Department of Agricultural and Resource Economics
University of California Davis

Insider Privatization with a Tail: The Buyout Price and Performance of Privatized Firms in Rural China

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Hongbin Li and Scott Rozelle

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Hongbin Li Scott Rozelle[2]

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[2]Hongbin Li is assistant professor at The Chinese University of Hong Kong. Scott Rozelle is professor at University of California, Davis. Please send comments to Hongbin Li by email lhongbin@cuhk.edu.hk or phone (852)2609-8185.

Abstract

This paper studies insider privatization in transition economies. We show theoretically that the underperformance of insider-privatized firms could be due to the manager-cum-owner's lack of incentives after privatization. A screening theory predicts that a firm's postprivatization incentives increase with the firm's buyout price. The empirical results show that the buyout price decreases with the degree of information asymmetry and that a firm's postprivatization performance increases with the buyout price. We also find that the performance of premium-paying firms converges with that of private firms after privatization; in contrast, heavily discounted firms perform indistinguishably from government-owned firms.

1 Introduction

Insider privatization is one of the most widely observed forms of institutional transformation in transition economies. In a typical insider privatization, the former manager purchases the firm from the government. The practice has been widely documented in Russia (Boycko, Shleifer, and Vishny, 1995; Blanchard and Aghion, 1996; Earle and Estrin, 1996), in many Eastern European countries (Carlin and Aghion, 1996; Frydman et al., 1999), and in some Asian countries such as Mongolia (Anderson et al., 1999) and China (Cao et al., 1999).

The record of insider privatization on improving performance, however, has not always been positive. Earle (1998) finds that the performance of insider-privatized firms does not improve in Russia. Using a sample of firms in the Czech Republic, Hungary and Poland, Frydman et al. (1999) find that privatization has a greater effect on performance when outsiders buy the firm. Barberis et al. (1996) show that privatization improves a firm's postprivatization performance only when old managers are replaced by more capable ones during the privatization process. Lacking both the necessary financial and human capital for enhancing the performance of firms, insider privatization is frequently found to be ineffective (Frydman and Rapaczynski, 1994; Blanchard and Aghion, 1996; Black et al., 2000).

In this paper, we provide a new explanation for why insider privatization may be expected to fail in some cases. For two reasons, it could be that the new owners do not have good incentives after privatization.

The lack of incentives could arise from the nature of one form of privatization contract designed to overcome information asymmetries. One problem with insider privatization, which is an act that transfers ownership from the original owner, the government, to the buyer, the manager, is that information is asymmetric between the two parties (Frydman and Rapaczynski, 1994; Putterman, 1997). The official in charge of privatization usually does not have a sound way to assess how valuable a firm will become after ownership is transferred to its manager. In contrast, the manager possesses insider information about the firm's earnings potential. Government officials cannot rely totally on the manager's valuation of the firm, however, since there are substantial rewards for understating the firm's value. It also is difficult to rely on the assessment of Certified Public Accountants (CPAs) or some other objective third party since such services are underdeveloped in transition economies (Black et al., 1999). A CPA's assessment is itself based on imperfect information. Without any mechanism to reveal additional information about the firm's true value, an official has to accept the price offered by the manager and leave him large rents.

It is possible, however, that officials could use a screening contract to elicit private information from the manager about the firm's future profitability. Such a screening contract could have two parts: a buyout price and a contingent payment in the form of a claim on future firm profits by the official. The screening contract is similar to the one developed by Laffont and Tirole (1986), which trades off between ex ante information revelation and ex post incentives. The final contract either is one in which the manager pays a high price for the firm and keeps most of the firm's future profit stream or is one in which the manager pays a low price and must share any future profits with the government. When an official shares the privatized firm's future profits, following a Chinese proverb, we call it "privatization with a tail."[1] In coming to a final agreement, the seller offers a menu of contracts to the buyer, and the buyer then chooses the terms of privatization and manages the firm under the contractual terms after paying the buyout price. Although such a contract maximizes the revenues of the seller, it reduces the efficiency of firms that continue to share profits after privatization, and would account for the poor postprivatization performance experienced by some firms.

Alternatively, the incentive problems faced by the new owners after privatization may be traced back to corruption. If the official were to ask the firm for a payment to her personal account, the manager might be allowed to purchase the firm for a below-market, discounted price. If there were no chance of being caught (and if there was neither any information asymmetry between the official and the manager nor screening contracts), the manager would have full incentives for the firm's future profits. However, if there was a chance of that the manager gets caught and be punished for corruption, and if the probability of getting caught was greater the more discount the manager received, the manager in this case would obviously face imperfect incentives.

Our paper investigates one of the largest privatization movements in the world: the privatization of China's rural industry. As an important part of China's economic revival, rural industries, which began as locally government-owned firms (Walder, 1995), produce nearly half of China's industrial outputs. Since the mid-1990s, however, more than half of China's locally government-owned firms, up to two million firms, have been privatized (Nyberg and Rozelle, 1999). Moreover, it has been reported that almost all of these firms have been sold to insiders.

Although we have data on firms in only two coastal provinces, Jiangsu and Zhejiang, the data provide a good laboratory to study insider privatization. According to our survey that included more than 600 firms, 65 percent were privatized between 1993 and 2000. More than 90 percent of

[1] In Chinese, "with a tail" or "leaving a tail" mean that things are not completely done. Specifically in this paper, it means that privatization does not give the new owner full incentives, since the original owner, the government, retains rights over future profits.

the privatized firms were sold to their managers.[2] On the basis of the record, we believe Eastern China is a good place to study insider privatization. Moreover, although performance of some firms have improved, many other firms perform poorly after privatization. In fact, there is still a hot debate over the record of privatization in rural China (Du and Yuan, 2000; Li and Rozelle, 2000).

By drawing on our data, we test both whether the buyout price influences firm performance postprivatization and whether information asymmetries affect the buyout price. Using performance measures, we first employ an Ordinary Least Squares (OLS) estimator to test for the effect of the buyout price on performance. We found that as the price rises, the postprivatization performance of a firm improves. While the finding is consistent with our hypothesis that officials use screening contracts to implement insider privatization, a number of potential econometric problems need to be addressed before we can be confident with our results. After using a variety of methods to control for the omitted variable bias, simultaneity bias and other econometric problems, we find that all of the empirical exercises robustly support the theoretical predictions: the buyout price decreases with the degree of information asymmetry and a firm's postprivatization performance increases with the buyout price. We argue that our results may offer one explanation of why not all privatization in the initial period of transition has been successful.

Our data set also allows us to measure the magnitude of the impact of the buyout price on privatized firms by comparing the performance of privatized firms with that of private and government-owned firms. In the final part of our empirical analysis, we find that firms that pay low buyout prices perform no better than government-owned firms. In contrast, firms that pay high buyout prices catch up to the performance standards of private firms (and private firms are shown to significantly outperform government-owned firms).

Our paper has two limitations. First, we cannot definitively partition the influence of screening from that of corruption. The main problem is that we do not have a good measure for corruption. Second, we do not answer directly the question why China's rural officials have depended so heavily on insider privatization. It could also be that outsiders in China possess so little information about these rural firms that buying them could be extremely risky investments. Likewise, insiders in China may already have an overwhelming advantage. Because reforms to China's management system in the rural sector have been unfolding since the mid-1980s, many income and control rights had already been shifted to managers by fixed lease contracts. Privatization in this case is merely the shift of ownership of the firm's assets.

[2] Another survey of 16 villages in Wuxi County also shows that village-owned firms were exclusively sold to the original managers (Kung, 1999).

The structure of the rest of the paper is as follows. Section 2 describes the data. Section 3 examines privatization trends in China and shows some primary findings on the relationship between the buyout price and performance. Section 4 lays out three possible theoretical explanations for the observed facts. Section 5 provides more systematic tests of the theories. Section 6 concludes.

2 Data

The data set used in this paper is from a survey we conducted with colleagues in 1998. The survey concentrated on township enterprises (TEs) and private firms and focused on the period from 1994 to 1997.[3] We randomly sampled 168 enterprises in 15 counties in Jiangsu and Zhejiang Provinces, two of China's most developed coastal provinces, one north of Shanghai and the other south. Thirty-three out of the 168 firms were originally established as private firms (henceforth *private* firms), and 135 were owned by the government (henceforth *government-owned* firms) in 1994.[4] During the study period, only part of the government-owned firms (88 out of 135) were sold off to private owners, or in our terminology became *privatized* firms. Both private and government-owned firms (as of 1994) were included in the sample in order to ultimately allow us to test how well privatized firms do relative to private firms (which are assumed to face full incentives) and government-owned firms (which are assumed to face less than full incentives).[5] We chose 1994 as the starting time because most privatization has occurred since the mid-1990s. Although we tried during the pretest period to elicit information as far back as 1990, we found that the recall of officials and managers, and secondary accounting and financial data, deteriorated when trying to answer questions on activities that had occurred more than five years before. A detailed description of the sample design is included in Appendix A.

The firm-level survey form included two main parts. Enumerators conducted a sit-down survey with the firm manager. The manager survey elicited detailed information on firm ownership during the survey period, the privatization process (including how firms were evaluated), and on the buyout negotiation during which the initial price was established. We also asked the manager about other

[3] The township (town) is the lowest level of government in China's administrative hierarchy. Township governments established many enterprises in the 1980s, which are called Township Enterprises (TEs). This paper will use TEs and (locally) government-owned enterprises interchangeably. Most of the literature put Township and Village Enterprises together and call them TVEs, although TEs and VEs have some fundamental differences. To have a better understanding of China's TVEs, see Che and Qian (1998), Chen and Rozelle (1995), Putterman (1997) and Walder (1995).

[4] Private firms in the sample are those firms that had never been government-owned. In other words, they were originally established as private firms.

[5] Although we are assuming here that private firms face better incentives and they outperform government-owned firms (thus establishing a standard for judging the performance of privatized firms), we actually test for this in the empirical part.

property rights, corporate governance, the firm's production and marketing activities, and his or her human capital attributes. The firm's accountant also filled in a set of tables from the firm's financial and cost accounting records.

One of the most important goals of the survey was to collect good measures of the manager's effort levels and the firm's performance. In order to do this, we took great effort to record detailed information from the firm's income statements and balance sheets. We focus on three effort and performance measures: the manager's weekly workload, accumulated inter-firm arrears to asset ratio, and value added per worker. The manager's weekly workload is a straightforward measure of performance and is defined in Table A3 in the Appendix.

To create a good measure of accounts receivable management, we start with the *inter-firm arrears rate*, which is defined as a ratio of accumulated accounts receivable to total assets. We then turn this variable into a "positive" measure of performance, called *accounts receivable management*, a new variable that is defined as (1 - inter-firm arrears rate). We argue that the way a firm manages its accounts receivable provides a measure of managerial behavior since unpaid accounts or arrears tend to accumulate in firms whose managers have poor incentives to collect overdue accounts.[6] For example, in firms in which managers or salespeople sell products for a personal rebate (or kickback) instead of increasing the firm's income, firm arrears could easily accumulate. Even worse, managers sometimes diverge cash by providing trade credit to other firms that are owned by their relatives or friends. At the very least, managers with poor incentives are not willing to put out the effort to collect firm arrears.

We also use the firm's labor productivity to directly measure firm's performance. Specifically, we use value added per worker as a proxy of firm's labor productivity. As in Shirley and Xu (2001), value added is defined as the difference between sales and materials costs. We then define value added per worker as the value added to worker ratio. In estimating the production functions later, we use the log of value added per worker as the dependent variable.

3 Privatization in Rural China: Primary Findings

According to the data, township enterprises have experienced a dramatic shift in ownership from government to private and officials sold most of the enterprises to the former managers. In 1993, of the 135 government-owned firms in the sample, 88 had been privatized by the time of the survey

[6]Inter-firm arrears are used in Frydman and Rapaxzynski (1994), World Bank (1996), and Havrylyshyn and Mcgettigan (1999) in studying privatization.

in the summer of 1998 (Table 1).[7] The ownership share of private individuals increased sharply during the privatization movement, and management dominated the process. The government's share of the 88 firms that privatized between 1994 and 1997 fell from 96 percent to only 12 percent. Managers of the firms increased their personal shares the most, owning by far the largest part of privately-held shares (nearly 70 percent).

Most firms (92 percent) also exercised insider privatization. In a typical case, the original manager (or the manager that ran the firm preprivatization) bought out the firm completely or partially. In only seven cases did outsiders buy the firm, but all of them were the only bidders for the firms they bought. Even in these cases, however, the "outsiders" were local businesspersons who knew the firms well.

One of the main problems with insider privatization is that the officials are at an informational disadvantage vis-a-vis managers during the negotiation process which establishes the buyout terms for the firm. Officials in China's rural areas typically do not know how efficient a firm will become after ownership is transferred to its manager. The township governments usually own multiple firms (the sample median is 12 firms per township). There is no way that officials can know each one well. Furthermore, each firm may sell its products to markets in many localities (the sample median is 4 county market destinations per firm). Officials have little idea where these markets are located and who the firm's customers are. Officials also do not have enough time to get to know the firms because they are charged with many other duties. In contrast, the managers, who in most cases have been running the firms for many years (the sample median is 5 years as the manager and 12 years as an employee), better understand the firm's future profit-earning potentials and have a more informed basis for knowing how much effort will be needed to overcome any serious inefficiencies. The main point here is that managers have a more accurate assessment of the true value of firms than officials when the privatization deals are negotiated.

Evaluations do not always help to reduce the information problem. Most evaluations (67 percent) were carried out by the local government without an independent CPA. Even if there are CPAs, their ability may be questionable. The evaluation team usually ends up primarily assessing the value of the firm's assets and debts. Their most important job is to establish the book value of the firm's assets. After enumerating the values of both the firm's assets and debts, the evaluation team then sets the firm's equity value–the difference between the values of its asset and debts. We define this as the firm's *base value*.

Another problem with insider privatization in China is that some privatization deals may involve

[7] Privatization means shifting all or part of a firm's share from the government to the manager or employees.

corruption. Corrupted officials may care more about the personal payments they receive than the payment the government receives by selling these firms. Although we do not have a good measure for the degree of corruption and the size of bribes, our talks with local officials, firm managers and bank managers indicate that some under-priced deals indeed involve under-the-table payments. Systematic information on this topic, however, is difficult to obtain since firms being caught engaging in corruption can be severely punished. We know of cases both before and after privatization where the books of firms were reviewed during a corruption investigation.

3.1 Performance and the Buyout Price

The buyout prices that managers pay on firms vary sharply across the sample. In Table 2, we divide the privatized firms into groups, ranking them by the ratio of the buyout price to the base value, a normalized measure of the buyout price. We will call this ratio the BPBV ratio. At one extreme, twenty-one firms (row 1) have a BPBV ratio close to zero (9 of them are zero). Managers of these firms did not have to pay much, or in some cases did not have to pay anything to buy the firm. At the other extreme, seven firms have a negative BPBV ratio (row 6). In these cases, the firms were sold for a non-negative price, although they had a negative base value (or the firm's debts exceeded its assets). There also are 20 firms which have a BPBV ratio exceeding one. The rest of the firms had a BPBV ratio between zero and one.

The last column of Table 2 shows the average of the premium rate, another measure of normalized buyout price, associated with each BPBV category. We define *premium* and *premium rate* respectively by using the formula: premium = buyout price - base value, and premium rate = premium/book value of asset. The premium rate is a better measure than the BPBV ratio for a number of reasons. First, seven firms have a negative equity value and, as a result, a negative BPBV ratio. The negative ratios are difficult to compare to the positive ones, since, in fact, managers paid a positive premium for these firms. Second, there are also some firms with small equity positions, that have BPBV ratios that are very large. Hence, the BPBV ratio has a skewed distribution, with the 90th percentile almost 5,000 times as big as the 10th percentile. The buyout price is not subject to this problem since its distribution is smooth. In the following, we will call the premium rate the *normalized buyout price* or just *buyout price* for simplification.

Examination of the data reveals a correlation between performance and the buyout price of the firm: managers who pay "higher" premiums tend to perform better than those who pay "lower" premiums postprivatization. Table 3 divides the sample into three groups of firms: "heavily-discounted" firms or those with buyout prices less than -.2 (30 firms), "moderately-discounted"

firms or those with buyout prices between -0.2 and 0 (26 firms), and "premium-paying" firms or those with buyout prices greater than or equal to 0 (32 firms). Grouped this way, it is clear that the performance of premium-paying firms postprivatization improved more than that of the discounted firms. Heavily-discounted firms, in contrast, performed the poorest when comparing preprivatization performance to postprivatization performance.

During our interviews, we also distinctly noticed that firms with different buyout prices also differed in the amount of effort their managers exerted. Some managers exerted almost no effort to improve the efficiency of their newly acquired firms. These, almost always, were the ones that said they bought their firms at a relatively low buyout price. But according to conventional economic thinking, it would not have been the discount that caused the under-performance. Under "ordinary" circumstance, the buyout price should have been considered as a sunk cost. Rather, the poorer effort may have been the consequence of getting the firm for such a discount, and other terms accompanying the discount may have affected their incentives to exert effort in the firm. The attitude of owners of heavily-discounted firms toward the firms often had not changed much from the time when they were hired as managers for the government-owned firms.

Our data also contain evidence of the differential efforts. Managers, who paid a positive premium appear to have exerted more effort and showed more interest in improving their newly acquired firms (Table 3). For example, managers of the premium-paying firms work 13 hours longer per week than managers of the heavily-discounted firms (column 1).

3.2 OLS: The Baseline Specifications

To further test the relationship between performance and the buyout price, we employ the OLS model, which we call the "baseline" specification. The OLS model to estimate performance (or effort) is specified as

$$\pi = \beta_0 + V\beta_1 + X\beta_2 + Z\beta_3 + \epsilon_1, \tag{1}$$

where βs are a set of coefficients, ϵ_1 is the residual, and the variables are defined as follows. We use two alternative measures of the dependent variable, π, in two separate equations: the manager's workload and accounts receivable management. The variable, V, represents the buyout price, and X includes a set of variables representing the firm's size, asset level, and two attributes of the manager, his education and managerial experience. We include X to control for factors that can be observed about the quality of the firm. Following Groves et al. (1994) and Frydman et al. (1999), we also include Z, which represents a set of provincial and industrial sector indicators to control for local policies and market conditions. Some regressions do not include Z and are called "partial

specification," while others that include Z are called "full specification." All variables and their explanations are listed in Table A3 in the Appendix.

Following Jensen and Meckling (1979), McMillan et al. (1989), Groves et al. (1995) and Shirley and Xu (2001), we also estimate an value added worker ratio. In estimating the production functions, we take the logs of dependent and some independent variables. The OLS model to be estimated is:

$$logy = \alpha_0 + V\alpha_1 + (logL)\alpha_2 + (logk)\alpha_3 + Z\alpha_4 + \epsilon_2, \tag{2}$$

where $logy$ is the log of value added per capita, $logL$ is the log of employment and $logk$ is the log of capital labor ratio.

To measure the impact of the buyout price on the performance of privatized firm (postprivatization), we use a sub-sample to estimate equations (1) and (2). In this sub-sample, we use all postprivatization years for the privatized firms. For each firm in this sample, we can have at most four observations (1994 to 1997), if the firm was privatized in 1994. All firms have at least one observation (that is at least the observation for 1997, if it was privatized in the last year of our sample).[8]

The OLS estimate using the full specification performs fairly well (Table 4). The R-squared ranges between 0.23 and 0.59, and other goodness of fit statistics are rather high. The F-statistics are also significant, at least at the 10 percent level. Many coefficients on the variables representing firm size (assets and employment) and the manager's human capital are not significant.

The baseline specification lends some further support to the hypothesis that the buyout price is positively correlated with firm performance (Table 4, row 1) The signs on the coefficients of the normalized buyout price variable are all positive and significant. When managers pay a high premium for their firms, they appear to work more hours per week, reduce the proportion of the assets accounted for by accounts receivable and increase labor productivity.

4 Theories

While the primary results show that there is a correlation between firm's postprivatization performance and the buyout price in Table 4, they do not prove causation. For example, it could be that both the buyout price and performance are determined by unobserved firm quality. Suppose that both government official and manager know the true value of the firm ex ante and the buyout price

[8]Unfortunately, we can only use this sampling strategy for two performance measures–accounts receivable management and value added per worker. We have to use a smaller sample for the manager's workload since we only collected data on workload for 1997.

reflects nothing but the postprivatization quality of the firm. In this case, firms with higher buyout prices perform better ex post simply because they are better. In other words, the coefficient on the buyout price variable is biased.

In the rest of this section, we are going to provide two more theoretical explanations for the positive correlation between firm's performance and the buyout price. Although the two theories differ, in general, they both predict the same causation: An increase of buyout price will cause an increase of firm performance. Specifically, the two theories show that the buyout price and postprivatization incentives uniquely determine and increase with each other. This one-to-one relationship indicates that firm's postprivatization performance increases with the size of buyout price. In the following section, we will subject the theories to a series of empirical tests.

4.1 Screening Theory

In this subsection, we explain how a screening mechanism, first modeled by Laffont and Tirole (1986), can be used by officials to elicit information from managers and how the model generates predictions consistent with the observation in the field, our descriptive findings, and the preliminary results. We first describe the theory. We then generate predictions from the model. Finally, we show how economic environment and especially the degree of information asymmetries affect the size of buyout price. The formal model and its proofs are provided in the appendix.

There are two risk neutral players in the model: an official who represents the government, the seller of the firm, and a manager, the buyer.[9] Since we have only one firm, the normalized buyout price and buyout price are the same thing. Both the official and the manager care only about their own benefits.[10] The official has a firm to sell and the only buyer is the firm's manager.

After taking possession of the firm, the manager will run a "one-shot" project and then shut down the firm. The profit of this project is $\pi = e + \epsilon$, where e, the deterministic part, denotes the manager's effort level, and ϵ, the stochastic part with mean zero, is determined by some set of exogenous factors. Implicitly, the price of the manager's effort is 1. There is a personal cost to the manager for his effort, $C(e, \theta)$. The parameter, θ, can either be the manager's ability to manage a firm or the quality of the firm that is only known by the manager.

Both the manager's type (θ) and effort (e) are the manager's private information. Thus, the official does not know ex ante the expected profits of the firm under the manager's ownership. The

[9] Risk neutrality is not crucial in this paper. We could have a risk averse manager or even a risk averse official. But since the focus of the paper is not risk sharing, risk neutrality can simplify the analysis.

[10] Township officials have strong incentives to maximize revenues, because they need to use these revenues to pay their own wages and to cover most of the expenditures of the governments, which if done successfully could lead to promotion. See Qian and Weingast (1997) and Chen and Rozelle (1999) on this.

official only knows the distribution of θ, and observes the firm's profits when the production process has finished. The manager's type θ has a p.d.f. f and a c.d.f. F on $(\underline{\theta}, \overline{\theta})$.[11]

The screening contract has two parts: a buyout price for the firm, V, and a future payment contingent on the privatized firm's profitability, α, which specifies that α share of the profits are kept by the manager and $1-\alpha$ share goes to the official. The official offers the manager a menu of contracts, each one consisting of some combination of the two key terms. For managers who pay a lower premium, the government will have the right to take a larger part of the firm's postprivatization profits. Such a contract is said to "leave a tail" in the hands of government officials. For managers who are willing to pay more for the firm ex ante, the government will take a smaller (or no) part of the firm's postprivatization profits. In equilibrium, good managers will be separated from bad managers.[12] *Good managers*, who believe that they can make substantial profits if they put all of their efforts into the firm, would prefer to pay a greater buyout price ex ante and keep most or all the profits in the future. *Bad managers*, in contrast, knowing that they will not likely achieve much postprivatization, will pay only a small amount up front and share a greater part of the profits with the government.

As discussed in Laffont and Tirole (1986), there is a tradeoff between inducing revelation ex ante and inducing effort ex post for this kind of mechanism. Although this mechanism makes it possible to elicit important information ex ante for the government, there is a cost. The contract terms accepted by some managers will not provide strong ex post incentives. In this subset of cases, the manager's ownership rights are incomplete, and their postprivatizaiton performance will be reduced. They face a moral hazard problem because the manager's effort at improving the firm efficiency is not completely observable or contractible. However, it could be that this cost, under some circumstances, is worth it if the benefit of the better screening mechanism allows local officials to elicit useful information and to execute complete privatization (or privatization without a tail) with the best managers and best firms. As is common in this setup, in equilibrium the official will give full incentives to the best managers but not to the others.

The implications of the screening theory are summarized as follows. When a manager pays a buyout price for his firm, in fact, it is not a sunk cost; the size of the buyout price actually ends up positively affecting effort and performance. The marginal impact arises because the contract for a good manager, compared with that for a bad manager, not only involves a higher buyout price,

[11] F is such that the hazard rate $h(\theta) = f(\theta)/(1-F(\theta))$ is weakly increasing. This assumption is needed to show that there exists a unique equilibrium.

[12] In our paper, managers are "good" if they either have an inherent ability to manage firms and make them perform better or if they are the managers of firms that ex ante have a high potential to earn future profits (but this potential is unobserved by outsiders).

but the higher buyout price is accompanied by a more favorable sharing rule. In other words, the sharing rule α and the buyout price V are uniquely determined by and increase monotonically with each other.

These results essentially provide the basis for empirically testing the hypothesis that the buyout price positively affects performance. Since we know that performance π and effort e increase with α, and α increases with V, π and e increase with the size of the buyout price, V. This result allows us to use V as a proxy for incentives α in the empirical models.

The screening theory also implies that the best managers and only the best managers ($\overline{\theta}$) are given the socially optimal incentives ($\alpha = 1$) and exert socially optimal effort (e^*). Although the main goal of privatization is to give managers better incentives so that they can improve the firm's performance, giving all managers full incentives might not be feasible given the severe information asymmetries. In order to elicit information from the manager, the official has to sacrifice some efficiency. As a result, only the best managers are given full incentives, and the other managers are given less than socially optimal incentives. The ultimate implication of this means that we should see a wide range of performance of insider privatized firms, as well as giving us another testable hypothesis: Privatized firms with good incentives, or those that pay the highest buyout prices, will perform as if they were private firms; those with poor incentives, or those that pay lower prices, do not perform as well as private firms. Firms paying lower prices were being tested to see if they actually perform like government-owned firms, which will be shown to perform significantly worse than private firms.

One important assumption for the screening mechanism to work is that the government officials must be able to commit to a contract, either explicitly or implicitly. Reputation frequently is a mechanism that prevents the government officials from breaching their contracts. The officials in rural China, in order to develop their local economy and collect more taxes or fees from these enterprises, have a strong incentive to create a reputation for fair dealing (Walder, 1995). Breaching a contract could be costly to officials, since local businesses could move away if they believed the government officials were unfair to the firms. The officials also care about their reputations if they had additional firms to sell or other direct enterprises to run in the future (for example, renting out township-owned land or selling real estate).

Some Extensions of the Screening Theory

Our screening theory has several simplifying assumptions: (1) all officials face the same degree of information asymmetries, (2) managers are risk neutral, and (3) managers do not have wealth

constraints when they buy a firm. Although there are reasons to believe these assumptions do not hold in reality, relaxing them does not change our basic theoretical findings. In fact, the variation of degree of information asymmetries, risk level and wealth constraints provide ways to examine the contract selection.

The equilibrium buyout price and the profit sharing rule may depend on the degree of information asymmetry. Officials with better information should be able to refine contracts to better fit the manager's types. The official with better information before privatization can request the manager pay more up front and provide him with better rights postprivatization (that is a higher α). As a result, the firm performs better postprivatization.

One easy way to demonstrate this is as follows.[13] Suppose that the official's information about the manager's type becomes more precise in such a way that she knows that θ is no worse than $\underline{\theta_0}$, or θ is distributed between $[\underline{\theta_0}, \overline{\theta}]$, where $\underline{\theta} \leq \underline{\theta_0} \leq \overline{\theta}$. In this case, the more precise information structure will not change the sharing rule α but will increase the buyout price V. The better-informed official (that knows the manager is not lower than a certain quality $\underline{\theta_0}$) can raise the buyout price since she can eliminate certain sets of contracts, the ones with low buyout prices (V) and low sharing rules (α) for types lower than $\underline{\theta_0}$. When these contracts are not available, the official does not need to worry that the remaining managers will pretend to be a poor manager (there are none) and select to choose that contract that allows him to pay a low buyout price. The official can then raise the buyout prices for all of the remaining contract choices, while leaving the sharing rule constant. When the upper bound of the distribution is reduced *and* the lower bound raised, both $\alpha(\theta)$ and the $V(\theta)$ could increase. At the extreme, when the upper bound fades enough and the lower bound rises enough so that $\underline{\theta} = \theta = \underline{\theta}$, then information becomes symmetric. The first best outcome, $\alpha = 1$ and $V =$ the firm's true value, can be achieved.

We also have neglected risk aversion and wealth constraints in our framework. Clearly, both risk aversion and wealth constraints of the manager may have a role in justifying a smaller share of future profits and a smaller buyout price.[14] When a high quality manager is credit constrained, the problem is that although his optimal contract is one with a large buyout price and a sharing rule near 1, he is unable to produce enough cash to pay the buyout price. In this case, the official needs to redesign the contract, dropping both the buyout price and the sharing rule, which means that the official will be worse off than if there was not a wealth constraint. The lower welfare position of the official is not surprising since the new problem that she is solving is one with an

[13] See Laffont and Tirole (1993) for a more detailed arguement

[14] See Laffont and Matousssi (1995) for a more detailed argument.

additional constraint which means the official's welfare can not be higher. Making the manager risk averse will affect the outcome of the problem similarly. Following Laffont and Matoussi (1995), in certain versions of our empirical analysis we hold wealth and risk constant to illustrate that our findings regarding the effect of information asymmetries on contract form does not change even after accounting for credit constraints and risk considerations.

Direct Evidence of the Screening Contract

Although our original survey instrument was not able to isolate the contractual contingencies, new information supports the idea that a tail does exist with privatization in rural China. In a supplementary survey that we conducted in the summer of 2000, we asked the following question to government officials: Are there firms which you privatized for which you received only a small buyout price, but from which you expect to receive future payments? Officials in 15 out of 38 townships answered "yes" to this question. Many respondents actually told us that this question is sensitive because the central government has been cracking down fee collecting activities by the local governments.[15] We consider this to be prima facie evidence that such contractual forms do exist. But discussions with the new survey enumerators raise caution about using this information for any thing more than establishing a lower bound. Another set of survey questions on fees and profits turned into the government by the firm show that firms indeed make further payments post-privatization, and the payments are negatively correlated with the buyout price. The correlation between the postprivatization payment (as a percentage of profit) and the normalized buyout price is -0.39. [16]

4.2 Corruption Theory

A corruption theory could also explain our primary empirical findings. If the official were to ask the firm for a payment to her personal account, the manager might be allowed to purchase the firm for a below-market, discounted price. If there were no chance of being caught, the manager would have full incentives for the firm's future profits. However, if there was a chance of that the manager gets caught and be punished for corruption, and if the probability of getting caught was greater the more discount the manager received, the manager in this case would obviously face imperfect incentives.

In terms of our theoretical framework, we can also demonstrate the impact of corruption on performance. Suppose the firm's value is E, and the manager can pay any price, V, between 0

[15] Although the central government action is mainly about fees imposed on farmers, the local officials were conservative even when being interviewed by our enumerators.

[16] This provides only some anecdotal evidence since we have only 25 responses on this question.

and E for the firm. The official also demands that the manager pay her a bribe $\eta(E-V)$. If $0<\eta<1$, then the manager underpays (or gets a dsicount) when he buys the firm. Suppose that the probability that corruption is not detected is P, and P is a function of $V-E$, the observed discount the manager receives. We assume that P increases with $V-E$, or $P'(V-E)>0$. In other words, the probability of being detected is higher for a higher discount (bribe). This would be the case if the degree of underpayment could trigger an audit or if it becomes more likely someone would notice the official's increase in wealth when he takes a higher bribe. It is also not unreasonable to assume that if the manager is caught, he will lose the firm. If he is not caught, the value of the firm will be $\pi = e + \epsilon$.[17] The manager maximizes the following expected utility after privatization: $P(V-E)e - C(e)$, where $C(e)$ is the cost of the manager's effort, subject to the manager's Individual Rationality constraint, $P(V-E)e - C(e) > \eta E + (1-\eta)V$. Suppose for simplicity that the buyout price, V, and the size of the corruption $\eta(E-V)$ are determined by the government official. If we assume C is convex, then it can be shown that the manager's effort level, e, and also the firm's performance, π, increases with V.[18]

One of the most significant results for our empirical work is that the corruption theory generates the same prediction as the screening theory: Manager's postprivatization effort and the firm's performance increase with the size of the buyout price. Hence, if we see in the performance equation that the coefficient on the buyout price variable is positive, we do not know if this is due to the nature of the screening contract or the result of corruption. The main difference here is that the corruption theory does not require information to be asymmetric. In other words, even when the official knows a firm's true value, the firm could still be under-priced because the official may provide a discount to the manager in exchange for a bribe. Hence, if asymmetric information significantly impacts the buyout price, we can have evidence that screening matters. In the next section, we will test statistically whether asymmetric information is playing an important role in the size of the buyout price. If it is, we can assume at least part of the effect of the buyout price on performance is from screening. We cannot rule out, however, that another part is from corruption.

5 Further Empirical Tests and Results

We have three objectives in this section. First, we want to identify the causation that is predicted by screening and corruption theories which lead to the result that the buyout price improves effort

[17] There could be more serious punishment for bribing such as being jailed, but we consider only economic punishment specific to the firm for the analysis.

[18] We can allow V to be endogenously determined. Under certain assumptions, V should have an interior solution on $[0, E]$. The result of $\frac{d\pi}{dV} = \frac{de}{dV} > 0$ should still hold.

and performance. Second, we want to show that information and screening play an important role in the privatization process. Last, we want to measure the *magnitude* of the effect of the buyout price on performance.

To accomplish these tasks, our strategy of estimation can be described in four steps. The first two focus on identifying the causation between firm performance and the size of the buyout price. The third step focuses on testing the role of information asymmetries on the size of the buyout price. The fourth step compares the performance of privatized firms to that of private and government-owned firms.

5.1 Firm Fixed-Effect Model

As discussed above, one potential problem with the primary OLS results is that they might be subject to an endogeneity problem. The OLS model implicitly assumes that the buyout price is exogenous and uncorrelated with the error term specified in equations (1) and (2). The buyout price, however, might be endogenous due to the omission of important variables that characterize the quality of the firm and the abilities of the manager. Although we do control some of the manager's attributes, for example, education and managerial experience, other variables, such as the manager's entrepreneurship, are not observed.[19] If an unobservable, in particular the quality of the firm, is correlated with the buyout price, the coefficient estimated by OLS would be biased. In such a case, part or all of the magnitude of the coefficients on the buyout price variable would be measuring the impact of the quality of the firm on the buyout price.

To account for the omitted variable bias, we employ a firm fixed-effect model. The firm fixed-effect model requires that we use a panel data of the privatized firms from 1994 to 1997. To implement this estimation strategy, we include a firm indicator variable for each firm, which measure the unobserved firm and manager characteristics, and take the first difference between years. We run OLS regressions using these differences. Assuming the unobserved firm and manager characteristics are time-invariant (a fixed firm specific dummy variable across years), the firm fixed-effect model will essentially eliminate these characteristics from the estimation, and eliminates any bias.

The independent variables in the firm fixed-effect models are, however, somewhat different from those in previous models. Since we include all observations on each individual firm, we have an indicator variable (*postprivatization* indicator) to capture the effect of privatization. This is needed since the privatization effect must first be removed in order to isolate the buyout price effect. Since

[19] These unobservable variables are of two types: one type is unobserved by both the officials and the econometrician. The other type is only unobserved by the econometrician. Both types could be correlated with the buyout price.

the buyout prices only apply to those years postprivatization, they equal zero otherwise. Also, we drop all variables that do not vary across years. The control variables in z capture the interactive effect of year with province and sectors. Specifically, we use the interactive terms of the year indicators with the province and sector indicators, to control for local policies and industry and market conditions in different years.

The fixed-effect model results support the hypothesis that the increase of the buyout price leads to improved firm performance even when controlling for the quality of the firm (Table 5, row 3). The sign on the coefficient of the normalized buyout price overall are positive and significant in both equations. The magnitude of the effect is also large. An increase in the normalized buyout price by one standard deviation (0.21) will decrease firm arrears rate by 4 percentage points (the mean is 19 percent) and increase value added per worker by 11,309 yuan (the mean is 11,635 yuan).

5.2 2SLS

The buyout price, however, might be endogenous for another reason. It could be that the size of the buyout price is paid by the manager who is anticipating how well he will perform (or how much effort he will expend) after choosing the buyout price and accompanied incentives. If such thinking greatly influences the way contracts are designed, then conceptually the performance of the firm might be said to be affecting the size of the buyout price.

In order to test for and control both the simultaneity and the omitted variable bias, we employ a 2SLS approach. In the first stage, we estimate a reduced form buyout price function which includes two instrument variables (IVs). In the second stage, we use the fitted value of the buyout price from the first stage of the analysis to examine the effect of the buyout price on firm performance.

The key to using a 2SLS model is to find appropriate IVs to identify the buyout price. Good IVs should be able to explain the buyout price, but not have any independent explanatory power on the firm's performance except through its effect on the buyout price. To this end, we use measures of the degree of information asymmetry as IVs. We argue that these measures satisfy both conditions. First, as seen in the theory part of the paper, the buyout price increases with the improvement of the official's information about the firm. At the extreme, when information is symmetric between the official and the manager, the buyout price will be the same as the firm's true value. Second, the extent of knowledge the officials have about the firm's potential earning capability should have no direct influence on firm performance.

The two measures we use to measure information asymmetry in the analysis are the number of government-owned firms in the township in 1993 and the number of markets in which each firm sells

its products.[20] We use *the number of firms* and *the number of market destinations* as instruments because in townships where there are a large number of firms or where firms, preprivatization, operate in a large number of markets, township officials have relatively less information about any given firm. Ceteris paribus, officials that have less information about the firm will receive relatively less buyout price for that firm (and vice versa), since the manager can more effectively use his inside knowledge of the firm to bargain for a good price. The buyout price should decrease with both the number of government-owned firms and the number of market destinations.

Using the two IVs, we can estimate the following two equation model, [21]

$$\text{Buyout price} : V = \gamma_0 + IV\gamma_1 + X\gamma_2 + \mu \quad (3)$$

$$\text{Performance} : \pi = \beta_0 + \hat{V}\beta_1 + X\beta_2 + \epsilon_1. \quad (4)$$

When estimating equation (3), we use both a full and a partial specification, defined in the same way as those in the OLS models. Because the partial model fits better, it is used for generating the fitted buyout price, $\hat{V}$, that is used in estimating equation (4).

The results of the first stage regression show that the two IVs perform well and have an interesting interpretation (Table 6). Both the number of firms and the number of market destinations have negative and significant effects on the buyout price. The negative signs of these coefficients confirm the prediction that asymmetric information leads to a lower buyout price. Moreover, the findings are just the opposite of what would be expected if the indicators primarily reflect the value of the firm (since firms in successful townships and with big markets might be expected to be positive firm characteristics that would yield a higher buyout price). Even more importantly, the number of firms and the number of market destinations are statistically valid instruments. A Hausman exclusion restriction test shows that the two IVs have joint explanatory power on the buyout price (with a p-value of 0.008 as reported in Table 6) and that they have no independent effect on performance (with a p-value at least as large as 0.55).[22]

The results of the second stage of the 2SLS model provide further confirmation that the buyout price has a positive effect on performance (Table 5, row 4). All coefficients of the variable buyout price are positive and significant. Although standard errors are larger compared to those of the

[20] Kung and Lin (2000) use the number firms to measure the ability of the village officials to monitor their enterprises.

[21] The counterpart for the production function is $logy = \alpha_0 + \hat{V}\alpha_1 + (logL)\alpha_2 + (logk)\alpha_3 + Z\alpha_4 + \epsilon_2$.

[22] To test if the set of identifying instruments are exogenous, a Lagrange multiplier test can be used (Hausman, 1983). The chi-square distributed test statistics with 2 degrees of freedom, is $N \times R^2$, where N is the number of observations, and R^2 is the measure of goodness of fit of the regression of the residuals from the performance equations on the variables, which are exogenous to the system. The test statistics ranges between 0 and 1.22 which indicate that the null hypothesis that there is no correlation between the exogenous instruments and the disturbance term from performance equation can not be rejected.

OLS estimations, the coefficients on the buyout price are also larger.

5.3 Determinants of Buyout Price

To further investigate the determinants of the buyout price, we estimate equation (3) again, but with two more variables to capture the effects of wealth constraints and risk aversion. We do this because in addition to wanting to increase our understanding of the factors that affect the buyout price, we also want to ensure that at least of the determinants of the buyout price is asymmetric information, and we are not merely picking up a spurious correlation. Our *wealth constraint* variable is created from information derived directly from managers during our survey. If the manager said he was wealth-constrained, the wealth constraint variable is set equal to 1; if the manager did not believe he was wealth constrained, the variable is set equal to 0. Twenty-four percent of the managers reported facing wealth constraints. The variable *risk level* is measured as the standard deviation of a firm's sales growth. We expect that both variables have a negative sign in the regressions. Wealth-constrained managers can not afford the "optimal" buyout price; risk-averse managers facing higher risk levels will only purchase the firm for a lower price.

The regression results, even when wealth constraints and risk considerations are added, still support our theory that ex ante information asymmetries and screening play an important role on the size of the buyout price. Both wealth constraints and risk level have negative effects on the buyout price as expected (Table 7). Managers facing wealth constraints have a normalized buyout price more than half a standard deviation lower (columns 2, 3 and 5). The risk level also has a negative but modest effect. An increase of the risk level of one standard deviation (3.4) reduces the normalized buyout price by about one-sixth of one standard deviation. After controlling for the effects of wealth constraints and risk level, however, a manager still pays a relatively larger buyout price the more the official knows about her firm. Our measure of information asymmetries, both the number of firms and the number of market destinations, have a significant effect on the buyout price (columns 3 to 5) . The coefficients on both variables are also stable and jointly significant. Adding the two measures of information asymmetries improves the goodness of fit (column 2 versus 5).

If these effects are typical for firms in rural China, they show, in general, how privatization of small firms leads to improved firm performance. They also show that not all firms improve their performance equally. Firms with a higher buyout price improve performance more than those with a lower buyout price.

5.4 Efficiency Effect

To examine the magnitude of the effect of the buyout price, we compare the performance of privatized firms with that of private and government-owned firms. In order to do this, we employ a *group fixed-effect* model and use the whole panel data set, including private firms and government-owned firms. "Group" in this case reflects the way in which we divide our firms. We split the sample into eight groups according to their ownership and buyout price–one group for government-owned firms, one for private firms, and six for privatized firms.

In order to pinpoint the effect of privatization, we divide privatized firms into three groups: premium-paying firms, moderately-discounted firms and heavily-discounted firms. To compare performance before and after privatization and to control for omitted variable bias, we further divide each buyout price group into two sub-groups by the time of privatization: preprivatization and postprivatization. Thus, in total we have six indicator variables for privatized firms. For example, the premium-paying preprivatization indicator equals one if the firm is a premium-paying firm but it has not been privatized in that year. The rest of these indicator variables are defined in Table A3.

The analysis demonstrates that private firms indeed perform better than government-owned firms (Table 8). Compared with government-owned firms, private firms have 3.8 percentage points lower arrears rate (the mean of all firms is 19 percent), a 12,032 yuan higher value added per worker, and their managers work 9.4 hours longer per week. Row 1 shows that ownership does make a difference in performance.

Our results also demonstrate that firm postprivatization performance increases with the buyout price (rows 5 to 7). For the premium-paying firms, manager's workload is 11.9 hours higher than for government-owned firms. Value added per worker is 12,214 yuan higher. Better management in premium-paying firms has decreased the firm arrears rate by 5.5 percentage points when compared with the government-owned firms. The significance level and magnitude of the coefficient of the buyout price variable decrease as the size of the buyout price falls.

Our approach also allows us to test whether the premium-paying firms are catching up with private firms in terms of performance and whether the heavily-discounted firms perform differently from government-owned ones. In order to test these hypotheses, we conduct a series of F-tests, testing the equivalence of the performance of the various types of firms. In particular, we first test for the equivalence of premium-paying firms and private firms postprivatization. More simply, we are testing if the coefficients in row 1 are the same as those in row 5. If we fail to reject the first

test, we can say that the premium-paying firms caught up with private firms after privatization. A similar test for heavily-discounted firms tests whether they were in any way distinguishable from government-owned firms.

The findings of the hypothesis tests demonstrate the role that the buyout price plays in improving managerial incentive in privatized firms (Table 9). Manager's workload, accounts receivable management and value added per worker of premium-paying privatized firms are indistinguishable from those of private firms (row 1). In contrast, heavily discounted firms perform the same as the more poorly performing government-owned firms (row 2). Another test also shows that premium-paying firms perform significantly better than heavily discounted firms (row 3).

6 Conclusion

In our efforts to explain the heterogeneous performance of insider privatized firms across China's townships during the late 1990s, we have provided two theoretical explanations of the observed facts: screening and corruption. Our screening theory suggests that in the face of information asymmetry between the seller and buyer of a firm, the buyout price and a contractually contingent payment in the form of a claim on future firm profits by the government official can be used to elicit private information from the buyer about the firm's future profitability. Using such a contract, officials can maximize their revenues and keep privatization from becoming stalled. Although some inefficiency arises due to the poorer incentives that some managers face, "privatization with a tail" allows officials to separate good managers from poor managers (or strong firms from weak firms) and attain a second-best solution.

Our corruption theory, which produces similar predictions to the screening theory, concludes that firms are under-priced because officials receive bribes from managers. Afraid of being audited, the likelihood of which would increase with the size of the discount the manager received for the firm, managers are uncertain about the security of the ownership they have acquired by bribing, and act as if they do not have full incentives.

In the empirical part of the paper, by drawing on a unique data set that we collected in 1998, we demonstrated that the buyout price influences firms' performance postprivatization and information asymmetries affect the buyout price. We are also able to show that managers of premium-paying firms perform as well as private firms, while those that pay a heavily-discounted buyout price do not perform any better than the sample's relatively inefficient government-owned firms.

Although our study centers on the case of a subset of firms from Jiangsu and Zhejiang Provinces,

it may help in explaining a number of empirical regularities, both for China as a whole and for transition economies beyond China. For example, the study's findings are consistent with the mixed results that frequently appear in studies of the effects of insider privatization (Earle, 1998; Havrylyshyn and McGettigan, 1999; Nellis, 1999). Although there are other explanations why insider privatization may not succeed, the results of our empirical models suggests that perhaps if other studies grouped privatized firms that were sold to their managers on the basis of the size of the buyout price, they might have found that some privatized firms consistently outperformed those of others.

The results of our study, however, still leave a number of questions unanswered. It is still unclear why it is that China's rural officials have depended so heavily on insider privatization and "privatization with a tail" while officials in other countries have not. The fact that China's rural firms are smaller and that formal and informal credit markets in China are more developed, may facilitate sales to individuals or sets of individuals where such transactions are not possible elsewhere. It could also be that outsiders in China possess so little information about these rural firms that buying them could be extremely risky investments. Likewise, insiders in China may already have an overwhelming advantages. Because reforms to China's management system in the rural sector have been unfolding since the mid-1980s, many income and control rights had already been shifted to managers by fixed lease contracts. Privatization in this case is merely the shift of ownership of the firm's assets. Or there might be a winner's curse–if outsiders win an auction they must have overpaid because of the lack of information. It could even be that it is easy for the corrupted officials to strike a bribe deal with the insider.

But, privatization, in general, and insider privatization, in particular, are flourishing in rural China. And it is happening on its own. In many cases, privatized firms are succeeding. In this aspect, our study is among the first to really provide an systematic explanation–both theoretical and empirical–of what appears to be the largest episode of privatization in any country since transition began, and perhaps in history.

Appendix

A Survey Design

Our survey involved fieldwork that spanned more than two years and geographically covered all of our two study provinces. Following three pilot surveys in 1997 and early 1998, the main survey was conducted in the summer of 1998. Thirteen enumerators spent three months in the study area. Although the two provinces are known as one of the heartlands of the rural industrial movement, each province has its own special features and contains great heterogeneity.

The sampling procedure was designed to ensure that we randomly chose a diverse and broad-based set of sample regions. We drew eight counties from Jiangsu Province and seven counties from Zhejiang Provinces after stratifying all of the counties in each province into three income groups. The fifteen counties are located in five regions of the two provinces: Northern Jiangsu, Central Jiangsu, Southern Jiangsu, Northern Zhejiang and Southern Zhejiang. Within each county we chose four townships also by stratifying on the basis of income. In total, we conducted surveys in fifty-nine townships.

Firm selection also followed several pre-defined rules to ensure that we had a sample of firms that would facilitate our analysis. Upon arriving in each township, the business administration bureau provided us with a comprehensive list of all firms that operated in the township in 1994. Using size and ownership data that also came from the same bureau, we narrowed the sample, following six rules: a.) the sampled enterprise should have no foreign shares; b.) the sampled enterprise should be an independent tax paying unit with no subsidiaries; c.) the sampled enterprise should have at least twenty employees and a fixed capital base that exceeded 200,000 yuan.[23] d.) the sampled enterprise should be a manufacturing firm, and firms classified as providing services were excluded; e.) the sampled firm should be located within the geographic center of the township's official area, and would be excluded if it were located far away from the center.[24] f.) the sampled enterprise was not in bankruptcy in the summer of 1998. The enumeration group randomly selected three firms from the revised list. In total, we completed surveys on 168 rural enterprises. Tables A1 and A2 present industry distributions and the means of firm size for each ownership group.

[23] One US Dollar = 8.3 Chinese yuan.

[24] The sampling is so designed because almost all TEs and big private firms are located at the center of the township, and distance is the major cost when conducting the survey.

B The Screening Model

The official's expected profit, $\pi(\theta)$, from each contract $(\alpha(\theta), V(\theta))$ with a manager of type θ, is the sum of the down payment $V(\theta)$ and the expected value of her share of the future profits $W(\alpha(\theta), \theta)$,

$$V(\theta) + W(\alpha(\theta), \theta), \tag{5}$$

where $W(\alpha(\theta), \theta) = (1 - \alpha(\theta))e(\theta)$. The manager's expected utility function *ex ante* is given by

$$-V(\theta) + U(\alpha(\theta), \theta), \tag{6}$$

where $U(\alpha(\theta), \theta) = \alpha(\theta)e(\theta) - C(e(\theta), \theta)$ is the manager's *ex post* utility.

We assume that the manager's cost of effort, $C(e, \theta)$, has the following properties: (i) $C(0, \theta) = 0$, $C_e(0, \theta) = 0$ and $C_{e\theta}(0, \theta) = 0$; (ii) for $e > 0$, $C_e = \partial C/\partial e > 0$, $C_{ee} = \partial^2 C/\partial e^2 > 0$, $C_\theta = \partial C/\partial \theta < 0$ and $C_{e\theta} = \partial^2 C/(\partial e \partial \theta) < 0$; (iii) $C_{eee} = \partial^3 C/\partial e^3 \leq 0$, $C_{ee\theta} = \partial^3 C/(\partial e^2 \partial \theta) \leq 0$, and at least one of the two inequalities holds, and $C_{e\theta\theta} = \partial^3 C/(\partial e^2 \partial \theta) \geq 0$; (iv) $C_{e\theta\theta}C_{ee} + C_{eee}\frac{C_{\theta\theta}^2}{C_{ee}} - 2C_{ee\theta}C_{e\theta} > 0$. Here, assumption (i) defines the initial conditions; assumption (ii) is the convexity and the single crossing condition; assumptions (iii) and (iv), together with later assumptions, guarantee the existence of a unique equilibrium.[25]

Note that after making the down payment, the manager only cares about the ex post utility, $U(\alpha(\theta), \theta)$. The *social surplus* ($S$), the sum of the official's profit (equation 5) and the manager's utility (equation 6), is

$$\begin{aligned} \mathrm{S} &= W(\alpha(\theta), \theta) + U(\alpha(\theta), \theta) && (7) \\ &= e - C(e(\theta), \theta). && (8) \end{aligned}$$

Notice that equation 8 shows that the social surplus is exactly the firm's expected value, e, minus the cost of the manager's effort C. The first order condition for maximizing the social surplus, given the manager's type, θ, is

$$1 - C_e(e, \theta) = 0, \tag{9}$$

where the marginal cost of the manager's effort, C_e, equals the marginal benefit, 1. The solution to equation 9, e^*, is the socially optimal level of effort.

Given the objectives and choices of the official and manager in this subsection, in the following subsections, we characterize the economic behavior of the two parties under different assumptions. We first solve for the optimal contract and ex post manager's effort in the case of symmetric

[25] A quardratic cost function, $C = \frac{e^2}{\theta}$ satisfies assumptions (i)-(iv).

information. Then, we demonstrate the existence of a unique optimal linear scheme of the screening model when the manager's information is private. Finally, we conduct comparative statics in the case of asymmetric information in order to be able to formally relate performance (π) to the down payment (V).

B.1 Manager's Type Known

In this subsection, we consider the case of symmetric information, a case in which the manager's type is known to the official. We solve for the manager's optimal effort level and the optimal contract. As is well known in the literature, the social optimum defined by (5) is attainable. This finding is summarized in Proposition 1.

PROPOSITION 1: *When the manager's type, θ, is known to the official, the official will choose $\alpha = 1$ and V such that the manager receives his reservation utility, zero.*[26] *After privatization, the manager will have full ownership and exert socially optimal effort.*

Proof of Proposition 1:

The official maximizes her profit function by choosing the optimal contract $(\alpha(\theta), V(\theta))$ subject to the manager's individual rationality (IR_θ) or participation constraint:

$$\begin{aligned} \max_{\{\alpha(\theta),V(\theta)\}} \quad & V(\theta) + W(\alpha(\theta),\theta) \\ st \quad & -V(\theta) + U(\alpha(\theta),\theta) \geq \quad 0. \end{aligned}$$

where We have normalized the manager's reservation utility to zero for all types, and so the manager's ex post utility is at least as great as the down payment. Substituting the constraint into the objective function, we have the reformatted version of the official's problem, $\max_{\{\alpha(\theta)\}} W(\alpha(\theta),\theta) + U(\alpha(\theta),\theta)$. This is exactly the social surplus. Solving this problem will give the solution $\alpha = 1$ and e^* defined by the first order condition $1 - C_e = 0$. The manager in this case exerts effort until the marginal cost of effort equals the marginal benefit from the project. In order to implement this socially optimal effort level, the official privatizes the whole firm ($\alpha = 1$), leaving herself with no tail, while collecting a single initial payment from the manager, $V = U(e^*, \theta)$. This contract will give the manager exactly the reservation utility of 0. Q.E.D.

[26] The reservation utility of the manager $\underline{U}(\theta)$ is defined as his opportunity cost, and it is assumed to be the same (normalized to zero) for managers of all types. This would be true if the "quality" of the managers is firm-specific. If so, when two managers of different qualities leave their firms, neither commands a wage premium relative to the other in the outside market.

B.2 Manager's Type Unknown

When the manager's type is unknown to the official, the nature of the problem changes. In this case, the social optimum is no longer obtainable, and the official needs to design a contract to obtain a second best solution. By the revelation principle, the official can restrict herself to linear contracts of the following form: (i) the manager announces his type first; (ii) the official offers a contract that specifies an outcome $[\alpha(\hat{\theta}), V(\hat{\theta})]$ for each possible announcement $\hat{\theta} \in \Theta$; (iii) in every state $\theta \in \Theta$, the manager finds it optimal to report the state truthfully.[27]

Solving for the optimal linear contract takes two steps. In the first step, we solve the problem in which the firm is privatized and the manager has made the initial down payment, V. The solution to this problem will give the effort level, $e(\alpha, \theta)$, under arbitrary values of α and θ. The second step in obtaining the optimal contract involves using the manager's effort function ($e(\alpha, \theta)$) derived from the first step and solving for the official's optimal contract ($\alpha(\theta), V(\theta)$). The solution to the problem is second best, however, since the manager's effort is lower when a "tail" is left in the officials' hands. The behavior of the manager is summarized in Lemma 1.

LEMMA 1: *When the manager's type is unknown to the official, the manager's ex post effort is lower than the socially optimal level unless privatization leaves no tail with the official ($\alpha = 1$).*

Proof of Lemma 1:

The manager's ex post utility function is given by

$$\max_{\{e\}} \alpha e - C(e, \theta).$$

Choosing effort, e, to maximize the manager's utility, the first order condition is

$$\alpha - C_e(e, \theta) = 0$$

Since the second order condition is satisfied for a maximum ($-C_{ee} < 0$), there is a unique interior maximum, $e = e(\alpha, \theta)$. This is the manager's effort function, an expression that relates the manager's effort to his type and the contractual terms. The manager's maximized ex post expected utility is given by $U = \alpha e(\alpha, \theta) - C(\alpha, \theta)$. From the first order condition, it can be seen that the manager will exert less than the socially optimal level of effort unless $\alpha = 1$. Since the manager only cares about his share of the firm, he will not consider the total benefit from the project. Incomplete incentives will lead to a sub-optimal effort level. Q.E.D.

[27] We solve for the optimal contract by Mirrlees' First Order Approach (Mirrlees, 1971).

Solving the manager's problem will generate the manager's effort function

$$e = e(\alpha, \theta). \tag{10}$$

Although managers exert sub-optimal effort levels when privatization leaves a tail ($\alpha < 1$), it does not mean that all privatized firms are equally inefficient. The following lemma describes the factors that increase or decrease the effort and utility levels of managers of privatized firms.

LEMMA 2: *The manager's optimal effort level and the maximized ex post utility increase with the manager's type θ and with the profit share α. Algebraically, $e_\theta \equiv \partial e/\partial\theta > 0$, $e_\alpha \equiv \partial e/\partial\alpha > 0$, $U_\theta \equiv \partial U/\partial\theta > 0$, and $U_\alpha \equiv \partial U/\partial\alpha > 0$. Furthermore, good managers are more responsive than bad managers to an increase in α, which can be seen from the sign of the cross derivative, $e_{\theta\alpha} \equiv \frac{\partial^2 e}{\partial\theta\partial\alpha} > 0$.*

Proof of Lemma 2:

Totally differentiate the manager's first order condition $\alpha - C_e(e, \theta) = 0$ with respect to α and e, we get $\frac{\partial e}{\partial\alpha} = \frac{1}{C_{ee}} > 0$. Totally differentiate it with respect to θ and e, we get $\frac{\partial e}{\partial\theta} = -\frac{C_{e\theta}}{C_{ee}} > 0$. Using the envelop theorem, we can get $U_\alpha = e > 0$ and $U_\theta = -C_\theta > 0$. We can further get $\frac{\partial^2 e}{\partial\alpha\partial\theta} = -\frac{C_{eee}e_\theta + C_{ee\theta}}{(C_{ee})^2} > 0$, where, the last inequality holds given the assumption that $C_{eee} \leq 0$ and $C_{ee\theta} \leq 0$ and at least one inequality holds. Q.E.D.

Having solved the manager's ex post problem and obtained the effort function 10, we will next solve the official's problem for the optimal contracts. While the official does not know the exact type of the manager, she knows the distribution of the manager. Besides facing the IR constraints as in the symmetric information setup, the official also faces a set of incentive compatibility constraints (ICs), which guarantee that the manager of type θ chooses the "right" contract and does not have an incentive to pretend to be the manager of another type, say, $\hat{\theta}$. Given the expected level of effort from each type of manager (θ) for each contract (V, α), the official solves the following problem by choosing a menu of contracts, $(V(\theta), \alpha(\theta))$.

$$\max_{\{V(\theta),\alpha(\theta)\}} \quad \int_{\underline{\theta}}^{\overline{\theta}} [V(\theta) + W(\alpha(\theta), \theta)] f(\theta) d\theta \tag{11}$$

$$st: \quad U(\alpha(\theta), \theta) - V(\theta) \geq U(\alpha(\hat{\theta}), \theta) - V(\hat{\theta}) \quad \forall\theta, \hat{\theta} \in \Theta \tag{12}$$

$$U(\alpha(\theta), \theta) - V(\theta) \geq 0 \qquad \forall\theta \in \Theta. \tag{13}$$

where equation 12 defines the incentive compatibility constraints, $IC_{\theta\hat{\theta}}$, and equation 13 defines the individual rationality constraints, IR_θ.

While the problem defined by equations 11 to 13 is complicated since there are infinitely many constraints, it can be simplified in two ways. First, the $IC_{\theta\hat{\theta}}$ constraints and the IR_θ constraints imply that the IR constraint of the worst type ($IR_{\underline{\theta}}$) binds and all the other IRs are redundant. Hence, the IR constraints reduce to one binding constraint: $U(\alpha(\underline{\theta}), \underline{\theta}) - V(\underline{\theta}) = 0$. Second, using the First Order Approach first proposed by Mirrlees (1971), the IC constraints can be simplified to the manager's first order condition ($ICFOC$) plus a monotonicity condition (M). These two simplifications are summarized in Lemmas 3 and 4.

LEMMA 3: *In the solution to the official's problem, only the worst type's IR constraint, $IR_{\underline{\theta}}$, binds, and all the other IRs are redundant.*

Proof of Lemma 3:

We will proceed with the proof by the following claims.

Claim 1 Given the profit share α, the manager's effort level increases with his type, or $e_\theta > 0$; and at the same time the manager's ex post maximized utility increases with type, or $U^*_\theta > 0$.

Claim 1 follows from Lemma 2.

Claim 2 $IR_{\underline{\theta}}$ binds.

For any $\theta \in \Theta$, such that $\theta > \underline{\theta}$, we have

$$\begin{aligned} U(\alpha(\theta), \theta) - V(\theta) &\geq U(\alpha(\underline{\theta}), \theta), -V(\underline{\theta}) \\ &> U(\alpha(\underline{\theta}), \underline{\theta}) - V(\underline{\theta}) \\ &\geq 0 \end{aligned}$$

Where the first inequality is $IC_{\theta\underline{\theta}}$, the second inequality follows since $U(\alpha(\underline{\theta}), \theta) > U(\alpha(\underline{\theta}), \underline{\theta})$, and the last inequality is $IR_{\underline{\theta}}$. Thus, if $IR_{\underline{\theta}}$ is not binding, then IR_θ is not binding. Since there is slack in both $IR_{\underline{\theta}}$ and IR_θ (for all $\theta \neq \underline{\theta}$), both constraints will hold when increasing $V(\theta)$ (for all $\theta \neq \underline{\theta}$) and $V(\underline{\theta})$ by ϵ. The official will be better off from this without violating any of the IC constraints. Therefore, $IR_{\underline{\theta}}$ must bind.

Claim 3 IR_θ ($\forall \theta \in \Theta$ and $\theta > \underline{\theta}$) is redundant. Again, we have

$$\begin{aligned} U(\alpha(\theta), \theta) - V(\theta) &\geq U(\alpha(\underline{\theta}), \theta), -V(\underline{\theta}) \\ &> U(\alpha(\underline{\theta}), \underline{\theta}) - V(\underline{\theta}) \\ &= 0, \end{aligned}$$

where we used Claim 2 to get the last equality. Thus, IR_θ ($\forall \theta \in \Theta$and $\theta > \underline{\theta}$) is redundant.

Thus, we have proved Lemma 3 by claim 1, 2, and 3. Q.E.D.

LEMMA 4: *The IC constraints can be reduced to two constraints:* $U_\alpha(\alpha(\theta),\theta)\alpha_\theta(\theta) - V_\theta(\theta) = 0$ *(ICFOC) and the monotonicity constraint,* $\alpha_\theta(\theta) > 0$ *(M).*

Proof of Lemma 4 is skipped. See a detailed proof of Lemma 4 in Laffont and Tirole (1993).

With Lemmas 3 and 4, we can reduce the official's original optimization problem to

$$\max_{\{V(\theta),\alpha(\theta)\}} \quad \int_{\underline{\theta}}^{\overline{\theta}} [V(\theta) + W(\alpha(\theta),\theta)] f(\theta) d\theta \tag{14}$$

$$st: \quad U_\alpha(\alpha(\theta),\theta)\alpha_\theta(\theta) - V_\theta(\theta) = 0 \quad \text{for a.e.} \theta \tag{15}$$

$$\alpha_\theta(\theta) > 0 \quad \text{for a.e.} \theta \tag{16}$$

$$U(\alpha(\underline{\theta}),\underline{\theta}) - V(\underline{\theta}) = 0 \tag{17}$$

Solving such a program generally requires optimal control techniques. However, we can use a shortcut introduced in Laffont and Tirole (1993). We initially ignore the monotonicity constraint (equation 16), and solve the "relaxed" problem. Next, we check if monotonicity holds at the solution to the relaxed problem. We show that the monotonicity property does hold and there exists an equilibrium. In other words, it can be shown that when the official offers a menu of contracts to the manager in equilibrium, a better manager always chooses a contract with better incentives while a poorer manager always chooses a contract with poorer incentives. The results are summarized in Proposition 2.

PROPOSITION 2: *The monotonicity property holds at the solution to the relaxed official's optimization problem that ignores the monotonicity constraint. The optimization problem defined by equations (14)-(17) has a unique solution* $(V(\theta),\alpha(\theta))$*. Furthermore, the best managers (type* $\overline{\theta}$*) choose the socially optimal contract with* $\alpha(\overline{\theta}) = 1$*.*

Proof of Proposition 2:

Define $\Phi(\theta,\theta) \equiv U(\alpha(\theta),\theta) - V(\theta)$, and define $G(\theta) \equiv \Phi(\theta,\theta)$, where the first θ in Φ is the "announced" type by the manager and the second θ is the real type. Using the Envelope Theorem, we can get $G'(\theta) = U_\theta(\alpha(\theta),\theta)$. Since U is differentiable, we can rewrite G as $G(\theta) = G(\underline{\theta}) + \int_{\underline{\theta}}^{\theta} U_\theta(\alpha(\theta),\theta)d\theta$. Since $G(\underline{\theta}) = U(\alpha(\underline{\theta}),\underline{\theta}) - V(\underline{\theta}) = 0$, we get $G(\theta) = \int_{\underline{\theta}}^{\theta} U_\theta(\alpha(\theta),\theta)d\theta$. Now, we can rewrite the official's objective function (equation 14) as

$$\int_{\underline{\theta}}^{\overline{\theta}} [U(\alpha(\theta),\theta) + W(\alpha(\theta),\theta) - G(\theta)] f(\theta) d\theta \tag{18}$$

$$\Rightarrow \int_{\underline{\theta}}^{\overline{\theta}} [\underbrace{U(\alpha(\theta),\theta) + W(\alpha(\theta),\theta)}_{\text{Social Surplus}} - \underbrace{\int_{\underline{\theta}}^{\theta} U_\theta(\alpha(\theta),\theta)d\theta}_{\text{Informational Rent}}] f(\theta) d\theta \tag{19}$$

We see from equation 19 that the official's objective function is divided into two parts: the social surplus and the manager's informational rent. In order to separate good managers from bad mangers, the official has to give up more rents to the good ones. The better the manager is, the more rent he gets. The only mangers who do not earn any rents are those at the bottom (type $\underline{\theta}$). Since this objective function is distorted downward from the social surplus, the solution to this program may not be socially optimal. Differentiating by parts, the expected informational rent can be rewritten as

$$\int_{\underline{\theta}}^{\overline{\theta}} [\int_{\underline{\theta}}^{\theta} U_\theta(\alpha(\theta),\theta)d\theta]f(\theta)d\theta = \int_{\underline{\theta}}^{\overline{\theta}} U_\theta(\alpha(\theta),\theta)\frac{1-F(\theta)}{f(\theta)}f(\theta)d\theta \tag{20}$$

Using equation 21, equation 20 can be rewritten as

$$\int_{\underline{\theta}}^{\overline{\theta}} [U(\alpha(\theta),\theta) + W(\alpha(\theta),\theta) - U_\theta(\alpha(\theta),\theta)\frac{1-F(\theta)}{f(\theta)}]f(\theta)d\theta \tag{21}$$

Let's define virtual surplus $J(\alpha,\theta) = U(\alpha(\theta),\theta)+W(\alpha(\theta),\theta)-U_\theta(\alpha(\theta),\theta)\frac{1-F(\theta)}{f(\theta)}$. Thus, the official will maximize the expected value of virtual surplus. The expected virtual surplus will be maximized when $J(\alpha,\theta)$ is simultaneously maximized for almost every type θ. This maximization problem has a unique solution $\alpha(\theta)$ for each type θ as shown below.

Rewrite J as $J = e-C(e,\theta)+C_\theta\frac{1-F}{f}$. The first order condition is $\frac{\partial J}{\partial \alpha} = (1-C_e+C_{e\theta}\frac{1-F}{f})\frac{\partial e}{\partial \alpha} = 0$. Since $\frac{\partial e}{\partial \alpha} > 0$ by Lemma 1, $L(\alpha) \equiv 1 - C_e + C_{e\theta}\frac{1-F}{f} = 0$. We know $L(0) = 1$ since the effort will be 0 for $\alpha = 0$. On the other hand, $L(1) = C_{e\theta}\frac{1-F}{f} \leq 0$. Thus, there exists (at least) a solution $\alpha \in [0,1]$ to the first order condition.

Differentiate L with respect to α, then $\frac{\partial L}{\partial \alpha} = (-C_{ee} + C_{ee\theta}\frac{1-F}{f})\frac{\partial e}{\partial \alpha} < 0$. Thus, there is a unique solution $\alpha(\theta)$ to $L = 0$. Therefore, there is a unique maximum $\alpha(\theta)$.

Thus, the optimal $\alpha(\theta)$ is defined such as

$$\alpha(\theta) \in argmax[U(\alpha(\theta),\theta) + W(\alpha(\theta),\theta) - U_\theta(\alpha(\theta),\theta)\frac{1-F(\theta)}{f(\theta)}] \tag{22}$$

We need to check whether the monotonicity condition holds. A sufficient condition for that is that the SCP holds, or $\frac{\partial^2 J}{\partial \alpha \partial \theta} > 0$. This is proved below.

The first half of J is the social surplus. Rewrite the social surplus as $U(\alpha,\theta) + W(\alpha,\theta) = e(\alpha,\theta)-C(e(\alpha,\theta),\theta)$, and differentiate it with respect to α, we get $\frac{\partial(U+W)}{\partial \alpha} = (1-C_e)\frac{\partial e}{\partial \alpha} = (1-\alpha)\frac{\partial e}{\partial \alpha}$ where $C_e = \alpha$ follows from the manager's first order condition. Further differentiating with respect to θ, we get $\frac{\partial^2(U+W)}{\partial \alpha \partial \theta} = (1-\alpha)\frac{\partial^2 e}{\partial \alpha \partial \theta} > 0$, where the last inequality follows from Lemma 2.

The second half of J is the informational rent, which is the product of U_θ and $1/h(\theta)$. Replacing U_θ by $-C_\theta$, and differentiating the informational rent with respect to α, we get $\frac{\partial(U_\theta/h(\theta))}{\partial \alpha} =$

$-\frac{C_{\theta e}}{C_{ee}}\frac{1}{h(\theta)}$. Given assumptions (iii) and (iv), $\frac{\partial(U_\theta/h(\theta))}{\partial\alpha}$ decreases with θ. Now, we can conclude that $\frac{\partial^2 J}{\partial\alpha\partial\theta} > 0$.

Since the Single Crossing Property holds, at the optimum $\alpha(\theta)$ increases with θ. Since the monotonicity property holds, there is a unique equilibrium for the official's problem.

Last, when $\theta = \overline{\theta}$, $F(\overline{\theta}) = 1$ and $J(\alpha, \overline{\theta}) = S$. Thus, the best managers have full incentives or $\alpha(\overline{\theta}) = 1$ and they exert socially optimal effort level. Q.E.D.

B.3 Comparative Statics

Given the problems of officials and managers, we now demonstrate how the manager's effort changes with the size of the down payment. In other words, We establish the nature of the relationship between firm postprivatization performance and the size of the down payment. This relationship can be derived by the following proposition.

PROPOSITION 3: *In the equilibrium solution to 14-17, the profit sharing rule, $\alpha(\theta)$, and the manager's down payment, $V(\theta)$, are uniquely determined by θ and increase with θ. Consequently, the manager's effort level, e, is determined jointly by the size of the down payment, V, and his type, θ, and the manager's effort level increases with the size of the down payment, V. Algebraically, these statements can be written as $e = e(V, \theta)$ and $e_V > 0$.*

This result allows us to replace α with V in equation 10 and define the equation that will be estimated empirically,

$$e = e(V, \theta). \tag{23}$$

Since we know that e increases with α, and α increases with V, proposition 3 shows that the effort level, e, increases with the size of the down payment, V. Finally, since expected firm performance (π–for example, growth and profits) positively depends on e, equation 23 essentially provides the base for empirically testing the hypothesis that the down payment positively affects performance or $\frac{\partial\pi}{\partial V} > 0$.

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Table 1: The Distribution of Ownership of Rural Enterprises in China, 1994-1998. (N=168)†

	1993	1994	1995	1996	1997	1998
Government-owned[1]	135	112	105	79	53	47
Privatized[2]	0	23	30	56	82	88
Private[3]	33	33	33	33	33	33

†The sample is from a survey by the author in two provinces in Southern China: Jiangsu and Zhejiang Provinces in 1998.
[1]Government-owned in this sample are all township-owned firms.
[2]Privatized firms are those that shifted all or part of their shares from the government to the managers and employees (about 70 percent of the shares to the managers in our sample).
[3]Private firms are those firms that were originally established as private.

Table 2: The Buyout price, Base Value, and Buyout price of Privatized Firms in Rural China, 1994-1997. (N=88)

Buyout price to base value ratio[1] (percent)	(1) Number of firms	(2) Buyout price[2] (million yuan)	(3) Base value [3] (million yuan)	(4) Asset value[4] (million yuan)	(5) The premium[5] (million yuan)	(6) Preimum rate [6]
0-0.2	21	0.78	7.16	18.06	-6.39	-0.32
0.21-0.5	14	1.48	4.65	11.67	-3.17	-0.29
0.51-0.75	13	1.57	2.39	6.80	-0.82	-0.12
0.76-1	13	3.09	3.80	16.61	-0.70	-0.03
Greater than 1	20	3.24	2.58	10.88	0.93	0.10
Less than 0[7]	7	0.20	-0.69	6.22	0.89	0.18

[1]The ratio is calculated by dividing column 2 by column 3.
[2]The buyout price is the cash paid by the new owner to the government at the time of privatization.
[3]The base value is the book value of equity, which is the difference of the book value of assets and the book value of debt.
[4]The asset value is the book value of assets.
[5]The premium is the difference of the buyout price and the base value, or column (5) = column (2) - column (3).
[6]The premium rate is the ratio of premium to the asset value, or column (6) = column (5) / column (4). The premium rate is used as the normalized buyout price in the following tables.
[7]The BPBV ratio is negative because the book value of equity is negative.

Table 3: Performance Measures of Heavily-Discounted, Moderately-Discounted and Premium-Paying Privatized Firms in Rural China, 1994 to 1997. (N=88)[†]

	Manager's workload[1] (hours)	Accounts receivable management[2] (ratio)	Value added per worker[3] (1,000 yuan)
Heavily-discounted firms (30 firms)[4]			
Preprivatization		0.780(0.153)	12.87(8.08)
Postprivatization	**69.8**(14.8)	0.749(0.131)	9.59(5.50)
Improvement[5]		**-0.031**	**-3.28**
Moderately-discounted firms (26 firms)[4]			
Preprivatization		0.823(0.137)	9.28(4.55)
Postprivatization	**75.4**(16.2)	0.846(0.099)	13.19(8.18)
Improvement		**0.023**	**3.91**
Premium-paying firms (32 firms)[4]			
Preprivatization		0.796(0.120)	8.81(2.75)
Postprivatization	**82.5**(16.4)	0.833(0.098)	12.00(8.16)
Improvement		**0.037**	**3.29**

[†]This table reports the means and standard deviations (in parentheses) of each group of firms for all four years except that the manager's workload is only for the year 1997.
[1]Manager's workload is the number of hours the manager works per week.
[2]Accounts receivable management = 1 - inter-firm arrears/assets.
[3]Value added per worker = value added / number of workers.
[4]Heavily-discounted firms are those in which the buyout price is less than -0.2; moderately-discounted firms are those in which the buyout price is between -0.2 and 0; premium-paying firms are those in which the managers have paid a non-negative premium (the buyout price is positive or zero).
[5]Improvement is defined as: postprivatizaiton mean - preprivatization mean.

Table 4: Ordinary Least Squares Regressions Using the "Full Specification" to Measure the Impact of the Buyout price on Performance of Privatized Firms in Rural China, 1994-1997[†]

	Dependent variable		
	(1)	(2)	(3)
	Manager's workload[1]	Accounts receivable management[1]	Value added per worker in log[1]
Normalized buyout price	24.980***	0.181***	0.285*
	(8.578)	(0.045)	(0.146)
Asset	-0.001	0.0003	
	(0.075)	(0.0005)	
Employment (log)			0.035
			(0.043)
Capital-labor ratio (log)			0.479***
			(0.040)
Manager's attributes			
Education	0.790	0.001	-0.027*
	(0.872)	(0.004)	(0.016)
Experience	0.485	0.003	-0.006
	(0.346)	(0.002)	(0.006)
Observations	80	160	167
R-squared	0.23	0.30	0.60
F-statistic	1.69*	1.59**	5.34***

[†]Standard errors are reported in parentheses. Significance levels of 10, 5 and 1 percent are represented by *, ** and ***. All regressions include a constant and interactive terms of year indicators with provincial and sectoral indicators (not reported).

[1]The first regression uses a smaller sample since we observe the manager's workload only for the year 1997. For the last two regressions, however, we use the sample of privatized firms for all postprivatization years.

Table 5: Coefficients of OLS, 2SLS and Firm Fixed-Effect Regressions Measuring the Impact of the Buyout price on Performance of Privatized Firms in Rural China, 1994-1997[†]

	Dependent variable		
Estimator	(1) Manager's workload[1]	(2) Accounts receivable management[2]	(3) Value added per worker in log[2]
OLS (partial specification)[3]	26.899***	0.151***	0.312**
	(8.241)	(0.042)	(0.134)
OLS (full specification)[4]	24.980***	0.181***	0.285**
	(8.578)	(0.045)	(0.146)
Firm fixed-effect[5]		0.188***	0.788***
		(0.059)	(0.247)
2SLS[6]	49.842*	0.375***	0.817**
	(26.290)	(0.117)	(0.395)

[†]Standard errors are reported in parentheses; significance levels of 10, 5 and 1 percent are represented by *, ** and ***.
[1]We observe the manager's workload only for the year 1997, so the OLS and 2SLS regressions have only 80 observations and we cannot conduct the firm fixed effect estimations for the manager's workload.
[2]For the dependent variables accounts receivable management and value added per worker, we have 167 observations for OLS and 2SLS and 298 observations for firm fixed-effect model.
[3]The partial specification includes the firm size and the manager's attributes as other independent variables. The value added per worker equation also includes the log employment and log capital-labor ratio.
[4]In regressions using full specification, besides the variables in the partial specification, we also include interactive terms of provincial and sector indicators with year indicators.
[5]The 2SLS regressions use the partial specification and the fitted value of buyout price predicted by regression (1) in Table 6. We conducted a Hausman exclusion restriction test, a Lagrange multiplier test for the instruments. The chi-square distributed test statistics with 2 degrees of freedom, is $N \times R^2$, where N is the number of observations, and R^2 is the measure of goodness of fit of the regression of the residuals from these regressions on the two IVs. (See footnote.) All three regressions pass the test with the p-value of the tests ranging from 0.55 to 0.99.
[6]In the firm fixed-effect estimations, we include firm indicators and also postprivatization indicators.

Table 6: Ordinary Least Squares Regression (and the First Stage of the Two-Stage Least Squares Regression) Explaining the Buyout price of Privatized Firms in Rural China, 1994-1997.

	Dependent variable: Normalized buyout price	
	(1) Partial specification[1]	(2) Full specification[2]
Number of firms (IV)	-0.010*	-0.011*
	(0.005)	(0.006)
Number of market destinations (IV)	-0.007***	-0.006*
	(0.003)	(0.003)
Assets (lagged)	-0.001	-0.001
	(0.001)	(0.001)
Manager's attributes		
Education	-0.005	-0.005
	(0.011)	(0.012)
Experience	-0.003	-0.001
	(0.004)	(0.005)
Observations	80	80
R-squared	0.13	0.16
F-statistic	2.12***	0.94
Joint significance of two IVs in the first-stage regression[3]		
F-statistic	7.44	6.59
p-value	0.008	0.012

†Standard errors are reported in parentheses. Significance levels of 10, 5 and 1 percent are represented by *, ** and ***.

[1]The predicted buyout price from the partial model is used in the second-stage regression. (see Table 5, row 3)

[2]The full specification, besides all the independent variables in the partial specification, also includes the provincial and sectoral indicators (not reported).

[3]The null hypothesis of the test is the sum of the coefficients on the two IVs (number of firms and number of market destinations) is zero.

Table 7: Ordinary Least Squares Regression Explaining the Buyout price of Privatized Firms in Rural China, 1994-1997.

	Dependent variable: Normalized buyout price				
	(1)	(2)	(3)	(4)	(5)
Information asymmetries variables					
Number of firms	-0.009*		-0.010**	-0.009*	-0.009**
	(0.005)		(0.005)	(0.005)	(0.005)
Number of market destinations	-0.006***		-0.005**	-0.007***	-0.006**
	(0.002)		(0.002)	(0.002)	(0.002)
Wealth constraints[1]		-0.139***	-0.102*		-0.118**
		(0.051)	(0.052)		(0.051)
Risk level[2]		-0.011**		-0.010**	-0.011**
		(0.005)		(0.005)	(0.005)
Assets (lagged)	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	86	86	86	86	86
R-squared	0.11	0.13	0.15	0.16	0.21
F-statistic	3.44**	4.32***	3.64***	3.76***	4.25***

[†]Standard errors are reported in parentheses. Significance levels of 10, 5 and 1 percent are represented by *, ** and ***.
[1]Wealth constraint is an indicator variable, equal to 1 if the manager is wealth constrained when buying a firm.
[2]Risk level is the standard deviation of the firm's sales growth.

Table 8: Group Fixed-Effect Regressions Using the Whole Panel Including Private and Government-owned Firms Explaining the Impact of the Buyout price on Performance[†]

	Dependent variable		
	(1) Manager's workload	(2) Accounts receivable management	(3) value added per worker in log
Private firm indicator	9.355**	0.038**	0.185**
	(4.012)	(0.019)	(0.076)
Privatized firm indicators			
Preprivatization[1]			
Premium-paying		0.019	0.122
		(0.024)	(0.102)
Moderately-discounted		0.053**	-0.018
		(0.022)	(0.086)
Heavily-discounted		-0.008	0.185*
		(0.025)	(0.100)
Postprivatization[1]			
Premium-paying	11.930***	0.055**	0.200**
	(3.804)	(0.022)	(0.086)
Moderately-discounted	5.905	0.059**	0.193**
	(4.169)	(0.024)	(0.093)
Heavily-discounted	-0.243	-0.028	-0.039
	(3.917)	(0.021)	(0.084)
Assets	0.024	0.001***	
	(0.024)	(0.0005)	
Employment (log)			0.102***
			(0.024)
Capital-labor ratio (log)			0.328***
			(0.026)
Manager's attributes			
Education	1.088*	-0.005*	-0.001
	(0.590)	(0.002)	(0.011)
Experience	0.408*	0.001	0.015***
	(0.236)	(0.001)	(0.004)
Observation	167	575	567
R-squared	0.19	0.16	0.38
F-statistics	2.17***	2.05***	6.30***

[†]Standard errors are reported in parentheses; significance levels of 10, 5 and 1 percent are represented by *, ** and ***. All regressions include interactive terms of year indicators with provincial and sectoral indicators (not reported).
[1]Privatized firms are divided into three groups by the magnitude of the normalized buyout price: premium-paying, moderately-discounted and heavily-discounted firms. (See Table 3 and Table A3). We have an indicator for each of the groups for their postprivatization years. In order to control for unobservables (or selection bias), we also divide the preprivatization years of privatized firms into three groups by the buyout price: premium-paying, moderately-discounted and heavily-discounted firms.

Table 9: Results of Hypothesis Tests Examining Improvement of Privatized Firms over Time and Comparison with Private and Government-owned Firms, 1994-1997[†]

F-test/t-test to test equivalence of performance[1]	(1) Manager's workload	(2) Accounts receivable management	(3) Value added per worker
Equivalence of private firms and premium-paying privatized firms (row 1 vs. row 5)			
F-statistic	0.36	0.52	0.03
p-value	0.55	0.47	0.87
Equivalence of government-owned firms and heavily-discounted privatized firms (row 7)			
t-statistic	0.062	1.30	0.465
p-value	0.95	0.193	0.642
Equivalence of premium-paying firms and heavily-discounted privatized firms postprivatization (row 5 vs. row 7)			
F-statistic	8.29***	10.50***	6.19***
p-value	0.005	0.001	0.01

[†]Significance levels of 10, 5 and 1 percent are represented by *, ** and ***. All tests are based on regressions in Table 8.
[1]The null hypotheses are the coefficients in the two rows (from Table 8) specified are equal.

Table A1: Sectoral Distribution of Sample Firms in Jiangsu and Zhejiang Provinces, China, 1994-1997[†]

	Government-owned firms		Privatized firms		Private firms	
	Number	Percent	Number	Percent	Number	Percent
Metal mining	1	2	0	0	0	0
Metal processing	2	4	10	11	6	18
Construction material	3	6	2	2	1	3
Chemicals	9	19	17	19	3	9
Machinery	4	9	28	32	8	25
Electronics	7	15	5	6	3	9
Textile and clothing	14	30	18	20	8	24
Food and agricultural product processing	2	4	3	3	2	6
Miscellaneous light manufacturing industries	5	11	5	6	2	6

[†]The sectors are based on the 2-digit SIC code adjusted for Chinese classification.

Table A2: Average Firm Size Measured by Asset Value, Sales and Number of Employees in Rural China, 1994-1997.

	1994	1997
Assets (million yuan[1])		
Government-owned	14.25	35.68
Privatized	9.06	14.18
Private	3.82	15.45
All	9.72	20.44
Sales (million yuan)		
Government-owned	16.22	24.93
Privatized	9.85	14.98
Private	6.13	18.52
All	11.16	18.46
Number of Employees		
Government-owned	261	258
Privatized	197	172
Private	90	209
All	195	203

[1]The exchange rate is: 1 dollar = 8.3 yuan

Table A3: Definition of Variables

Variable Name	Definition
Performance Measures	
Manager's workload	number of hours the manager works per week
Profit rate	net profit / sales
Inter-firm arrears rate	firm trade arrears / assets
Accounts receivable management	(1 - inter-firm arrears rate)
Value added	sales - materials cost
Value added per worker	value added / number of workers
logy	natural log of value added per worker
Firm Valuation	
Base value	book value of assets - book value of debt
Premium	buyout price - base value
Normalized buyout price (premium rate)	buyout price premium / assets
Premium-paying indicator	an indicator variable which equals 1 if the normalized buyout price is non-negative and equals 0 otherwise
Moderately-discounted indicator	an indicator variable which equals 1 if buyout price is between -0.2 and 0 and equals 0 otherwise
Heavily-discounted indicator	an indicator variable which equals 1 if buyout price is below -0.2 and equals 0 otherwise
Ownership indicators	
Private firm	an indicator variable which equals 1 if the firm is private and equals 0 otherwise
Preprivatization	an indicator variable which equals 1 if the firm is a privatized firm but has not been privatized in the current year and equals 0 otherwise
Postprivatization	an indicator variable which equals 1 if the firm is a privatized firm and has been privatized in the current year and equals 0 otherwise
Preprivatization premium-paying	an indicator variable which equals 1 if both the preprivatization indicator and premium-paying indicator equal 1, and equals 0 otherwise
Preprivatization moderately-discounted	an indicator variable which equals 1 if both the preprivatization indicator and moderately-discounted indicator equal 1, and equals 0 otherwise
Preprivatization heavily-discounted	an indicator variable which equals 1 if both the preprivatization indicator and heavily-discounted indicator equal 1, and equals 0 otherwise
Postprivatization premium-paying	an indicator variable which equals 1 if both the postprivatization indicator and premium-paying indicator equal 1, and equals 0 otherwise
Postprivatization moderately-discounted	an indicator variable which equals 1 if both the postprivatization indicator and moderately-discounted indicator equal 1, and equals 0 otherwise
Postprivatization heavily-discounted	an indicator variable which equals 1 if both the postprivatization indicator and heavily-discounted indicator equal 1, and equals 0 otherwise

Table A3: Definition of Variables (continued)

Variable Name	Definition
Firm size measures	
Employment	number of employees in the firm
Sales	gross income from sales
Assets	value of total assets
logL	natural log of employment
logk	natural log of capital labor ratio
Manager's attributes	
Education	years of schooling
Experience	number of years as the firm's manager
Measures of information asymmetry	
Number of TEs	number of township government-owned firms in each township
Number of market destinations	number of market destinations (counties) to which a firm sells its output
Wealth constraints	an indicator variable which equals 1 if the manager is wealth-constrained when buying a firm
Risk level	the standard deviation of a firm's sales growth
Other control variables	
Sector indicators	8 industry indicators (see Table A1)
Provincial indicators	in indicator variable which equals 1 for Zhejiang Province and equals 0 for Jiangsu Province
Year indicators	three year indicators for 1995, 1996 and 1997