Agency Theory and Executive Compensation:

The Case of Chinese State-Owned Enterprises

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Abstract. This paper examines the extent to which agency theory may explain CEO compensation in state-owned enterprises (SOEs) in China during the 1980s. We find that the sensitivity of CEO pay to firm performance decreases with the variance of performance. This is consistent with the prediction of a tradeoff between incentives and insurance in agency theory. On the other hand, the data lend little support to the relative performance evaluation hypothesis. We also find that the performance sensitivity of CEO pay increases with the marginal return to executive action, that is, pay sensitivity increases with managerial control rights, worker incentives, profit retention rates of firms, and the degree of product market competition faced by the firm. While the elasticity of pay to sales is slightly smaller than that found in the literature on conventional firms in the West generally, our estimate of the semi-elasticity of pay with respect to profitability is comparable to estimates for regulated industries in the United States.

JEL codes: D2, G3, J3, L2, L3, P5.

Key words: CEO compensation, agency theory, relative performance model, SOEs, China.

I. Introduction

The large and growing body of empirical work on the economics of managerial compensation is mostly based on the theme of aligning the interest of corporate executives with that of shareholders. However, among the papers that formally test predictions of standard models of agency, only half a dozen or so are concerned with insurance-incentives tradeoffs in compensation schemes.[1] These include, for example, Aggarwal and Samwick (1999), which analyzes a large data set from 1500 U.S. companies and find strong evidence of pay schemes trading off the provision of incentives against the allocation of performance risk: not only does executive pay increase in firm performance, but pay-performance sensitivity also decreases in the variance of performance. This evidence is supported by results of Garen (1994) and Lambert and Lacker (1987), but happens to be contradicted by, for example, Core and Guay (1998), Bushman et al. (1996), and Yermack (1995), which find little evidence in their data favoring the incentive-insurance tradeoff hypothesis. A part of the literature is also concerned with a second aspect of agency theory, namely, the relative performance evaluation hypothesis. Here too the evidence is rather mixed: while most studies do not support the hypothesis, there are notable exceptions.[2]

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[1] See Rosen (1992), Murphy (1999), Lazear (1999), Abowd and Kaplan (1999) and Prendergast (1999) for surveys in this topic. In our view the main achievement of the literature so far is the consensus that executive earnings increase with corporate performance (e.g., Jensen and Murphy, 1990; Garen, 1994; Kaplan, 1994; Baker and Hall, 1998; Hall and Liebman, 1998; and Aggrawal and Samwick, 1999). There is also substantial evidence that managers respond to pay incentives, that is, greater current pay-performance sensitivity leads to subsequent improvement in corporate performance (e.g., Masson, 1971; Abowd, 1990; Leonard, 1990). Although the first of these findings is consistent with the agency theory, it is by no means a unique prediction of the theory. As Prendergast (1999) notes, observed responsiveness of managers to incentives vindicates a premise, rather than an implication, of agency models.

[2] The studies failing to find evidence of relative performance evaluation are Barro and Barro (1990), Janakariman et al. (1992), Garen (1994), Aggarwal and Samwick (1999). Two exceptions are Gibbons and Murphy (1990), and Antle and Smith (1986). Gibbons and Murphy (1990) find that, while the rate of growth of pay increases in shareholder rate of return, it also decreases in the market rate of return, which is consistent with the use of relative performance evaluation in pay determination. Empirical studies of CEO compensation conducted within the conceptual framework of agency theory but not concerned with testing implications considered here include Agrawal and Koeneber (1998) on the effect of the threat of takeover

Also motivating this paper is the fact that the two key predictions of the agency theory have mainly been tested on compensation data drawn from Western corporations only. In order to examine the extent to which the agency theory may explain CEO compensation in other contexts, the paper brings the predictions against data on CEO compensation in commercialized State-owned enterprises (SOEs) in China in the 1980s. It also assesses the relationship between the marginal productivity of executive action and the sensitivity of CEO pay to firm-performance.

There are striking and important differences between the typical SOE in China and large US corporations that have a bearing on executive compensation. The two institutions nonetheless share features that seem to generate the same agency problems. First, ownership is clearly separated from control, and the owner-versus-executive relationship seems to exhibits informational asymmetry of the same nature in the two institutions. Second, the local government which typically owns the Chinese SOE appears to seek the maximization of the value of the enterprise following the reforms of the late 1970s and early 1980s. Third, both institutions seem to obtain and reward management services through a managerial labor market (Groves at al. 1995).

Our data consist of a ten-year panel of observations on managerial compensation and corporate performance on approximately 400 SOEs, drawn from a survey carried out by the Chinese Academy of Social Sciences (CASS).[3] Our analysis implies that the performance sensitivity of the CEO pay decreases with the variance of performance.

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on compensation, Core, Holthausen and Larcker (1999) on the effect of governance structures, Bliss and Rosen (2001) on the effect of mergers and acquisitions, and Perry and Zenner (2001) about the effects of regulation on CEO pay level and pay sensitivity. On a methodological theme, Hermalin and Wallace (2001) question the assumption of uniform pay-performance sensitivity that is made in practically all existing empirical work on managerial compensation. See also Main, O'Reilly, and Wade (1993), Kaplan (1994), Kole (1997), Bognanno (2001), Eriksson (1999), Roomkin and Weisbrod (1999), and Lindbeck and Snower (2000).

[3] Other users of the data set include Groves et al (1994, 1995), Li (1997), Xu (2000), and Shirley and Xu (2001).

However, the evidence for relative performance evaluation is rather weak. The coefficient of average industry performance in the CEO pay equation is never statistically significant, and has the wrong sign when CEO fixed effects are controlled for.

One of the advantages of the CASS survey is that it captured enterprises at different stages of the implementation of China's industrial reforms. This enables us to assess the impact of individual reforms on CEO pay sensitivity. The significance of this for the agency theory is that it allows us to examine whether CEO pay sensitivity increases in the marginal productivity of executive actions. For example, increase in the marginal profit retention rate was one of the major reform measures through which authorities sought to improve firm incentives. Other things being equal, such a measure would increase the resources controlled by management. The marginal productivity of executive action would rise consequently. This in turn would raise the performance sensitivity of the CEO pay, which is indeed what we detect in the data. We also find that the performance sensitivity of the CEO pay is larger the more competitive is the product market in which the firm operates. This too is consistent with CEO pay sensitivity decreasing with the variance of performance, which is expected to be lower for firms facing greater competitive pressure. The semi-elasticity of CEO pay with respect to profitability that we estimate hovers around 0.29 and ranges from 0.08 (for firms facing the highest performance risk) to 0.77 (for the lowest-risk firms). The average is almost as high as that found in regulated firms in the United States as documented by Joskow, Rose and Shepard (1993), in which the semi-elasticity estimates of pay with respect to accounting return range from 0.2 to 0.7.

Before delving into details of our findings we will set out the context of our data by describing the managerial labor market of Chinese SOEs briefly, the industrial reforms which gave rise to it, and the relationship between SOEs and local governments

as their owners. We will also describe the data and the empirical framework in which we have analyzed them to generate our findings.

II. China's SOEs and the Managerial Labor Market

Before the 1980s, the Chinese SOE was the lowest link in the chain of command of a central planning machinery. This was a setting that made the enterprise director less of a business executive than a civil servant responsible for the implementation of a set of "plan targets" routinely passed down a national or regional planning hierarchy. The director was evaluated and compensated accordingly and came under the overseeing authority of the enterprise Communist Party Committee, the secretary of which had a greater say in the enterprise's affairs than the director. The manpower of the economy was allocated between enterprises by central planners and was remunerated at nationally determined pay rates and benefit rules. Enterprises were required to remit all of their profits into the state budget.

The reforms began with the state relinquishing part of its control over incomes generated by enterprises through a variety of profit retention schemes introduced between 1980 and 1984. An SOE would no longer be obliged to remit all of its profits to the state. Although it would continue to be required to make payments into the state budget, this would be in the form of a pre-specified quota of profits. At the same time it could retain a fixed proportion of the same quota, and between 60 and 100 percent of profits above the quota for the purpose of financing its own investment and bonus schemes. Mandatory production targets were also replaced by a below-capacity quota of output that the enterprise was required to produce according to the state plan, and the remaining capacity could be used to produce for the market outside of the plan. Profit retention and "output

autonomy" schemes were introduced in various experimental forms to selected regions, and were in force in most enterprises by the end of 1984 (Perkins, 1988).

The reform process entered a second phase towards the end of 1984, when, after a series of experimental measures covering a selection of enterprises, the government abolished profit remittance into the state budget and replaced it with a profit tax at a maximum rate of 55 percent. The firm could use the after-profit tax as before for investment, product development, bonus schemes and welfare benefits. Moreover, the balance of power shifted from the party secretary to the director, who now was the sole representative of the enterprise to outsiders, and had authority in the area of personnel decisions, which until then was the preserve of the party committee (Byrd, 1992). The change was necessary for the implementation of the various Contractual Responsibility Systems (CRSs) that the government introduced during the same phase.[4] These supplanted the central planning hierarchy of earlier years by contracts negotiated between the SOE and its supervising authority. Contracts typically lasted for a period of three to four years. Often, they also specified minimum profitability and productivity standards and investment levels that the enterprise had to meet. As the signatory of the contracts the enterprise director was personally responsible for fulfilling those obligations. In many cases the director also posted personal assets as performance bonds. Byrd (1992) observes that, in an apparent attempt to balance the assumption of personal risk by the director for enterprise performance, the director's reward was allowed to exceed the pay of the average worker by as much as 10 times.

The appointment, evaluation and dismissal of the director of the Chinese SOE of the 1980s were also made by a central or regional government bureaucracy, and often reflected political priorities of the controlling government. On the other hand, Groves et

al. (1995) demonstrate that political control over the selection and dismissal of management was exercised within the framework of a functioning managerial labor market throughout the 1980's: As they write, "managerial efforts were being rewarded and managerial resources were being assigned in accordance with criteria established by market forces." Their evidence for this comes primarily from an analysis of the CASS survey data set that we use and is in two parts. First, managerial turnover rates were comparable to those observed in developed market economies and appeared to be sensitive to enterprise performance. Replacements to these were typically on shorter-term contracts, and often subject to the posting of performance security deposits that were several times higher than the average annual salary for the industry. Changes in management, usually following poor performance by the former director, typically led to improvement in firm performance. The second part of the evidence for a functioning managerial labor market is that managerial earnings significantly increased with enterprise profits and with enterprise sales.

These findings provide the starting point of our analysis of the CASS data set. In particular we pursue the suggestion of Groves et al (1995) that the provision of incentives might have been an important objective of the managerial compensation policies of the supervising authorities. Beyond the question of the existence of incentives in pay schemes, we also ask whether the observed provision of incentives was consistent with the predictions of the standard agency theory of compensation, namely, the existence of an incentives-insurance tradeoff, the use of relative performance evaluation in compensation schemes, and whether CEO pay-performance sensitivity increases with CEO marginal productivity.

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[4] See Shirley and Xu (2001) for analysis of the Chinese performance contracts.

III. Empirical Results

1. The data

Our data source, the CASS survey, covered a total of 769 SOEs in 36 two-digit industries in four Chinese provinces and involved the collection of annual production, cost and organizational data between 1980 and 1989. For 1989 the employment size distribution of the sample has a median of 930 employees, a 10^{th} percentile of 304, and a 90^{th} percentile of 3175. About 70 percent of the enterprises were owned by municipal governments at the time of the survey, the remaining being distributed more or less equally between central, provincial and county governments. Nearly all SOE directors or CEOs in the sample had management contracts of three to five year terms in the late 1980s. Some 56 percent of these had taken up the current post prior to 1985. Another 10 percent had been appointed prior to 1979, the year China launched its industrial reforms. This corresponds to a median CEO tenure of two years, a 25 percentile of one year and a 75 percentile of five years.

Since 1987, SOEs have sometimes required their CEOs to post performance bonds. Five percent of the CEOs posted bonds in 1987. The figure then rose to 28 percent by 1989. The bond was in the form of a security deposit to be forfeited in case of failing contractual commitments at the end of the contract. The median deposit for 1989 was 6000 *Yuan*, about three times the average annual wage in China's SOE sector for the same year.

Roughly 400 of the 769 SOEs have observations on most of variables of interest for all the 10 years spanned by the survey.[5] Definitions and descriptive statistics of the

[5] As explained in the footnotes for profit retention rate and wage elasticity in Table 1, these two variables have some missing observations, and we impute the missing observations with province-year means, and control for the missing indicators for potential imputation errors and selection bias.

variables are given in Table 1. The dependent variable in all of the reported regression results is the log of CEO pay, defined as the annual salary and bonuses of the SOE director expressed at 1980 prices.[6] As can be seen in Figure 1, its average nearly doubled in real terms between 1980 and 1989.

In our analysis we relate pay data to enterprise profitability as the measure of performance on which CEO contracts were normally written, and which 72% of enterprise directors responding to the CASS survey identified as the most important "target" in enterprise plans. Since SOE asset values reported in transitional countries are often considered to be less reliable than sales figures, we have used the ratio of operating profits to total sales (ROC) instead of ratio of profits to assets. On the other hand, there is no indication in the literature, or in the response of mangers to the CASS questionnaire, that CEOs were evaluated in terms of the growth rate of sales.

2. Hypotheses

Assume, for simplicity, that enterprises always write a linear CEO contract, $W = b_0 + b_1 y$, where W is CEO wage, and y is firm performance such that $y = mt + \varepsilon$, where m is the marginal product of CEO efforts, t is effort, and ε follows a normal distribution with a mean of zero and a variance of σ_ε^2. Agency theory is a set of propositions regarding the determination of b_1 that follow from certain regularity conditions. It can be shown , for example, that under some of these, $b_1 = \frac{m^2}{m^2 + c\sigma_\varepsilon^2}$, where c increases with agent's degree of absolute risk aversion and the cost of the agent's effort. This combines two key comparative-static results of the theory, of which one is that the

[6] The reason for this definition is that, unlike many their counterparts in Western corporations , CEOs of China's SOEs are not granted stock options and are not covered by long-term incentive plans.

optimal compensation scheme trades off the provision of incentives against the allocation of performance risks, that is, a higher risk (σ_ε^2) leads to a lower pay-performance sensitivity. The second is that pay-performance sensitivity increases with the marginal productivity of the agent's effort.

An implication of the inverse relationship between the pay-performance sensitivity and σ_ε^2 also leads to the relative performance evaluation hypothesis. The greater is σ_ε^2, the lower is the incentive component of the CEOs pay since a greater σ_ε^2 would mean a higher noise-to-signal ratio in *y*. It therefore pays the principal to write the compensation contract on any additional variable that reduces this ratio even when the additional variable is uncorrelated to the CEO's effort. To the extent that ε is only partially idiosyncratic to the enterprise, a natural candidate as an additional variable is the performance, θ, of a peer group such as firms in the same industry. In other words, the optimal contract would be of the form $W = b_0 + b_1 y + b_2 \theta$, where b_2 is a constant. The relative performance evaluation hypothesis is the proposition that b_2 is negative while b_1 is positive, that is, the optimal CEO pay increases with the firm's own performance but decreases with the industry average performance.

3. Testing for Relative Performance Evaluation

Following Gibbons and Murphy (1992), the relative performance evaluation (RPE) hypothesis can be tested by estimating the following equation:

$$W_{ijt} = f(controls_{it}) + b_0 + b_1 y_{it} + b_2 \theta_{it}^{*} + \beta t + \varepsilon_{ij} + u_{ijt} \qquad (1)$$

where *i, j,* and *t* index firm, CEO, and time, respectively; $f(.)$ is a linear combination of a set of control variables, y_{it} is profitability defined as the ratio of profits to sales (and

denoted ROC hereafter), θ^*_{it} the two-digit industry-year average of y_{it}, βt capture trends in CEO pay, and u_{ijt} is a random error term with zero mean and a constant variance. Our controls include the enterprise's size as measured by the log of current sales at 1980 prices, the CEO's schooling and the CEO's experience. One theoretical basis for an association between firm size and CEO pay is Rosen's hypothesis that the marginal product of management ability increases as one moves up in the hierarchy ladder. On the assumption that the "chain of command" in management is longer the larger is the firm, CEOs running larger enterprises should earn more on account of their higher marginal productivity (Rosen, 1982). Schooling and experience are observed only for the incumbent manager at the time of interview for the survey. We also include among the controls the dummy variable of "the previous CEO", which is equal to unity if the observation relates to a year when the CEO is different from the CEO in 1990 (at the time of the interview), whose characteristics are observed in the data.[7]

The term ε_{ij} represents CEO fixed effects. Controlling for such effects is important when the omitted CEO characteristics are correlated with those of the firm. This could mean that the CEO-firm match is endogenous, in which case, both the OLS and firm-fixed-effects estimates would be biased (Ackerberg and Botticini, 2002).[8] Arriving at consistent estimates of parameters under these circumstances requires that we control for the CEO fixed effects as well. Since adding up the firm-specific CEO dummies invariably leads to one, the inclusion of ε_{ij} in equation (1) means that we have, in effect, controlled for both *CEO* fixed effects and *firm* fixed effects.

[7] The CEO characteristics were obtained through interviews conducted with the current CEO in 1990. For example, if the 1990 CEO reported that he assumed his current post in 1987, all observations on CEO pay and firm performance before 1987 would correspond to a value of unity for "Previous CEO". On the other hand, those for 1987 and for years thereafter would correspond to value of zero for "Previous CEO".

Table 2 contains the results of the fixed-effect estimation of equation (1). Although the main result is in column (2), where we include CEO fixed effects, we also present results that control only for firm fixed effects in column 1. This should enable us to assess the importance of potential biases arising from possible match endogeneity.

Both columns suggest that the evidence in our data does not favor the RPE hypothesis. In neither column is the industry ROC both negative and statistically significant. This is very much in line with the unfavorable evidence for the RPE based on U.S. firms, including that in Gibbons and Murphy (1992), Hall and Liebman (1998), and Rosen (1992). Notice that in obtaining this result we control for both firms size and CEO characteristics. Depending on the range of other controls employed in estimation, we find that larger SOEs pay more for their CEOs, and the pay-size elasticity ranges from 0.12 to 0.14.

4. Testing for an incentives-insurance tradeoff

Following Garen (1994) and Aggarwal and Samwick (1999), we test for an incentives-insurance tradeoff based on the following equation:

$$W_{ijt} = f(controls) + b_{00} + b_{01}h(\sigma_{it}^2) + [a_0 + a_1 h(\sigma_{it}^2)]\, y_{it} + \beta t + \varepsilon_{ij} + u_{ijt} \qquad (2)$$

where $h(.)$ is monotonically increasing, $b_{00} + b_{01}h(\sigma_{it}^2) = b_0$, $a_0 + a_1 h(\sigma_{it}^2) = b_1$, and σ_{it}^2 is the variance of y_{it} as estimated by the sample variance of y_{it} over the preceding five years, that is, by the sample variance of $y_{it-5}, y_{it-4}, ..., y_{it-1}$.[9] Our choices of *h(.)* are two. The first is the logarithmic transformation of the sample variance, $\ln(\sigma_{ROC}^2)$. The second

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[8] We thank Canice Prendergast for drawing our attention to this problem.

[9] We have dropped the industry ROC variable from the wage equation because it is never statistically significant, as found earlier.

is the percentile of σ^2_{ROC}, bounded between 0 and 1, and denoted as F(σ^2_{ROC}). As before, we also control for CEO fixed effects. An incentives-insurance tradeoff is detected if the estimate of a_1 is negative and statistically significant.

The estimation results are reported in Table 3 and are based on three alternative specifications of the error term, namely, that under which OLS estimates would be consistent, that with firm fixed effects, and that with CEO fixed effects. In estimating each specification, the covariates of CEO pay considered include (i) ROC only, (ii) ROC, ln(σ^2_{ROC}), and ROC× ln(σ^2_{ROC}), and (iii) ROC, F(σ^2_{ROC}), and ROC× F(σ^2_{ROC}). The table provides strong evidence of an incentives-insurance tradeoff in CEO pay determination. Our estimate of the coefficient of the interaction term between the ROC and the log of the estimate of its variance is negative and statistically significant in columns (5) and (8). On the other hand, the OLS estimate of the same coefficient is not statistically significant and has the wrong sign. This demonstrates the importance of controlling for firm or CEO fixed effects. However, comparing the estimates under the assumption of firm-fixed-effects only with that under the assumption of CEO-fixed-effects as well, we see that CEO fixed effects add little beyond those that are already captured in firm fixed effects. We note that the same conclusion is reached when we use the percentile of variance as an alternative measure of risk. Indeed, we see from the table that pay sensitivity is given by $0.77\text{-}0.69\,F(\sigma_r^2)$. Thus the sensitivity is 0.77 for firms least exposed to performance risk, 0.43 for firms facing the median level of risk, and 0.08 for firms facing the highest risk**.**

Turning to the importance of observable controls in equation (2), we note that the empirical literature reviewed in Rosen (1992) suggests an elasticity of CEO pay with respect to sales of about 0.20 to 0.25 for firms in the West. This is comparable to our

OLS estimate, which is approximately 0.22 and significantly larger than the FE estimates in Table 3 and 4, ranging from 0.12 to 0.16. While CEO schooling is associated with lower wages, [10] CEO experience is associated with a wage premium. Notice, however, that our estimate of the effect of performance risk on the salary component of CEO compensation is positive but statistically insignificant (columns (5), (6), (8), and (9)).[11]

5. Pay-performance sensitivity and the marginal return to executive action

It is difficult to imagine a situation in which the marginal productivity of executive actions is empirically observable. Nonetheless, the CASS data set provides an opportunity for indirectly testing the proposition that the sensitivity of the CEO's pay increases with the marginal productivity of CEO actions. This stems from the fact that the data set tracked each enterprise over various stages of the implementation of China's industrial reforms. Many of the reform measures increased the autonomy and incentives of the enterprise and the control of its CEO over resources, and should therefore be expected to have raised the return to the CEO's action.[12] In particular, this should be the case with measures that increased the enterprise's autonomy in production decisions, raised worker incentives, or increased the enterprise's marginal profit retention rate. We expect each of these to have raised the sensitivity of CEO pay by increasing the value of the marginal productivity of the CEO. Let R be a vector of reform variables, each measuring the incidence of a reform measure. If R influences the marginal productivity of

[10] This should not be entirely unexpected since it is quite possible in the executive labor market that characteristics such as attitude to risk and unobservable abilities might dominate the effect of skills learned in schools on earnings.

[11] Aggarwal and Samwick (1999) argue; " The principal-agent model does not give an unambiguous prediction as to whether the expected *level* of compensation is increasing with the firm stock return variance."

[12] See Groves et al. (1994), Li (1997), Xu (2000), and Shirley and Xu (2001) for details of the effects of reform measures on productivity.

executive action then it should also influence a_0 in the approximation of b_1 in equation (2). If we assume that we can further approximate $a_0 \approx d_0 + \sum_{j=1}^{J} d_j R_j$, $j = 1,...,J$, substitution for a_0 in equation (2) leads to a series of interaction terms of reforms with y_{it}, the coefficients of which measure the effect of an individual reform on the performance sensitivity of CEO pay.

Among the variables we interact with enterprise performance in this way are "autonomy" , "profit retention", and "markup ratio" of Table 1. The first is a dummy variable which is equal to unity if the enterprise director had acquired autonomy in output, product variety, technology, scheduling, and export. The second is the marginal profit retention rate. The variable "markup ratio" is our measure of market power, the construction of which we discuss in the appendix. The index is reported to have decreased considerably over the decade.[13] This should have increased pay-performance sensitivity in so far as greater product-market competition could mean less noise in the measurement of firm performance in pay determination, or, in so far as it could mean higher marginal return to CEO efforts.[14] The variable "wage elasticity" is the elasticity of an enterprise's total wage bill with respect to operating profits as *ex ante* agreed to between the CEO and the supervising authority. It is used here as a proxy for the CEO's ability to motivate the enterprise's work force, with which we expect the CEO pay-performance sensitivity to increase. The variable "posting bond" is a dummy variable equal to unity if the CEO has made a security deposit as a performance guarantee. Unlike

[13] Li (1997) and Xu (2000) provide evidence that greater competition (as measured by lower markup ratio) was one of the major mechanisms thorough which the reforms of the 1980s increased factor productivity in China's SOE sector.

[14] As Holmstorm and Tirole (1989) note, greater competition means 'more information about the

"autonomy", "wage elasticity", or "the markup ratio," this variable may not influence the CEO's capacity to affect firm performance. Performance bonding can nonetheless reduce pay-performance sensitivity, in so far as it is a substitute to pay-for-performance as an incentive instrument. As alternative means of motivation, both pay-for-performance and bond posting expose the CEOs to greater income risk. Since the evolution of SOE reform measures in Chinese industry during the 1980s and the early 1990s is well documented in other studies (Groves et al., 1994, 1995; Li, 1997; Xu, 2000; and Shirley and Xu, 2001), it suffices to note here that there were large variation in the incidence or the timing of the measures across firms. We exploit this variation in Table 4 to assess the impact that the reforms had through their influence on the marginal productivity of CEO actions.

Although the coefficient of the autonomy dummy is not statistically significant in the table, we see that the sensitivity of pay to ROC is dramatically larger for enterprises with greater firm-level wage elasticity or higher marginal profit retention rates; this is true regardless of whether we control for firm fixed effects only or for CEO fixed effects as well. The finding is consistent with the notion that the reforms have increased the marginal productivity of CEOs, and with results in the literature on regulated industries in the West that CEO pay sensitivity tends to increase following industrial or firm-level de-regulation (Smith and Watts, 1992; Gaver and Gaver, 1993; Mehran, 1995; Joskow, Rose and Wolfram, 1996; Palia, 1998; Baker and Hall, 1998; Himmelberg, Hubbard, and Palia, 1999; and Core and Guay, 1999).

Table 4 also shows that pay-performance sensitivity is higher in firms facing greater product market competition as indicated by a lower markup ratio. This contrasts with, for example, Hubbard and Palia (1995), according to which the greater competition

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circumstances in which the manager operates' and, hence, 'a richer information base on which to write contracts.'

in banking that followed the lifting of restrictions on inter-state banking in the US did not affect the performance sensitivity of CEO pay even though it raised its level. Lastly , we see in Table 4 that pay-performance sensitivity is lower in firms that required CEOs to post performance bonds, suggesting that bonds substituted pay-performance sensitivity as an incentive instrument.

To get an idea of the magnitude of the combined effect of industrial reforms on the structure of CEO pay in China's SOEs, we note that the mean pay-performance sensitivity would be 0.24 in the absence of reforms if we assume sample median values for our measure of enterprise performance risk and for the markup ratio. Reforms significantly strengthen the pay-performance sensitivity. Raising the values of our indicators of the reforms, namely the incidence of autonomy, wage elasticity, and profit retention rate from the 10^{th} percentile to the 90^{th} percentile in each cases would increase pay-performance sensitivity to 1.32. At the same 90^{th} percentile values of reform indicators, the requirement of managerial bond would lower pay-performance sensitivity from 1.32 to 0.72. On the other hand, lowering the markup ratio from 90^{th} percentile to 10^{th} percentile would increase pay sensitivity by 0.83.

6. Some comparison with regulated industries in the U.S.

Any quantitative comparison of our results with those of the existing literature on North American or European corporations needs to be made with great caution. Ideally one would compare magnitudes of parameters of the structure of executive pay of Chinese SOEs with their counterparts in private firms within China, or of government owned businesses in the West, or of SOEs in emerging or transitional economies. Unfortunately, we are not aware of any comparable findings on managerial compensation in the private sector in China, and, with the exception of a single article that we have

come across as we write, on SOEs outside of China. And yet it seems important that we put our parameter estimates in some international perspective. It should be useful to know whether CEO pay schemes in China's SOEs provide a stronger or weaker incentive than those in practice elsewhere in the global economy.

Given the limitation that the existing empirical studies of executive compensation is confined to that on Western corporations, the natural comparison seems to be with compensation schemes in regulated industries of Western economies. Like Chinese SOEs, regulated firms also often operate in an environment of price caps, or output requirements, possibly combined with restrictions on the level or structure of managerial compensation. In this sense, they are a step closer to our subject than the conventional Western firm.

Unfortunately the scope for quantitative comparison even within this narrower category of firms is further restricted for a variety of reasons. One of these is that firm performance is measured in the larger part of the relevant literature in terms of growth in shareholder wealth or stock market rate of return rather than in terms of accounting rates of return, which are applicable to unlisted companies as well. The definition of CEO pay also often includes stock options that are not a mode of compensation in any of the SOEs in our sample. Then there is the added complication of the lack of standardization in econometric specifications, including the choice of function form and of controls.

With these limitations in mind, among all the studies of CEO compensation in the West we consider Joskow, Rose and Shepard (1993) as the most relevant and comparable to ours. In that study the authors compare CEO compensation in a sample of U.S. corporations in regulated industries with a sample from the non-regulated sector during the 1970s and 1980s. Among the specifications of the CEO wage equation that they estimate, the authors regress the logarithm of salary and bonus on the firm's accounting

rate of return, along with log sales, CEO characteristics, and indicators of regulation as controls to arrive at a semi-elasticity of pay (i.e., salary and bonus) with respect to accounting rate of return of 0.40 to 0.70 for unregulated industries as opposed to 0.20 to 0.70 for regulated industries. This figure is a great deal smaller than the 1.0 to 1.2 that was reported in Rosen's (1992) summary of earlier estimates,[15] but very much concurs with our estimate of 0.5 (Column 1 of Table 3). We may then conclude that CEO pay–performance sensitivity in China's SOEs in the 1980s was reasonably comparable to that of regulated industries in the US during the same period.[16] On the other hand, CEO pay in China's SOEs of the period seems to be far more sensitive to enterprise performance than similar pay in the SOE sector of at least one East European economy. Estimating a specifications similar to ours , Jones and Kato(1996) used a sample of Bulgarian SOEs observed during 1989-1992 to find that CEO salary (and bonus) bore no statistically significant relationship to enterprise profitability as defined in this paper, that is, as the ratio of profits over sales.

VI. Conclusion

This paper has analyzed panel data from a sample of Chinese SOEs in the 1980s in order to test the key implications of agency theory to managerial compensation. Controlling for CEO fixed effects and firm fixed effects, we find strong evidence in favor of an insurance versus incentives tradeoff in pay schemes: the CEOs compensation is less sensitive to enterprise profitability the more uncertain is the latter's magnitude. This is very much in line with the relevant literature on conventional firms in the West, and if

[15] When using stock market return, the number tends to be reduced by a factor of 10 (Rosen, 1992), a finding corroborated by Joskow and Rose (1994), and Joskow, Rose, and Shepard (199?).

[16] Since Joskow, Rose and Shepard use the OLS specification, we pick the OLS estimates of the pay semi-elasticity to accounting return (as proxied by our profitability measure). Notice, however, that Even our fixed effects estimate of the pay sensitivity is comparable to the low end of the regulated industries in the U.S.

anything, our estimates suggest a stronger role for risk considerations in pay determination in Chinese SOEs than that implied in this literature.[17] If we assume that the Chinese government had at its disposal a smaller range of incentive instruments for motivating CEOs than shareholders of Western corporations, the finding is then consistent with Prendergast's suggestion (Prendergast, 2000) that the negative correlation between performance risk and the intensity of incentives is likely to be greater when it is more difficult for the principal to use instruments (such as direct monitoring) as alternatives to payment for performance. We also find that the CEO pay-performance sensitivity increases with the marginal productivity of executive action, which seems to have increased significantly in China's SOEs following the introduction of a series of reforms. On the other hand, there seems to be very little evidence of relative performance evaluation in our compensation data. This too corroborates with the findings on corporations in the West. In assessing the strength of CEO incentives in Chinese SOEs relative to comparable institutions elsewhere, we find that pay-performance sensitivity in Chinese SOEs was of a similar order of magnitude as that found in some regulated industries in the U.S., which in turn is lower than that in unregulated firms. On the other hand, incentives in Chinese SOEs seemed to be far stronger than those of SOEs in Bulgaria, the only transitional economy on which we could find comparable evidence.

[17] See Prendergast (2000) for the latest summary and analysis of this literature.

Data Appendix

The data set we use is *A Survey of Chinese State Enterprises: 1980-1989*. It covers 769 SOEs in 21 cities of four provinces (Shanxi, Jilin, Jiangsu, and Sichuan). The 769 firms constitute a stratified random sample of all SOEs in manufacturing. The data set has two parts. Part one is a quantitative table filled out by the accountants of an enterprise. It includes 321 variables covering details about products, costs, wages and labor utilization, investment, financing, fixed assets, profit distribution, taxes, prices, and material inputs. Part two is a questionnaire answered by the manager of the enterprise. The manager answered questions about performance contracts signed with the government, the relationship between the enterprise and the government, production autonomy, the characteristics of the management, and so on.

Construction of The Markup Ratio. We follow Li (1997) in constructing the markup ratio (denoted as M_{it}). Specifically, $M_{it} = \sum_{j=1}^{4} D_{ij}\mu_j - \theta \sum_{s=t+1}^{89} C_{is}$, The first term on the right hand side is the industry-specific markup ratio (with the industries being the light, material, chemical and machine industries) in 1989. It is assumed that the markup ratios were identical in 1989 within an industry, but differed across the four. The second term was calculated by assuming that the change in markup ratio was proportional to the change in output prices relative to input prices ($C_{it} = \pi_{it} - \pi_{it}^{m}$, π_{it} being enterprise-specific inflation in market prices of output, and π_{it}^{m}, the enterprise-specific inflation in input prices). To see this, note that (see Li 1995) when P_{it}/MC_{it} and its lagged value are close to 1, $\frac{P_{it}}{MC_{it}} \approx \ln(\frac{P_{it}}{MC_{it}}) + 1$, which implies

$$\frac{P_{it}}{MC_{it}} - \frac{P_{it-1}}{MC_{it-1}} \approx \ln(\frac{P_{it}/MC_{it}}{P_{it-1}/MC_{it-1}}) = \ln(\frac{P_{it}}{P_{it-1}}) - \ln(\frac{MC_{it}}{MC_{it-1}}) \approx \frac{\Delta P_{it}}{P_{it-1}} - \frac{\Delta MC_{it}}{MC_{it-1}}$$

The first term of the last equation is output inflation rate, and the second term is proxied by the inflation rate for intermediate inputs. Thus, the markup ratio, though assumed to be a industry-specific constant in 1989, is allowed to vary across firms and over time between 1980 and 1988. Li (1997) estimated θ to be 0.158. In addition, μ_1 is normalized to be 1, μ_j for material, machine, and chemical industries are estimated to be 0.41, 0.35, and 0.48. These estimates are then used to compute M_{it}. It is important to note that the

μ_j's are identified only up to the proportion with respect to μ_1; thus, if the markup ratio is 1 for the industry with the smallest markup ratio, the markup ratios for the rest of the industries are (1/0.35) * μ_j, respectively.

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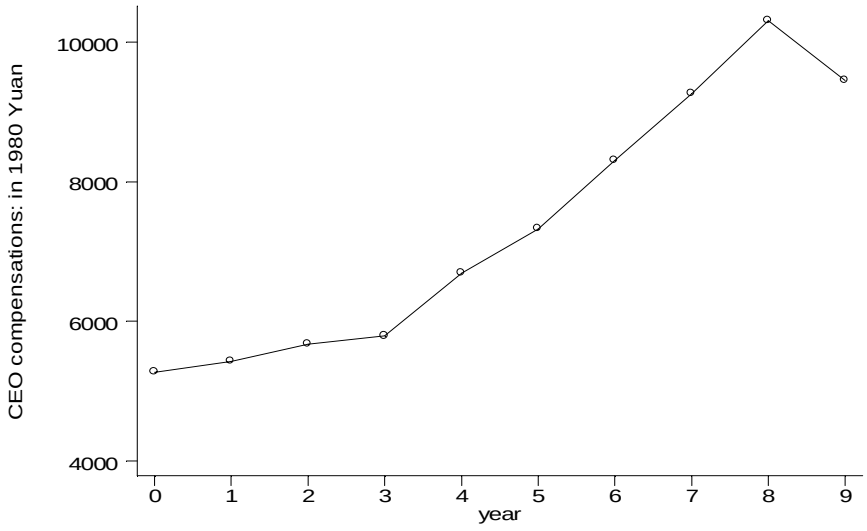

Figure 1. The Increase of CEO Compensation Over Time.

The average CEO compensation nearly doubled in the 1980s.

Table 1. Definition and Descriptive Statistics of Variables

Variable	*Obs*	*Mean* *(std. dev.)*	*Definition*
Ln(CEO Pay)	4067	8.3578 (1.0975)	The logarithm of annual CEO salary and bonuses (in *yuans*) at 1980 prices
Ln(profits)	3577	4.1920 (1.6524)	The logarithm of total profits (which is directly available from the data) in '0000 *yuans* at 1980 prices
Ln(sales)	4038	6.9030 (1.2300)	The logarithm of total sales in '0000 *yuans* at 1980 prices.
ROC	3990	0.0660 (0.1340)	The ratio of total profits to sales. Sales are directly from the data.
ROC_{ind}	4074	0.0734 (0.0413)	The industry-average of ROC, industry being the Chemical, Material, Light, and Machine industries.
σ^2_{roc}	1949	-6.6114 (1.6928)	The sample variance of ROC over years *t*-1 to year *t*-5.
$F(\sigma^2_{roc})$	1949	0.500 (0.287)	The percentile of σ^2_{roc}, bounded between 0 and 1.
Autonomy	4074	0.3471 (0.4761)	A dummy variable that is one if an observation on an enterprise was made after the enterprise director had acquired autonomy in output, product variety, technology, scheduling, and export.
Posting bond	3509	0.0775 (0.2674)	A dummy variable equal to one if the director posted a performance security deposit.
Profit retention rate	3040	0.1782 (0.2986)	The share of profit (above a pre-specified base amount) that the firm can retain for own use (and not remitting to the government).[18]
Wage elasticity	4074	0.0903 (0.2336)	The elasticity of the enterprises wage bill with respect to profits as specified in a performance contract *ex ante*. Equal to 0 when the firm does not have a contract. [19]
Markup ratio	3968	0.5982 (0.2672)	The ratio of price to marginal costs. The computing procedure was based on Li (1997) (see the data appendix).
Previous CEO	4614	0.252 (0.434)	A dummy variable that is one when the CEO during a particular year was not the CEO that responded in 1990 to the CASS questionnaire on CEO characteristics.
CEO schooling	4074	12.2562 (3.4293)	The number of years of schooling of the CEO.
CEO experience	3968	1.7742 (3.5961)	The number of years that the CEO had been director at some (though not necessarily the incumbent) firm.

[18] Since this variable has a significant amount of missing observations (60% of the total), to retain a reasonable sample and make the regressions with this variables to have similar observations to those without this variable, we replace the missing observations with province-year averages, and create a missing indicator for profit retention rate, which will capture the effects of imputation errors or other selection effects associated with the missing of profit retention rate.

[19] This variable also has some missing observations (2.4% of the total). For similar reasons as imputing profit retention rate, we replace the missing observations with province-year averages, and create a missing indicator for firm-level wage elasticity.

Table 2. Fixed-Effects Estimates of the Relative-Performance Models

Dependent Var. = ln(CEO Pay)

	(1)	(2)
	Firm fixed effects included	CEO fixed effects included
Year	0.038	0.045
	(9.01)***	(11.81)***
Ln(sales)	0.141	0.115
	(7.65)***	(6.19)***
ROC	0.186	0.077
	(2.54)**	(1.09)
ROC_{ind}	-0.235	0.066
	(1.33)	(0.40)
Previous CEO	-0.076	
	(0.89)	
CEO schooling	-0.002	
	(0.36)	
CEO experience	0.024	0.016
	(4.29)***	(3.16)***
Observations	3858	3858
R-squared	0.27	0.20
Number of cross-section unit	424	758

Note. *, **, and *** indicate significance at the 10, 5, and 1 percent levels. In parentheses are t-statistics. The coefficients for year and for the intercept are not reported.

Table 3. CEO compensation: risk-incentive tradeoff

	Ordinary least squares			firm fixed effects			CEO fixed effects		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Ln(Sales)	0.220	0.223	0.222	0.159	0.154	0.154	0.142	0.134	0.136
	(10.10)***	(10.11)***	(10.07)***	(5.42)***	(5.22)***	(5.24)***	(4.43)***	(4.18)***	(4.23)***
Previous CEO	0.007	-0.001	0.002	-0.335	-0.318	-0.318			
	(0.04)	(0.00)	(0.01)	(2.35)**	(2.23)**	(2.23)**			
CEO schooling	0.001	0.000	0.001	-0.024	-0.023	-0.023			
	(0.11)	(0.04)	(0.06)	(2.24)**	(2.16)**	(2.16)**			
CEO experience	-0.024	-0.024	-0.024	0.035	0.032	0.032	0.020	0.016	0.016
	(3.49)***	(3.49)***	(3.49)***	(2.54)**	(2.26)**	(2.27)**	(1.36)	(1.10)	(1.13)
ROC	0.495	0.555	0.492	0.313	-0.394	0.800	0.290	-0.464	0.766
	(2.00)**	(0.68)	(0.75)	(2.53)**	(1.26)	(3.18)***	(2.13)**	(1.38)	(2.90)***
$\ln(\sigma_r^2)$		0.015			0.007			0.003	
		(0.93)			(0.90)			(0.31)	
$ROC \times \ln(\sigma_r^2)$		0.008			-0.130			-0.138	
		(0.06)			(2.47)**			(2.48)**	
$F(\sigma_r^2)$			0.061			0.047			0.020
			(0.60)			(1.03)			(0.40)
$ROC \times F(\sigma_r^2)$			0.012			-0.700			-0.687
			(0.01)			(2.23)**			(2.08)**
Province dummies	yes	yes	yes						
Industry dummies	yes	yes	yes						
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	1884	1884	1884	1884	1884	1884	1884	1884	1884
R-squared	0.20	0.21	0.21						
Number of cross section units				416	416	416	574	574	574

Note. *, **, *** indicate significance at the 10, 5, and 1 percent levels. In parentheses are t-statistics. The intercept is not reported. Other controlled variables include year (to control for trend).

Table 4. CEO compensation and the marginal return of managerial efforts

	Firm fixed effects		CEO fixed effects	
	(1)	(2)	(3)	(4)
Ln(sales)	0.140	0.141	0.120	0.121
	(4.71)***	(4.74)***	(3.69)***	(3.74)***
Previous CEO	-0.330	-0.330		
	(2.31)**	(2.31)**		
CEO schooling	-0.023	-0.023		
	(2.12)**	(2.12)**		
CEO experiences	0.033	0.033	0.016	0.016
	(2.36)**	(2.37)**	(1.07)	(1.09)
ROC	-0.080	0.893	0.120	1.082
	(0.20)	(2.15)**	(0.26)	(2.39)**
$\ln(\sigma_r^2)$	0.004		-0.000	
	(0.55)		(0.00)	
ROC × $\ln(\sigma_r^2)$	-0.113		-0.115	
	(2.06)**		(1.97)**	
$F(\sigma_r^2)$		0.028		0.001
		(0.63)		(0.02)
ROC × $F(\sigma_r^2)$		-0.555		-0.525
		(1.72)*		(1.54)
ROC × autonomy	0.214	0.191	0.011	-0.018
	(1.05)	(0.94)	(0.04)	(0.07)
ROC × wage elasticity	0.986	1.011	0.934	0.982
	(2.14)**	(2.20)**	(1.85)*	(1.94)*
ROC × profit retention	1.024	1.054	1.246	1.278
	(1.95)*	(2.01)**	(2.16)**	(2.22)**
ROC × posting bond	-0.563	-0.584	-0.568	-0.596
	(1.61)	(1.67)*	(1.49)	(1.56)
ROC × markup ratio	-1.147	-1.087	-1.305	-1.244
	(2.20)**	(2.10)**	(2.31)**	(2.21)**
Autonomy	-0.052	-0.050	-0.009	-0.007
	(1.66)*	(1.61)	(0.22)	(0.16)
Wage elasticity	-0.010	-0.011	0.012	0.009
	(0.19)	(0.20)	(0.18)	(0.14)
Profit retention	0.072	0.071	0.048	0.046
	(0.92)	(0.90)	(0.51)	(0.49)
Posting bond	-0.024	-0.022	-0.014	-0.012
	(0.66)	(0.60)	(0.33)	(0.27)
Markup ratio	-0.041	-0.047	-0.100	-0.104
	(0.19)	(0.22)	(0.44)	(0.45)
Observations	1884	1884	1884	1884
Number of cross section units	416	416	574	574

Note. *, **, *** indicate significance at the 10, 5, and 1 percent levels. In parentheses are t-statistics. Unreported are the coefficients for the intercept, year, the missing dummies for firm level wage elasticity and for marginal retention rates, and the interaction of the dummies with ROC.