rent seeking ability being a competitive advantage in China's weak institutional environments. However, it is consistent with insiders, rather than public shareholders, reaping most of the benefits associated with rent seeking and vertical integration and vertical integration facilitates their grabbing. While hard to prove, barring a large

scale data collection, insiders could use their political connection and business privilege to develop a connected business group/pyramid. Their firms' vertical integration is only a reflection of the extensive and complicated interconnected business groups they are developing. Via these interconnected groups, the insiders could be tunneling extensively.

Insiders subject to scrutiny by sophisticated auditors may be less apt to appropriate such benefits. They may do this voluntarily – because of the positive signaling effect for obtaining financing in the future. Or, they may do this involuntarily, e.g., because their predecessors had done so. To test this, we set an indicator variable to one for firms audited by a "Big Four" auditor, and to zero otherwise. We then augment our basic regression model with this *auditor* variable and its interaction with V_{mean}. Since the auditor variable is likely subject to selection bias, we employ the Heckman procedure to control such treatment effect.[7] The results in Col. (5) show performance unrelated related to V_{mean}, but positively related to the *auditor* variable. Their interaction term is positive but insignificant. Overall, these results suggest that choosing a name-brand auditor has a positive effect on firm value, consistent with that credible firms self-select to be audited by reputable auditors and yet auditors' reputation still lends credibility to the firm. However, the auditor choice does not provide additional value to more vertically integrated firms than their less integrated counterpart.

We further address the next question: Does credible external monitoring also result in insiders sharing with public shareholders any benefits of vertical integration associated with political rent seeking? To investigate, we run regressions explaining

[7] Specifically, we construct a probit model to estimate the inverse Mill's ratio of auditor, denoted as *lambda2*. The dependent variable is a binary variable equal to one if the external auditor of a firm is 'Big Four'. The independent variables include firm size, performance (ROA), the ratio of long-term debt, asset structure (the ratio of current asset to current liability), accounts receivable over assets and inventory over assets. The result of this regression is in Panel A of Table 7.

average q modified to allow both two- and three-way interactions among V_{mean}, auditor, and each of the rent seeking variables in turn.

Table 8 reports the results. The right-hand side variables also appearing in Panel B of Table 7 attract consistent coefficients here. Performance is insignificantly related to V_{mean}, positively related to auditor, negatively related to the interaction term of V_{mean} and rent seeking, and unrelated to the interaction between V_{mean} and auditor.

The extra feature of Table 8 is the three-way interaction. The interaction effects of V_{mean}, *auditor*, and the rent seeking variables all attract positive coefficients, significantly so if rent seeking is gauged by the right to operate in regulated sectors or by access to long-term loans. This is consistent with rent seeking inducing vertical integration and, if done by managers subject to external monitoring, elevating public shareholder wealth. Overall, this is consistent with external monitoring constraining the ability of insiders to glean most of the benefits of vertical integration, after controlling for the possibility that insiders self-select to subject themselves to external monitoring.

[Table 8 about here]

As a robustness check we substitute V_{max} for V_{mean} and repeat the performance regressions. The results are again qualitatively similar to the tables.

Finally, both vertical integration and performance might be driven by institutional factors, rendering any statistical relation between them spurious. To address this, we repeat the performance regressions including as additional controls the full set of institutional variables and their interaction terms with the rent seeking and auditor variables. This does not qualitatively change our key results.

6. Conclusion

Patterns of vertical integration in China correspond well to likely regional

transactions cost differences. Firms are more vertically integrated in regions with weak legal property rights protection, poor quality government and underdeveloped markets for inputs and products; these observations are consistent with that vertical integration is used to overcome transaction difficulties where legal protection, government quality and market disciplinary forces are weak. Firms whose managers have closer ties to bureaucrats are also more vertically integrated, consistent with vertical integration augmenting the returns to political rent seeking. These results persist after controlling for the effects of industry factors, local transportation infrastructure, input *price uncertainty*, firm *size*, *years listed*, *diversification*, and the degree of regional economic development.

Our evidence of the effects of vertical integration on firm value is more mixed. Vertical integration associated with political rent seeking is negatively related to firm value in absent a "big four" auditor. However, in the presence of a "big four" auditor, this negative relationship switches signs. These results are consistent with the net benefits of vertical integration accruing to insiders absent a credible external monitor, but being shared with public shareholders in the presence of such a monitor.

Overall, these results are consistent with institutional factors exerting a substantial effect on a listed Chinese firm's vertical integration and its ensuing economic implications.

The usual caveats apply. One country's experience need not extend to other economies. Nonetheless, the evidence here provides a benchmark for comparison with other emerging and transition economies with similar institutional asthenia, and where textile companies also grow cotton and generate electricity, as the Weiqiao Group does in China.

References:

Acemoglu, D., Aghion, P., Griffith, R., Zilibotti, F., 2004. Vertical integration and technology: theory and evidence. Working paper 10997. National Bureau of Economic Research.

Acemoglu, D., Johnson, S., Mitton, T., 2005. Determinants of vertical integration: finance, contracts, and regulation. Working paper 11424. National Bureau of Economic Research.

Allen, F., Qian, J., Qian, M., 2005. Law, finance, and economic growth in China. Journal of Financial Economics 77 (1), 57-116.

Cabral, Luis, 2000. *Introduction to Industrial Organization*, MIT Press: Cambridge, Mass.

Carlton, D., 1979. Vertical integration in competitive markets under uncertainty. Journal of Industrial Economics 27 (3), 189-209.

Che, J., Qian, Y., 1998. Insecure property rights and government ownership of firms. Quarterly Journal of Economics 113 (2), 467-496.

Chipty, T., 2001. Vertical integration, market foreclosure, and consumer welfare in the cable television industry, American Economic Review 91 (3), 428-453.

Coase, R., 1937. The nature of the firm. Economica 4, 386-405.

Cull, R., Xu, L., 2005. Institutions, ownership, and finance: the determinants of profit reinvestment among Chinese firms. Journal of Financial Economics 77 (1), 117-146.

Fan, G., Wang, X., 2001, 2002, 2003. NERI index of marketization of China's provinces. Economics Science Press, Beijing.

Fan, J., 2000. Price uncertainty and vertical integration: an examination of petrochemical firms. Journal of Corporate Finance 6, 345-376.

Fan, J., Goyal, V., 2006. On the patterns and wealth effects of vertical mergers. Journal of Business 79 (4), 877-902.

Fan, J., Lang, L., 2000. The measurement of relatedness: an application to corporate diversification. Journal of Business 73 (4), 629-660.

Fan, J., Rui, M., Zhao, M., 2005. Rent seeking and corporate finance: evidence from corruption cases. Working paper, Chinese University of Hong Kong and Bentley College.

Fan, J., Wong, T., 2005. Do external auditors perform a corporate governance role in emerging markets? evidence from East Asia. Journal of Accounting Research 43 (1), 35-72.

Fan, J., Wong, T., Zhang, T., forthcoming. Politically connected CEOs, corporate governance and post-IPO performance of China's partially privatized firms. Journal of Financial Economics.

Joskow, P., 1987. Contract duration and relationship-specific investments: empirical evidence from coal markets. American Economic Review 77 (1), 168-185.

Khanna, Tarun, and K. G. Palepu. "Policy Shocks, Market Intermediaries, and Corporate Strategy: Evidence from Chile and India." *Journal of Economics and Management Strategy* 8, no. 2 (June 1999): 271-310

Khanna, Tarun and Felix Oberholzer-Gee, 2005, "The Political Economy of Firm-Size Distributions: Evidence from China," HBS working paper

Klein, B., Crawford, R., Alchian, A., 1978. Vertical integration, appropriable rents, and the competitive contracting process. Journal of Law and Economics 21, 297-326.

Klein, B., Leffler, K., 1981. The role of market forces in assuring contractual performance. Journal of Political Economy 89 (4), 615-641.

Lieberman, M., 1991. Determinants of vertical integration: an empirical test. Journal of Industrial Economics 39 (5), 451-466.

Li, P., Hou, Q., Jiang, M., Wang, C., 2004. The annual report of urban competitiveness in China. Social Sciences Academy, Beijing.

Lucas, Robert. E. Jr. 1978. "On the size distribution of business firms," Bell Journal of Economics, pp. 508-523.

Masten, S., 1984. The organization of production: evidence from the aerospace industry. Journal of Law and Economics 27, 403-418.

Milgrom, P., Roberts, J., 1988. An economic approach to influence activities in organizations. American Journal of Sociology, 94 (Supplement), 154-179.

Monteverde, K., Teece, D., 1982. Supplier switching costs and vertical integration in the automobile industry. Bell Journal of Economics 13 (1), 206-213.

Montinola, G., Qian, Y., Weingast, B., 1995. Federalism, Chinese style: the political basis for economic success in China. World Politics 48 (1), 50-81.

Mulherin, J., 1986. Complexity in long-term contracts: an analysis of natural gas contractual provisions. Journal of Law, Economics, and Organization 2 (1), 105-177.

Petersen, M., 2005. Estimating standard errors in financial panel data sets: comparing approaches. Working paper, Northwestern University.

Qian, Y., Weingast, B., 1996. China's transition to markets: market-preserving federalism, Chinese style. Journal of Policy Reform 1, 149-185.

Qian, Y., Weingast, B., 1997. Federalism as a commitment to preserving market incentives. Journal of Economic Perspectives 11 (4), 83-92.

Stigler, G., 1951. The division of labor is limited by the extent of the market. Journal of Political Economy 59 (1), 185-193.

Williamson, O., 1973. Markets and hierarchies: some elementary considerations.

American Economic Review 63 (2), 316-25.
Williamson, O., 1975. Markets and hierarchies: analysis and antitrust implications. Free, New York.
Williamson, O., 1979. Transaction cost economies: the governance of contractual relations. Journal of Law and Economics 22, 233-261.

Table 1
The Sample
This table reports the sample by year and industry. Our sample consists of most non-financial, non-public utility listed companies in Shanghai and Shenzhen Stock Exchange from 2001 to 2003. It totally has 2,765 firm-year observations.

Industry	2001	2002	2003	Total
Agriculture, Forestry and Fishing	15	12	11	38
Mining	9	11	13	33
Food and Beverages	51	56	54	161
Textile, Apparel and Leather	39	42	37	118
Lumber, Furniture, Paper and Printing	23	28	29	80
Petroleum, Chemicals, Rubber and Plastic Products	111	109	118	338
Glass, Minerals and Metals	96	109	123	328
Machinery, Equipment and Instrument	210	233	242	685
Medicine and Biological Products	49	56	67	172
Construction	15	19	20	54
Commerce	130	136	150	416
Real Estate	48	62	70	180
Services	50	53	51	154
Publishing, Motion Pictures and Arts	2	3	3	8
All industries	848	929	988	2765
Percentage of total listed firms	74.64	77.55	78.34	76.87

Table 2
The Patterns of Vertical Integration in China
This table presents the patterns of Chinese firms' vertical integration by year and industry. V_{mean} and V_{max} are vertical integration measures computed using the average method and the maximum method, respectively, as described in the text.

Panel A: V_{mean} by Year

Year	Obs.	Mean	Median	Std. Dev.	Min.	Max.
2001	848	0.0141	0.0086	0.0242	0.0000	0.2672
2002	929	0.0138	0.0073	0.0254	0.0000	0.2672
2003	988	0.0141	0.0078	0.0248	0.0000	0.2672
Total	2765	0.0140	0.0078	0.0248	0.0000	0.2672

Panel B: V_{max} by Year

Year	Obs.	Mean	Median	Std. Dev.	Min.	Max.
2001	848	0.0246	0.0131	0.0461	0.0000	0.5299
2002	929	0.0242	0.0123	0.0486	0.0000	0.5299
2003	988	0.0249	0.0127	0.0474	0.0000	0.5299
Total	2765	0.0246	0.0127	0.0474	0.0000	0.5299

Panel C: Vertical Integration by Industry

Industry	Obs	V_{mean}		V_{max}	
		Mean	Median	Mean	Median
Agriculture, Forestry and Fishing	38	0.0285	0.0069	0.0561	0.0114
Mining	33	0.0432	0.0146	0.0699	0.0265
Food and Beverages	161	0.0145	0.0063	0.0281	0.0116
Textile, Apparel and Leather	118	0.0182	0.0058	0.0313	0.0078
Lumber, Furniture, Paper and Printing	80	0.0093	0.0050	0.0169	0.0082
Petroleum, Chemicals, Rubber and Plastic Products	338	0.0158	0.0110	0.0273	0.0190
Glass, Minerals and Metals	328	0.0181	0.0023	0.0343	0.0033
Machinery, Equipment and Instrument	685	0.0124	0.0038	0.0222	0.0058
Medicine and Biological Products	172	0.0069	0.0008	0.0130	0.0015
Construction	54	0.0133	0.0116	0.0245	0.0214
Commerce	416	0.0160	0.0166	0.0253	0.0270
Real Estate	180	0.0051	0.0029	0.0077	0.0054
Services	154	0.0109	0.0084	0.0176	0.0130
Publishing, Motion Pictures and Arts	8	0.0072	0.0077	0.0110	0.0114

Table 3
Descriptive Statistics

This table provides the descriptive statistics of institutional variables and other control variables. 'Property rights' is the index of property rights protection. 'Government quality' is the index of government service. 'Market development' is the index of resource allocated by market. 'CEO affiliation' is a dummy variable equal to one if the CEO of a firm is or has been a bureaucrat of the central government, a local government or an industry bureau. 'Business privilege' is a dummy variable equal to one if one of the firm's industries is heavily regulated by government. 'Financial leverage' is a dummy variable equal to one if the firm's ratio of long-term debt to total assets is above the provincial median value. 'Auditor' is a dummy variable equal to one if the firm employs a 'Big Four' accounting firm as its external auditor. 'Price uncertainty' is the standard error of the residual of a detrending regression of a firm segment's industry-level annual primary input prices from 1980 to 2001. 'Transportation infrastructure' is measured as the length of transportation routes in a province divided by the total geographic area of the province. 'Size' is the natural logarithm of firm assets. 'Diversification' is the number of firm segments. 'Years listed' is the number of years since the firm went IPO. '*Per capita* GDP' is the provincial *per capita* gross domestic product.

Variable	Obs.	Mean	Median	Std. Dev.	Min.	Max.
Property rights	92[a]	7.19	7.36	2.1885	0.00	13.15
Government quality	31	0.0939	0.0963	0.0159	0.0715	0.1235
Market development	92[a]	3.85	5.52	6.6832	-35.94	10.00
CEO affiliation	2765	0.2561	0.00	0.4365	0.00	1.00
Business privilege	2765	0.1208	0.00	0.3259	0.00	1.00
Financial leverage	2765	0.4973	0.00	0.5001	0.00	1.00
Auditor	2765	0.0709	0.00	0.2567	0.00	1.00
Price uncertainty	2765	22.1434	7.3923	25.5495	0.0305	67.5195
Transportation infrastructure	93	0.4124	0.3753	0.2921	0.0184	1.4457
Size	2765	20.9124	20.8487	0.8347	17.5534	26.6102
Diversification	2765	2.5128	2.00	1.4497	1.00	12.00
Years listed	2765	5.2499	5.00	2.6743	1.00	17.00
per capita GDP	93	0.9430	0.6565	0.7167	0.2662	4.0646

[a]The 2001 data of Tibet is not available in Fan and Wang (2001).

Table 4
Person Correlation of Coefficients

This table reports the Person correlation coefficients of variables. V_{mean} and V_{max} are vertical integration measures calculated using the average method and the maximum method, respectively, as described in the text. 'Property rights' is the index of property rights protection. 'Government quality' is the index of government service. 'Market development' is the index of resource allocated by market. 'CEO affiliation' is a dummy variable equal to one if the CEO of a firm is or has been a bureaucrat of the central government, a local government or an industry bureau. 'Business privilege' is a dummy variable equal to one if one of the firm's industries is heavily regulated by government. 'Financial leverage' is a dummy variable equal to one if the firm's ratio of long-term debt to total assets is above the regional median value. 'Auditor' is a dummy variable equal to one if the firm employs a 'Big Four' accounting firm as its external auditor. 'Price uncertainty' is the standard error of the residual of a detrending regression of a firm segment's industry-level annual primary input prices from 1980 to 2001. 'Transportation infrastructure' is measured as the length of transportation routes in a province divided by the total geographic area of the province. 'Size' is the natural logarithm of firm assets. 'Diversification' is the number of firm segments. 'Listing years' is the number of years since the firm went IPO. '*per capita* GDP' is the provincial *per capita* gross domestic product. P-values are in parentheses.

	V_{mean}	V_{max}	Property rights	Government quality	Market development	CEO affiliation	Business privilege	Financial leverage	Auditor	Price uncertainty	Transportation infrastructure	Size	Diversifica-tion	Years listed
V_{max}	0.9934													
	(0.000)													
Property rights	-0.0581	-0.0599												
	(0.002)	(0.002)												
Government quality	-0.0802	-0.0839	0.1074											
	(0.000)	(0.000)	(0.000)											
Market development	-0.0477	-0.0539	-0.0527	0.2961										
	(0.012)	(0.005)	(0.006)	(0.000)										
CEO affiliation	0.0955	0.0928	-0.0059	-0.0564	0.0634									
	(0.000)	(0.000)	(0.758)	(0.003)	(0.001)									
Business privilege	0.1242	0.1286	-0.0539	-0.1004	-0.0008	0.0165								
	(0.000)	(0.000)	(0.005)	(0.000)	(0.968)	(0.387)								
Financial leverage	0.0469	0.0522	0.0102	0.0037	0.0084	-0.0051	0.0686							
	(0.014)	(0.006)	(0.591)	(0.847)	(0.660)	(0.789)	(0.000)							
Auditor	-0.0313	-0.0302	0.1175	0.0750	0.0042	-0.0006	0.0446	0.0663						
	(0.099)	(0.113)	(0.000)	(0.000)	(0.825)	(0.975)	(0.019)	(0.001)						
Price uncertainty	0.0807	0.0581	0.0169	-0.0050	-0.0219	0.0312	0.2781	-0.0484	-0.0110					
	(0.000)	(0.002)	(0.375)	(0.794)	(0.251)	(0.101)	(0.000)	(0.011)	(0.562)					
Transportation infrastructure	-0.0277	-0.0326	0.4954	0.4086	0.1088	-0.0398	-0.0989	0.0056	0.2246	0.0558				
	(0.145)	(0.086)	(0.000)	(0.000)	(0.000)	(0.037)	(0.000)	(0.769)	(0.000)	(0.003)				
Size	0.0546	0.0565	0.0601	0.1053	0.0637	0.0147	0.2280	0.2320	0.2853	0.0549	0.1733			
	(0.004)	(0.003)	(0.002)	(0.000)	(0.001)	(0.441)	(0.000)	(0.000)	(0.000)	(0.004)	(0.000)			
Diversification	0.1797	0.1685	0.0357	0.0776	-0.0099	-0.0092	0.1200	0.0169	-0.0520	0.0288	0.0799	0.0422		
	(0.000)	(0.000)	(0.061)	(0.000)	(0.603)	(0.629)	(0.000)	(0.375)	(0.006)	(0.130)	(0.000)	(0.027)		
Years listed	-0.0571	-0.0623	0.2600	0.0375	-0.0130	0.0152	-0.1106	0.0177	0.0944	0.0338	0.2848	0.0145	0.0712	
	(0.003)	(0.001)	(0.000)	(0.049)	(0.494)	(0.424)	(0.000)	(0.353)	(0.000)	(0.076)	(0.000)	(0.447)	(0.000)	
per capita GDP	-0.0195	-0.0235	0.4396	0.3975	-0.0324	-0.0681	-0.0953	0.0037	0.2184	0.0850	0.9065	0.1814	0.0969	0.2969
	(0.305)	(0.218)	(0.000)	(0.000)	(0.089)	(0.000)	(0.000)	(0.845)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Table 5
Vertical Integration Level Sorted by Firm Rent Seeking Potential

This table reports the mean (Panel A) and median (Panel B) vertical integration levels of the sample firms sorted by their rent seeking potential. Vertical integration is alternately measured as V_{mean} and V_{max}, as defined in the text. Rent seeking potential is alternately proxied by three variables: 'CEO affiliation' is a dummy variable equal to one if the CEO of a firm is or has been a bureaucrat of the central government, a local government or an industry bureau; 'Business privilege' is a dummy variable equal to one if one of the firm's industries is heavily regulated by government; 'Financial leverage' is a dummy variable equal to one if the firm's ratio of long-term debt to total assets is above the regional median value. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A Mean

Subsample criteria	V_{mean}			V_{max}		
	High rent seeking potential	Low rent seeking potential	Difference	High rent seeking potential	Low rent seeking potential	Difference
CEO affiliation	0.0180	0.0126	0.0054***	0.0321	0.0220	0.0101***
Business privilege	0.0223	0.0129	0.0094***	0.0410	0.0223	0.0187***
Financial leverage	0.0152	0.0128	0.0024**	0.0271	0.0221	0.0050***

Panel B Median

Subsample criteria	V_{mean}			V_{max}		
	High rent seeking potential	Low rent seeking potential	Difference	High rent seeking potential	Low rent seeking potential	Difference
CEO affiliation	0.0091	0.0072	0.0019***	0.0138	0.0120	0.0018***
Business privilege	0.0099	0.0077	0.0022**	0.0170	0.0123	0.0047***
Financial leverage	0.0080	0.0077	0.0003	0.0131	0.0123	0.0008

Table 6

Heckman Corrected OLS Regression Results of the Determinants of Vertical Integration

This table reports Heckman corrected ordinary least squares regression results of vertical integration determination. In the first stage (Panel A), we estimate a probit model with the dependent variable equal to one if a firm is a multi-industry firm, or otherwise zero, while the independent variables include firm size (natural logarithm of total assets), market value of common equity to book value of common equity, the percentage of common shares held by government, the number of years since the firm went public, industry and year dummies. The results of the second stage regressions are reported in Panel B. The dependent variable is V_{mean}, a firm vertical integration measure as described in the text. On the right hand side, 'Property rights' is the index of property rights protection, 'Government quality' is the index of government service, 'Market development' is the index of resource allocated by market, 'CEO affiliation' is a dummy variable equal to one if the CEO of a firm is or has been a bureaucrat of the central government, a local government or an industry bureau, 'Business privilege' is a dummy variable that equals to one if one of the firm's industries is heavily regulated by government, 'Financial leverage' is a dummy variable equal to one if the firm's ratio of long-term debt to total assets is above the provincial median value, 'Price uncertainty' is the standard error of the residuals of a detrending regression of a firm segment's industry level annual primary input prices from 1980 to 2001, 'Transportation infrastructure' is the length of transportation routes in a province divided by the total geographic area of the province, 'Size' is the average value of the natural logarithm of firm assets in the firm's primary industry, 'Diversification' is the number of firm segments, 'Years listed' is the number of years since the firm went public, '*per capita* GDP' is the provincial per capita gross domestic product. 'lambda' is the inverse Mill's Ratio estimated from the first stage regression. The regressions employ the OLS method with standard errors clustered at the firm and the year level (Petersen, 2005). Z and t statistics are in parentheses in Panel A and B, respectively. ***, ** and * denote significance at 1%, 5% and 10% level, respectively. The sample size is smaller than the full sample, because of missing state ownership information of some firms.

Panel A The Selection Model of Multiple Segments

	Coefficients	Z value
Intercept	1.0372	(1.47)
Firm Size	0.0052	(0.17)
Market to Book Value	-0.0039	(-1.11)
State Ownership	-0.7089***	(-3.35)
Years listed	0.0433***	(4.15)
Industry dummies	Included	
Year dummies	Included	
Obs.	2744	
Pseudo R^2	0.06	

Panel B The Second Stage Regressions

	(1)	(2)	(3)	(4)	(5)
Intercept	-0.1478	-0.1150	-0.1207	-0.1113	-0.1102
	(-0.64)	(-0.48)	(-0.50)	(-0.47)	(-0.46)
Property rights		-0.0007*	-0.0008**	-0.0007*	-0.0007*
		(-1.89)	(-1.98)	(-1.89)	(-1.90)
Government quality		-0.1754***	-0.1649***	-0.1692***	-0.1765***
		(-3.29)	(-3.19)	(-3.29)	(-3.31)
Market development		-0.0002*	-0.0002**	-0.0002*	-0.0002*
		(-1.70)	(-1.99)	(-1.78)	(-1.71)
CEO affiliation			0.0048***		
			(3.68)		
Business privilege				0.0055**	
				(2.58)	
Financial leverage					0.0026***
					(3.09)
lambda	-0.0124***	-0.0125***	-0.0127***	-0.0126***	-0.0129***
	(-4.40)	(-4.41)	(-4.46)	(-4.42)	(-4.58)
Price uncertainty	0.0002**	0.0002**	0.0002**	0.0001**	0.0002**
	(2.50)	(2.49)	(2.47)	(2.10)	(2.45)
Transportation infrastructure	0.0007	0.0062	0.0057	0.0062	0.0061
	(0.18)	(1.39)	(1.28)	(1.38)	(1.37)
Price uncertainty × Transportation infrastructures	-0.0002***	-0.0002***	-0.0002***	-0.0002***	-0.0002***
	(-4.10)	(-4.15)	(-4.11)	(-4.14)	(-4.12)
Size	0.0076	0.0071	0.0073	0.0069	0.0068
	(0.67)	(0.61)	(0.63)	(0.60)	(0.59)
Diversification	0.0029***	0.0030***	0.0030***	0.0028***	0.0029***
	(13.78)	(13.91)	(13.93)	(11.99)	(13.72)
Years listed	-0.0007***	-0.0007***	-0.0007***	-0.0007***	-0.0007***
	(-4.18)	(-4.11)	(-4.37)	(-3.92)	(-4.22)
per capita GDP	0.0011	0.0009	0.0012	0.0009	0.0009
	(0.80)	(0.58)	(0.77)	(0.62)	(0.58)
Year	Included	Included	Included	Included	Included
Industry	Included	Included	Included	Included	Included
Obs.	2744	2738	2738	2738	2738
Adj-R^2	0.0694	0.0791	0.0862	0.0823	0.0818

Table 7
Regression Results of Vertical Integration and Firm Value

This table reports regression results of the performance effects of vertical integration. To mitigate potential selection effects of vertical integration and auditor selection, we employ the Heckman procedure. lambda is the inverse Mill's ratio associated with vertical integration, generated from the probit model as in Panel A of Table 6. lambda2 is the inverse Mill's ratio associated with auditor choice. It is estimated from the probit regression as in Panel A of this Table. The dependent variable equals to one if a firm's external auditor is 'Big Four'. The independent variables include: 'Size' as the natural logarithm of total assets; 'ROA' as the net income divided by total assets; 'Long-term debt' as the ratio of long-term debt to total assets; 'Asset Structure' as the current asset divided by current liability; 'Account Receivable' as the ratio of account receivable to total assets; 'Inventory' as the ratio of inventory to total assets. Z statistics are in parentheses. The reduction of sample is because of the dropping of perfectly predicted observations in the probit regression. Panel B reports the second stage results. The dependent variable is a version of Tobin's q ratio, measured as the market value of equity plus book value of debt divided by total assets. Due to the coexistence of tradable and non-tradable shares in China, we use the fiscal year-end stock price to compute the market value of tradable shares, and use book value to proxy for the value of non-tradable shares. *Vmean* is the vertical integration measure defined in the text. 'Auditor' is a dummy variable equal to one if a firm employs a 'Big Four' accounting firm as its external auditor. Political connection is measured in three alternative ways: 'CEO affiliation' is a dummy variable equal to one if the CEO of a firm is or has been a bureaucrat of the central government, a local government or an industry bureau; 'Business privilege' is a dummy variable equal to one if one of the firm's industries is heavily regulated; 'Financial leverage' is a dummy variable equal to one if the firm's ratio of long-term debt to total assets is above the provincial median value. 'Diversification' is the number of the firm segments. 'Size' is the natural logarithm of firm assets. 'Debt ratio' is defined as total debt divided by total assets. 'Growth' is measured as annual percentage growth in sales. 'State ownership' is the percentage of common shares owned by government. 'Years listed' is the number of years since the firm went public. Considering the high correlation between financial leverage and debt ratio, we don't include debt ratio in the regression when using financial leverage as firms' political connection measure. The regressions employ the OLS method with standard errors clustered at the firm and the year level (Petersen, 2005). t-statistics are in parentheses. ***, ** and * denote significance at 1%, 5% and 10% level, respectively.

Panel A The Selection Model of Auditor

	Coefficients	Z value
Intercept	-15.6951***	(-12.58)
Size	0.6443***	(12.02)
ROA	1.4644*	(1.91)
Long-term debt	-0.6978	(-1.14)
Asset Structure	0.0459**	(2.39)
Account Receivable	-0.6997	(-1.21)
Inventory	-0.0830	(-0.22)
Industry dummies	Included	
Year dummies	Included	
Obs.	2632	
Pseudo R^2	0.1760	

Panel B The Performance of Vertical Integration

	(1)	(2) CEO affiliation	(3) Business privilege	(4) Financial leverage	(5)
Intercept	7.8461***	7.8291***	7.8923***	7.8797***	8.3885***
	(27.91)	(27.95)	(27.68)	(24.60)	(6.37)
V_{mean}	-0.1296	0.5452	0.3379	0.8025	-0.1653
	(-0.49)	(1.29)	(0.73)	(1.28)	(-0.61)
Political connection		0.0223	0.0553**	-0.0379*	
		(1.00)	(2.25)	(-1.91)	
Auditor					0.1656***
					(4.13)
V_{mean} × Political connection		-1.2588**	-0.9746*	-1.2020*	
		(-2.34)	(-1.83)	(-1.79)	
V_{mean}× Auditor					1.9294
					(1.07)
Diversification	-0.0116**	-0.0128**	-0.0141**	-0.0124**	-0.0091
	(-2.12)	(-2.33)	(-2.46)	(-2.28)	(-1.61)
lambda	0.0538	0.0655	0.0553	0.0892	0.1044
	(0.69)	(0.83)	(0.70)	(1.13)	(1.35)
lambda2					-0.0146
					(-0.16)
Size	-0.3168***	-0.3162***	-0.3199***	-0.3175***	-0.3403***
	(-23.91)	(-23.91)	(-23.66)	(-20.99)	(-6.27)
Debt ratio	0.1471**	0.1498**	0.1492**		0.1411
	(1.99)	(2.02)	(2.02)		(1.25)
Growth	0.0133	0.0130	0.0135	0.0138	0.0106
	(0.90)	(0.89)	(0.92)	(0.91)	(0.67)
State ownership	-0.2100***	-0.2085***	-0.2060***	-0.2253***	-0.1863***
	(-3.11)	(-3.07)	(-3.05)	(-3.35)	(-2.72)
Years listed	0.0405***	0.0406***	0.0409***	0.0453***	0.0393***
	(9.96)	(10.00)	(10.08)	(10.99)	(9.50)
Year	Included	Included	Included	Included	Included
Industry	Included	Included	Included	Included	Included
Obs.	2739	2739	2739	2739	2621
Adj-R^2	0.3713	0.3721	0.3722	0.3682	0.3715

Table 8

Joint Effects of Rent Seeking and Monitoring on Vertical Integration Performance

This table reports the ordinary least squares regression results of the joint effects of monitoring and rent seeking on vertical integration performance. The dependent variable is a version of Tobin's q ratio, measured as the market value of equity plus book value of debt divided by total assets. Due to the coexistence of tradable and non-tradable shares in China, we use the fiscal year-end stock price to compute the market value of tradable shares, and use book value to proxy for the value of non-tradable shares. *Vmean* is the vertical integration measure defined in the text. 'Auditor' is a dummy variable equal to one if a firm employs a 'Big Four' accounting firm as its external auditor. Political connection is measured in three alternative ways: 'CEO affiliation' is a dummy variable equal to one if the CEO of a firm is or has been a bureaucrat of the central government, a local government or an industry bureau; 'Business privilege' is a dummy variable equal to one if one of the firm's industries is heavily regulated by government; 'Financial leverage' is a dummy variable equal to one if the firm's ratio of long-term debt to total assets is above the provincial median value. 'Diversification' is the number of the firm segments. 'lambda' is the inverse Mill's Ratio to control for self-selection of vertical integration. 'lambda2' is the inverse Mill's Ratio to control for self-selection of auditor. 'Size' is the natural logarithm of total firm assets. 'Debt ratio' is defined as total debt divided by total assets. 'Growth' is measured as annual percentage growth in sales. 'State ownership' is the percentage of common shares owned by government. 'Years listed' is the number of years since the firm went public. Considering the high correlation between financial leverage and debt ratio, we don't include debt ratio in the regression when using financial leverage as firms' political connection measure. We estimate the standard errors clustered by firm and year. t-statistics are in parentheses. ***, ** and * denote significance at 1%, 5% and 10% level, respectively. The reduction of sample is because of the missing data of some firms' state ownership.

	CEO affiliation	Business privilege	Financial leverage
Intercept	8.3335***	8.6055***	7.3057***
	(6.68)	(6.68)	(7.67)
V_{mean}	0.6019	0.5688	1.4673*
	(1.42)	(1.06)	(1.92)
Political connection	0.0212	0.0310	-0.0292
	(0.92)	(1.13)	(-1.41)
Auditor	0.1725***	0.1667***	0.1669***
	(4.17)	(4.16)	(4.30)
V_{mean} × Political connection	-1.4761***	-1.2558**	-1.9954**
	(-2.69)	(-2.12)	(-2.52)
V_{mean} × Auditor	0.1374	0.0187	-2.5085
	(0.05)	(0.01)	(-1.39)
V_{mean} × Political connection × Auditor	3.6323	12.0146**	6.3104**
	(1.20)	(2.39)	(2.39)
Diversification	-0.0101*	-0.0118**	-0.0101*
	(-1.77)	(-1.98)	(-1.80)
Lambda	0.1175	0.1152	0.1250
	(1.51)	(1.48)	(1.57)
Lambda2	-0.0129	-0.0229	0.0646
	(-0.14)	(-0.24)	(0.96)
Size	-0.3385***	-0.3505***	-0.2924***
	(-6.22)	(-6.24)	(-7.12)
Debt ratio	0.1436	0.1476	
	(1.27)	(1.30)	
Growth	0.0106	0.0105	0.0138
	(0.68)	(0.67)	(0.91)
State Ownership	-0.1837***	-0.1865***	-0.2059***
	(-2.67)	(-2.71)	(-3.05)
Years listed	0.0395***	0.0396***	0.0428***
	(9.53)	(9.61)	(10.22)
Year	Included	Included	Included
Industry	Included	Included	Included
Obs.	2621	2621	2621
Adj-R^2	0.3727	0.3738	0.3725

Appendix
Variable Definitions

Variable	Definition	Data source
Legal Property rights	The index of property rights protection, which measures the suit frequency and court efficiency. The frequency of lawsuits is defined as the number of business or economic lawsuits scaled by a location's GDP in constant "yuan". The court efficiency is the number of economic or business lawsuits concluded by the court in a year divided by number of cases filed in the year.	Fan and Wang (various years)
Government quality	The index of government service, which measures the level of bureaucratization, the frequency of government expropriation and the level of citizen satisfaction.	The Annual Report of Urban Competitiveness in China
Market development	An index, constructed to be inversely related to a local government's fiscal expenditure scaled by GDP, which captures the extent to which a province's resources are allocated by markets.	Fan and Wang (various years)
Auditor	Whether a firm's external auditor is a 'Big Four' firm.	CSMAR[a]
CEO affiliation	Whether a firm's CEO is or has been a bureaucrat of the central government, a local government or an industry bureau.	Fan, Wong and Zhang (forthcoming)
Business privilege	Whether one of the firm's industries is heavily regulated by government, such as coal, steel, petroleum, natural gas, water supply, mental, aircraft, electricity, railroads, aviation, finance, post and telecom.	Corporate Annual Report
Financial leverage	whether financial leverage of the firm is above the median of all firms in the same province.	CSMAR
Price uncertainty	The standard error of the residual of a detrending regression of a firm segment's industry annual primary input prices from 1980 to 2001	China Price Yearbook
Transportation infrastructure	The length of transportation routes (highway, railway, and waterway) in a province divided by the total geographic area of the province	China Statistical Almanac
Diversification	The number of firm segments	Corporate Annual Report
Tobin's q	Market value of firm divided by firm assets. The market value is measured as the market value of common equity plus the book value of debt. Due to the coexistence of tradable and non-tradable shares in China, we use the fiscal year-end stock price to calculate the market value of tradable shares, and use book value to proxy for the value of non-tradable shares	CSMAR
Size	The natural logarithm of firm assets	CSMAR
Debt ratio	The ratio of total debt to total assets	CSMAR
Growth	The annual percentage growth in firm sales	CSMAR
State ownership	The percentage of common shares owned by government	Corporate Annual Report
Years listed	The years since IPO	CSMAR
per capita GDP	The provincial per capita GDP, unit: ten thousand	China Statistical Almanac

[a]CSMAR is China Stock Market & Accounting Research Database, developed by Hong Kong Polytechnic University and Shenzhen GTA Information Technology Co. Ltd.