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# *Agency Theory and the Chinese Enterprise Under Reform*

Jon Cauley[#] and Todd Sandler[*]



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# *Agency Theory and the Chinese Enterprise Under Reform*


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This paper investigates structural wage reform pertaining to medium and large state-owned enterprises, within the context of the 1988 Enterprise Law. Evidence exists that this reform package failed to achieve its full potential. A primary purpose of the paper is to analyze this failure with the aid of principal-agent analysis, in which the manager is the principal and the workers are the agents. The analysis suggests that the reforms performed poorly since the workers' incentive problem was not adequately addressed. Much of the bonuses became fixed wage supplements, not tied to the output or profit of the enterprise. Moreover, free-riding incentives among workers were not adequately addressed. Multilevel concerns and the formation of coalitions among workers and supervisors are also analyzed. Means for making the reforms more effective are suggested. For example, rule governance can dilute collusion.

Since 1978, and as late as the winter of 1989, China's market-oriented reform policies have been heralded with unprecedented optimism. Some have even speculated that Gorbachev's perestroika was inspired by the economic success engendered by the post-Mao Chinese economy, while others have intimated that China would possess the world's second largest economy by 2010.[1] In the wake of the latest Tiananmen Square incident, the new central party leadership temporarily placed the expansion of economic reform on the "back burner."[2] Hence, this may be an appropriate time for analyzing and evaluating the reforms as they have currently evolved.[3]

This paper intends to investigate structural wage reform pertaining to medium and large state-owned enterprises,[4] within the context of the 1988 Enterprise Law. Evidence exists that the reform package embodied in this 1988 law failed to achieve its full potential (Lee, 1990). A primary purpose here is to analyze the failure of this reform package with the aid of principal-agent analysis. The principal-agent model is not intended here to describe existing Chinese enterprises, but is employed to explain how and why the reform package failed. In light of this analysis, we offer some specific and feasible suggestions that may enhance the future success of the 1988 Enterprise Law. The establishment of property rights is a necessary condition for the functioning of markets where prices and profits signal scarcity. For reforms to work in a centralized economy, property rights must be defined both within and outside of the firm. Without these property rights, people do not have the proper incentives to work hard, since they cannot use the fruits of their labor to buy goods and services that they want. The 1988 reform package was an attempt by the authorities to spell out a standard set of property rights within the enterprise so that reforms could be more generally implemented. The authorities certainly felt that a clearer specification of

property rights within the enterprise would increase the likelihood of successful reforms. The fact that ambiguity in property rights persisted due to weak enforcement and other considerations was the central reason that the package failed. For example, the 1988 law, in principle, placed responsibility for profits and losses of the enterprise with the manager; however, managers continued to complain about bureaucratic interference.

The remainder of the paper consists of five primary sections. Section 1 considers preliminaries including a description of enterprise reforms known as the CMI model. The second section sketches a simple principal-agent model with many agents and develops six propositions. Section 3 utilizes the theoretical development to analyze medium and large state-owned Chinese enterprises under the CMI reform package. Section 4 offers possible solutions to the problems that are plaguing the reform package, and Section 5 puts forth conclusions and directions for future research.

## 1. PRELIMINARIES

### The Principal and the Agent in the Chinese Enterprise

There are a number of ways to characterize the principal-agent problem with respect to the Chinese economic system. The appropriate characterization depends upon the purpose of the researcher and whether viable insights can be garnered. In the basic model of decision theory, the decision maker bears all of the consequences of his/her decisions. This assumption is unlikely to be realistic. As Firchau (1987, p. 81) points out, ". . . in agency theory the identity between the decision maker (the agent) and the usufructuary of the decision (the principal) is abolished." An apt example is the manager of the firm or enterprise as the principal and a subordinate(s) as agent (e.g.,

worker(s)).

The focus here will be on this particular specification of the principal-agent problem as it pertains to those medium and large Chinese enterprises that have been subjected to economic reforms by the authorities. The fundamental rationale for this focus is that, in recent enterprise reforms, the state has selected the manager as its instrumental player in the state-owned Chinese enterprise.[5] Prior to the reforms initiated in 1978, the central leadership of the Communist Party assumed the risk associated with production and investment.[6] With the ensuing reforms, the central party leadership intended to place more of the risk for running the enterprise on the managers by giving them a somewhat greater role in distributing the net gains (if any) or "profits" to their workers (Levy et al., 1988, p. 83). Managers could attempt to motivate workers by assigning them a share in these net gains, as in a principal-agent scenario. Under the reforms, the central party leadership stipulated a novel environment or regime within which the newly appointed principal was to interact with the agents (Schenk, 1988, ch. 2).

## The CMI Model

One of the latest innovations in this regime was the 1988 comprehensive reform package, known as the CMI model.[7] These reforms were essentially developed to specify property rights within the enterprise by formalizing a nexus of contracts that would provide a basis for more effective enforcement (e.g., contracts were drawn up and publicly notarized). The CMI reform package consists of three ingredients: the contract management system (CMS), the managerial responsibility system (MRS), and the internal contract system

(ICS). The acronym, CMI, is constructed by taking the first initial of the main word which describes each of the three components.

Under the CMS, the manager of a state-owned enterprise signs a contract with the relevant state organ (e.g., a municipal government). The contract stipulates that the manager has the right to manage the means of production, and is responsible for the enterprise's profits and losses. Moreover, the manager acquires some power over the use of retained enterprise profits. The managerial responsibility system (MRS) was ideally designed to reduce the party's role and to empower the manager to determine wages, bonus policies, and other critical economic matters. Bureaucratic constraints, however, limited managers' autonomy. Nevertheless, MRS provided the managers somewhat greater powers.

The internal contract system (ICS) is the final component of the CMI reform bundle and completes the nexus of contracts within which the enterprise manager operates. There are at least four interfaces in the ICS. At the peak of the hierarchy is the plant manager (director) who, as previously mentioned, possesses a contract with the state. The second level of the ICS hierarchy consists of contracts between the manager and middle-level managers, while the third level contains contracts between the managers and sub-divisions, headed by division directors.[8] The subdivisions are divided into various categories depending upon the type of outputs and/or inputs. At the bottom of the hierarchy lie the team or group leaders who are responsible for many decisions, critical to the workers. For instance, group leaders assign work, distribute bonus pay, perform job evaluations, and relay and evaluate many fringe benefit requests to the shop or division director. Division directors typically base their decisions on the group leader's recommendation (Walder,

1986, pp. 103-106).

The basic mechanism of the ICS is to assign the target levels (e.g., profit or output), associated with the state contract, among the divisions so that each is accountable for a portion of this target. The divisions then perform accounting and economic calculations designed to foster an internal consistency between targets assigned to each division. Since each division may depend on others for inputs or outputs, internal consistency must be addressed when targets are apportioned between divisions. Additionally, Lee (1990, p. 389) points out that, ". . . the strength of the ICS comes from motivating top and middle managers (division heads)." This motivation derives from the bonuses of top, middle-level managers and division directors that are based on the fulfillment of the main contracts with the state. Their bonuses are not based on division targets. In contrast, the manager releases bonus funds to the divisions (i.e., division directors) when division targets are fulfilled. We note, however, that division targets are set low and are easily fulfilled. If targets are overfilled, then additional funds are released.

Presumably, one of the major purposes of the ICS arrangement was to engender cooperation, coordination and communication among the top and middle-level managers in fulfilling main contracts with the state, since their bonuses are predicated upon meeting these contracts. A second and perhaps more important purpose of the ICS was ". . . , to create a more effective internal incentive system," (Lee, 1990, p. 389) in response to the fact that bonuses had become general wage supplements in Chinese state enterprises.

## 2. A SIMPLE L.E.N. AGENCY MODEL WITH MULTIPLE AGENTS

In recent years, economists (see, e.g., Ross 1973; Stiglitz, 1974;

MacDonald, 1984) have developed agency theory to design an optimal contractual arrangement between a principal (e.g., a manager) and an agent (e.g., a worker) when asymmetric information prevails. In particular, a principal can view the final outcome, in terms of output or profit, of an agent's action or effort, but is unable to observe the agent's actual action. This situation would arise when an exogenous risk factor intervenes in the output or profit process, so that the agent's effort is no longer uniquely associated with each outcome. Instead, a distribution of outcomes is associated with each effort level. Information is asymmetric since the agent, unlike the principal, knows his/her true effort. This asymmetric information leads to a moral hazard problem, inasmuch as the agent may use the principal's ignorance as an excuse to supply suboptimal levels of effort. Agent-principal difficulties can be overcome if the principal can design a contract or payment schedule that induces the agent to supply a first-best effort level. An entire schedule relating effort to payment must be chosen to maximize the principal's welfare subject to incentive-compatible and individually rational constraints. Such contracts often involve the sharing of risk between the principal and the agent, unless the latter is extremely risk averse. If a first-best result cannot be achieved by the contract, then agency costs arise in terms of losses associated with second-best contracts.

Although there are many general representations for the agent-principal problem, the analysis is sufficiently complex for even single-agent, single-principal problems to preclude exact or closed-formed solutions for the optimal payment schedule. Unlike the standard optimization problem in which a scalar value is chosen for a single level, principal-agent analysis involves the choice of an entire function (i.e., a payment schedule) for a multi-level

problem. At least two levels are required, since optimizing the principal's welfare must be consistent with the first level involving the agent's welfare maximization. MacDonald (1984) indicates that the set of feasible payment schedules must be limited, the type of uncertainty must be specified, and the utility functions of the agent and principal must be specified if concrete results are to be derived. We follow MacDonald's (1984) advice and extend the so-called Linear-Exponential-Normal (LEN) model, presented by Spremann (1987), to a situation with a single principal but many agents.

## Assumptions of the LEN Model

In the LEN model, the payment schedule and the output function are linear. The principal's gross (random) wealth is a linear function of the agent's total effort, x, and the exogenous risk, $\tilde{\theta}$:

$$\tilde{y} = x + \tilde{\theta}, \tag{1}$$

in which an overhead tilde denotes a random variable. Since $\tilde{\theta}$ is an additive random factor, $\tilde{y}$ is random. The principal's gross wealth may stand for profit or output. If prices are normalized to equal one, then there is no difference between profit and output in a perfectly competitive market as assumed here. Since we assume n agents, x depicts the sum of efforts of the agents; that is,

$$\begin{aligned} x &= \sum_{i=1}^{n} x_i \\ &= x_i + X_{-i}, \end{aligned} \tag{2}$$

in which $X_{-i}$ is the effort of agents other than agent i (i.e., $X_{-i} = \sum_{j \neq i} x_j$). The payment schedule for each agent is also linear:

$$p(y) = r/n + (s/n)y. \tag{3}$$

In (3), each agent receives a fixed payment or rent equal to r/n and a share s/n of the realized output, y.

For simplicity, we assume that all agents are identical in terms of their ability; hence, the equal sharing assumption is appropriate. A nonzero s implies that the agents share in the outcome. When $0 < s < 1$, both the agents and the principal have a stake in the outcome. Each agent can vary his effort $x_i$ between 0 and 1/2 so that $x_i \in [0, 1/2]$. Agents are assumed to be risk averse, while the principal is risk neutral. The risk neutrality of the principal facilitates greatly the derivation of a closed-form solution. In essence, the crucial assumption is that the principal is less risk averse than the agent. This assumption may well characterize modern-day managers in China. The agents possess an exponential utility function,

$$U_i = -\exp(-\alpha w_i), \qquad \alpha > 0 \tag{4}$$

in which $w_i$ denotes the ith agent's wealth or income. Utility function (4) denotes constant absolute risk aversion, since $\alpha = -U_i''/U_i'$ where primes stand for derivatives. The agent's wealth depends on the payment schedule and the disutility of effort. To preserve the strict concavity of the agent's utility function, the disutility of effort is assumed to be a quadratic function ($x_i^2$). Thus, the agent's random wealth is

$$\tilde{w} = r/n + (s/n)(x + \tilde{\theta}) - x_i^2 \tag{5}$$

or

$$\tilde{w} = r/n + (s/n)(x_i + X_{-i} + \tilde{\theta}) - x_i^2. \tag{5'}$$

Equation (5') makes clear that each agent's wealth ultimately depends on his own effort and that of the rest of the agents. In a Nash equilibrium, each worker chooses the optimizing $x_i$ in response to the best response for $X_{-i}$. Since the principal is risk neutral, his utility function $V(\bullet)$ is a linear

function of wealth.

The last assumption of the LEN model concerns the random factor associated with the agent team's output. In particular, $\tilde{\theta}$ is assumed normally distributed with a zero mean and $\text{var}(\tilde{\theta}) = \sigma^2$.

## Formal Analysis and Propositions

In a two-tier hierarchy, the LEN model can be solved to determine the n agents' optimizing effort level, $x_i^*$, the optimizing components ($r^*$, $s^*$) of the payment schedule, and the maximizing utility of the principal, $V^*$. This is accomplished in a number of steps: (i) the agents' utilities are maximized to determine the agents' response to the payment scheme; (ii) the agents' willingness to accept a payment scheme must be ascertained with respect to a reservation utility level; and (iii) the principal's utility must be maximized so as to determine the $s^*$, consistent with the agents' constraints derived in (i) and (ii). The constraint implied by (i) is known as incentive compatibility, while that of (ii) is known as individual rationality.

We now consider these steps explicitly in order to derive some propositions, relevant to evaluating recent attempts to reform medium-to-large sized enterprises in China. Following standard procedures,[9] we first express the ith agent's certainty equivalent utility associated with both the wealth level in (5) and the constant absolute risk aversion utility function in (4). Thus, we get

$$U_i(x, x_i, r, s) = r/n + xs/n - x_i^2 - \alpha s^2\sigma^2/(2n^2). \qquad (6)$$

In (6), the last right-hand side term is the risk premium that must be paid to risk averse agents, as assumed here, to induce them to share risk for $s \in [0, 1]$. If n were equal to 1, then this premium would equal $-\alpha s^2\sigma^2/2$. When

multiple agents are involved, the risk premium falls. This influence is termed to be risk spreading (Layard and Walters 1978, pp. 362-363) since the fixed risk $\sigma^2$ for the activity is shared among a number of agents. For a fixed n, an increase in the share parameter augments an agent's income and induces him to work harder; but it also decreases his well-being owing to risk. For each i, $U_i(\bullet)$ in (6) is maximized subject to the best response of $X_{-i}$ (i.e., the Nash assumption). Optimal effort from the agent's viewpoint results at

$$s/n - 2x_i = 0 \qquad i = 1,\ldots, n, \tag{7}$$

or

$$x_i^* = s/2n \qquad i = 1,\ldots, n. \tag{7'}$$

The effort levels consistent with (7') denote a Nash equilibrium and, owing to a free-rider problem common in teams, do not constitute a Pareto-optimum level of individual effort (Holmstrom, 1982; Rasmussen, 1987). The Pareto-optimum level is found as follows:

$$\max_{x_i} \sum_i U_i(\bullet) = r + sx - \sum_i x_i^2 - \alpha s^2\sigma^2/2. \tag{8}$$

The first-order conditions for (8) implies

$$x_i^* = s/2 \qquad i = 1,\ldots, n. \tag{9}$$

Thus, team or multiple agent contracts, common in Chinese firms, are a double-edged sword: (1) team contracts spread risk, thereby reducing risk premiums, and (2) team contracts reduce workers' optimizing efforts owing to free riding. The first factor makes the principal more willing to share risk (Proposition 3 below), while the second reduces output and payoffs. Free riding takes place since the principal cannot monitor individual effort levels--only the team output is observable. Hence, a shirker loses pay equal to only 1/n of his reduced effort, but gains in the efforts of others.

The following two propositions are immediate from (7′) and (9):

Proposition 1: Fixed rent payment schemes do not motivate workers. Regardless of the size of the agents' team, workers' effort is minimal if s = 0.

Proposition 2: For a linear payment scheme, individual effort decreases in proportion to the team size. The larger the team, the more inefficient individual effort owing to free-rider considerations.

Proposition 1, which follows from (7′), cautions us that agent effort is minimal ($x_i^* = 0$), unless rewards are based, in part, on the output or outcome. Wage supplements that do not depend on performance measures, such as fixed rent payment schemes, cannot motivate. If a firm makes zero profit, as is the case for some Chinese firms, then s is effectively zero and worker effort will be minimal. Proposition 2, which follows from a comparison of (7′) and (9), indicates the well-known free-rider suboptimality. If sharing rules were tied to the achievement of a Pareto-optimizing output level so that the existence of even a single shirker would cause all to suffer, then the free-rider problem could be overcome (Holmstrom, 1982, p. 327). Such schemes are not linear and may not be acceptable to workers who might need some assurance that their hard work will have some reward regardless of the other guy's action.

To determine the individual rationality constraint, each agent's reservation utility constraint,

$$U_i(x, x_i, r, s) \geq m, \tag{10}$$

must be satisfied. In (10), m denotes the lowest welfare level, acceptable to the agent under the terms of the contract. As such, m could refer to an opportunity cost or a minimal subsistence level. When, for an interior solution, (10) is evaluated at $x_i^* = s/2n$ and $x^* = s/2$, we get

$$\frac{r}{n} + \frac{s^2}{4n^2}(2n - 1 - 2\alpha\sigma^2) = m, \tag{11}$$

which implies that

$$r = mn - \frac{s^2}{4n}(2n - 1 - 2\alpha\sigma^2). \tag{12}$$

From (12), we see that the fixed fee and the share are inversely related only when $2\alpha\sigma^2 < 2n - 1$. Hence, a higher fixed fee may be needed to compensate an agent for sharing greater risk only when the exogenous risk and/or the agent's risk aversion is sufficiently great. An increase in team size increases, ceteris paribus, the likelihood that r and s are inversely, rather than directly, related.

The third issue or step concerns the payment scheme that maximizes thee principal's wealth subject to (7') and (12). Since the principal is the residual claimant to the output (profit) after the agents are paid, his utility is

$$V(x, r, s) = (1 - s)x - r, \tag{13}$$

which is linear owing to risk neutrality. The optimizing $s^*$ in the payment scheme is determined by

$$\max_s V(x^*, r, s)$$

subject to $U_i(x^*, x_i^*, r, s) \geq m$ for every i,

where $x_i^*$ satisfies (7'). This problem is equivalent to

$$\max_{s} \{(1 - s)\frac{s}{2} - [mn - \frac{s^2}{4n}(2n - 1 - 2\alpha\sigma^2)]\}, \tag{14}$$

when (7') and (12) are substituted into (13). The first-order condition, associated with (14), can be simplified to

$$s_m^* = \frac{n}{1 + 2\alpha\sigma^2}, \tag{15}$$

in which $s_m^*$ denotes the optimal sharing rule for a reservation utility level of m.

The following proposition follows from partially differentiating (15) with respect to n.

Proposition 3: An increase in team size increases the principal's choice of the share parameter in the linear payment scheme.

This result follows from the reduced risk premium demanded by the agents, which, in turn, makes risk sharing more attractive to the principal as agent group size increases. Since team size is expected to be large in Chinese enterprises, Proposition 3 implies that risk sharing with the agents (i.e., a nonzero s in the payment scheme) is desirable.

The optimal fixed fee is found by substituting $s_m^*$ for s in (12) to give

$$r_m^* = mn - \frac{(2n - 1 - 2\alpha\sigma^2)n}{4(1 + 2\alpha\sigma^2)^2} \tag{16}$$

Induced effort equals $x_{im}^{*'} = s_m^*/2n$, which could be expressed in terms of n, $\alpha$, and $\sigma^2$. Finally, the principal's utility for the payment scheme $(r_m^*, s_m^*)$ is

$$V^{*} = \frac{n}{4(1 + 2\alpha\sigma^{2})} - mn. \tag{17}$$

Equation (17) implies:

Proposition 4: For a given number of workers, the principal prefers less risk averse agents.

## Agency Cost

Agency cost emerges from the reduced efficiency attributable to the payment scheme $(r_m^*, s_m^*)$ as compared with a "first-best" effort level for a given n. In essence, agency cost, $AC_m$, equals

$$AC_m = V(x_m^o, p_m^o) - V(x_m^*, p_m^*), \tag{18}$$

in which V denotes the principal's utility. In (18), $V(x_m^o, p_m^o)$ denotes the principal's payment for $x_i^* = s/2n$, since n agents are involved. Hence, for $n > 1$, true first-best results are not forthcoming owing to free-riding. Given this consideration, the best that the principal can receive is

$$V(x_m^o, p_m^o) = n/4 - mn, \tag{19}$$

which corresponds to an agent's maximal effort level of $x_i = 1/2n$ when $s = 1$. If n were 1, then $V(x_m^o, p_m^o)$ would equal $1/4 - m$, and would constitute a first best. Efficiency losses are calculated in (18) for the optimal contract when free riding losses characterize both comparison utility levels for the principal. When (18) is computed for (19) and (17), we get

$$AC_m = \frac{n\alpha\sigma^{2}}{2(1 + 2\alpha\sigma^{2})}. \tag{20}$$

Since $AC_m$ in (20) is zero when $\alpha$ or $\sigma^2$ is zero, the following proposition holds:

Proposition 5: The unobservability of the agents' effort or their risk aversion precludes nonzero agency cost.

If n = 1, then the same two influences would inhibit first-best outcomes. Equation (20) also implies

Proposition 6: For a given number of workers, agency cost increases with an increase in risk aversion and/or risk. Agency cost also increases with n.

## Multi-Level Structures

Most large-scaled enterprises may consist of more than two layers. For instance, a firm might have a manager, a supervisor, and agent level. Many scenarios are possible even in the three-level structure. A typical case gives the supervisor greater information-gathering abilities than the principal. In particular, the supervisor may or may not observe the random factor, $\theta$; hence, the supervisor may or may not know the agent's true effort. If, in the absence of coalitions, the supervisor is risk neutral and has a fixed wage, then the previous analysis (with one small exception) applies, since the supervisor would have no reason to withhold information in that his payment cannot be increased by such dissembling (Tirole, 1986, pp. 190-91). The small exception involves the principal's wealth which is reduced by the supervisor's fixed fee. If, however, the supervisor can form a coalition with

the agent(s), then the supervisor's wealth would also depend on the agents' side payment, which, in turn, hinges on the outcome and the supervisor's report (Tirole, 1986, pp. 192-97). If, for example, a good state of nature results, the agent might be able to bribe the supervisor not to reveal this information. A supervisor's failure to reveal good states, when observed, augments the agent's utility since it allows the agents to get by with less effort. In fact, the coalition might operate so as to maximize the sum of the payment to the agents and supervisor.

With the formation of a coalition, a coalition incentive compatibility constraint can further restrict the feasible space, thereby reducing the principal's wealth. In summary, multiple levels may be plagued with agency costs (i.e., departures from first best) owing to coalitions, even when intervening supervisory levels have more information than the principal. In the Chinese enterprise, a supervisory level intervenes between the manager and the workers. Coalitions between the supervisory and agent level may form inasmuch as both parties may gain at the principal's expense from such arrangements.

## 3. INSTITUTIONAL ANALYSIS

### Development of Chinese Egalitarianism

In an attempt to increase labor productivity, the Chinese in 1978 revived bonus systems in accordance with the principle of "distribution according to work." This reform was intended to increase worker incentives by linking job performance with remuneration, in much the same way as a free market. The wage was to consist of not more than four components: basic wage, function wage, seniority wage, and floating wage (Krozec, 1988, p. 12). The basic wage is a baseline payment meant to meet subsistence; the function

wage is a fixed payment related to job difficulty and skill requirements; and the seniority wage is a payment for the number of years of service. All three components are independent of output (and effort) and, hence, constitute a rent component equivalent to r in the linear payment schedule. Only the floating wage[10] is related to output and, hence, corresponds to s(y) in the payment schedule.

With the 1988 CMI reforms, when a division achieves a predetermined quota, the manager releases bonus funds to the shop director or section chief for distribution. In an ideal situation, the shop director disperses the bonuses, based on the recommendation of the group leader, according to individual worker output (effort) (e.g., on a piece-rate basis). Thus, the bonuses were intended to be paid as the s(y) component. Since quotas were set so low as not, in practice, to be binding, a linear payment schedule, as presented in Section 2, is an apt characterization of the payment scheme intended by the 1988 CMI reforms.

What happened in practice was, however, very different from this ideal case. In many instances, an unambiguous and specific criterion for determining bonuses was never developed and workers became contentious. Individual performance was evaluated in the work group by dividing up the group's monthly output target and allocating portions to individual workers. In particular, Walder (1987, p. 27) states that, ". . . the common method used to assess workers, . . . , are face-to-face group discussions in which vague criteria are applied." In the final analysis, bonuses often depended upon the shop director's discretion and were used to reward friendships and other nonwork related matters (Walder, 1986, p. 237).

Another potential source of worker contentiousness lies in the

autocratic nature of the Chinese labor market and the high Chinese worker risk aversion. As such, the manager prefers less risk averse workers (Proposition 4). Workers are not free to change jobs, since ninety percent of the workers in state-owned enterprises have fixed, permanent job tenures (Lee, 1990, p. 388). In consequence, the workers must accept an assigned bonus share. This same sort of phenomenon also could have taken place with regard to the fixed portion of the wage. When workers were assigned bonus monies in an arbitrary and capricious manner, or were "forced" to accept a share beneath their risk premium, and/or were forced to accept a fixed fee inconsistent with their reservation utility level, they became contentious and disrupted the production process by striking or even engaging in riots.

Shop directors, working in conjunction with group leaders and striving to obtain production stability, frequently avoided these potential disruptions by paying out bonuses equally and either failing to set viable individual quotas, or disregarding them. Hence, a worker-supervisor coalition developed, as is common in multilevel enterprises, characterized by multiple agent-principal relationships. In the final analysis, the evidence suggests that the worst case scenario developed and all components of the Chinese wage became embedded in r and minimal worker effort was generated (Proposition 1). The process by which the bonus degenerated into a general wage supplement is referred to as egalitarianism (Walder 1987, p. 29).

## The Chinese Manager, Agency Cost, and Collusion

The unobservability of the agent's effort, Chinese worker's risk aversion, and uncertainty preclude nonzero agency costs and therefore first-best outcomes in the Chinese enterprise (Propositions 5 and 6). Moreover,

there are reasons to believe that agency costs are high owing to an unusually large variance ($\sigma^2$) in exogenous risk ($\theta$), associated with the Chinese enterprise in the wake of reforms. An additional factor contributing to high agency costs is the high degree of risk aversion ($\alpha$) possessed by the typical Chinese worker.

Many factors may contribute to the exogenous risk facing the Chinese enterprise. Medium and large-scaled firms require hundreds or even thousands of inputs to produce. In this respect, Tang (1987, pp. 210-236) and others have pointed to "systematic" shortcomings in the Chinese planning and supply systems that lead to a variability in the gross profits of enterprises.

First, administrative allocation of resources deals in broad aggregates, but enterprises commonly require inputs with particular specifications. In consequence, inputs may be sent out without reference to specialized requirements, and "chance" would then determine whether a match occurs. Second, poor coordination in the supply of broad aggregated inputs may result in insufficient quantities being supplied at a given time and place. Third, inputs may not appear at all owing to altered transportation constraints or failure. Fourth, input deliveries may be random owing to the presence of multiple leadership and ministerial and regional lines of authority that cut across one another (see Tidrick 1987, pp. 180-182, 197; Tang 1987, pp. 210-236). Two additional factors are worker absenteeism and machine failure. Although these would probably apply to most enterprises or firms wherever located, in China these factors may be of more concern. In socialist systems where most workers enjoy lifetime employment and rarely bear the consequences of worker-related mistakes, incentives to handle and operate machinery carefully are minimal. Permanent employment is also typically associated with

relatively high levels of absenteeism.

From the manager's perspective, the phenomena that produce these fluctuations in gross profit are exogenously generated by a random process or variable ($\theta$). Top-level management in a large enterprise is "too" distant from the actual production process to distinguish between workers' effort and exogenous factors in the distribution system that lead to output fluctuations. From the workers' perspective, gross profit or output variability arises from random factors beyond their control.

The second factor contributing to high agency cost is the apparent high degree of risk aversion ($\alpha$) possessed by many Chinese workers in their post-1949 economic system. If workers hold extremely risk averse attitudes, workers will not agree to share risk, as required for $s \neq 0$, unless a risk premium is paid. There have been many reports that suggest this risk aversion on behalf of Chinese workers; see Leung (1989) for examples.

High exogenous risk and worker risk aversion in the Chinese enterprise imply high agency cost (or utility losses) for the manager. Moreover, management discretion is severely restricted, since the manager cannot hire or fire workers (Lee, 1990, p. 6). Insofar as the manager's bonus and his/her job depend upon meeting and/or exceeding quotas contracted for with the state under the CMS, the manager is motivated to make some accommodation with the agents.

The manager knows of the worker-supervisor coalition and has two short-run strategies: (1) work to enforce strictly the provisions of the ICS by keeping its incentive mechanism in tact, or (2) collude tacitly with the worker-supervisor coalition by allowing it to exist. As Walder (1987, p. 33) observes regarding the latter, "Lest management forget this congenial strategy

and tread on worker interests by cutting bonuses or raising quotas, workers are prepared to become uncooperative." In fact, the manager did strike a tacit agreement with the worker-supervisor coalition, a phenomenon that Lee (1990, p. 389) refers to as lower-tier collusion. The manager then encouraged worker cooperation by attempting to obtain as much bonus monies as possible and to release it to the worker-supervisor coalition. These bonus monies are obtained by managers from bargains struck with the relevant and sympathetic local state organ for retained profit. A local state organ may be sympathetic since it receives a portion of the enterprise's profits, not released to the central authorities or retained by the enterprise. Responsibility for the success of the enterprise rests with the local state organ. As a quid pro quo, the local state organ "protects" the enterprise under its auspices. In return, the manager is expected to elicit worker effort so that quotas are met or exceeded (see Walder, 1987, pp. 32-33 for particulars). This phenomenon is referred to as upper-tier collusion by Lee (1990, p. 388).

When the worker-supervisor coalition formed and the bonus turned into a general wage supplement, an incentive was created for the manager to engage in collusion at the lower and upper tiers of the enterprise hierarchy, because the manager lost his/her ability to discipline the workers so as to maintain production stability. For the economy as a whole, the intended link between enterprise performance (i.e., efficiency) and worker compensation under the "principle of distribution according to work," was broken.[11] The basic tenet of agency theory became inoperable.

## Risk Aversion, Uncertainty, and Team Size

Walder (1986, p. 95) remarks that the lowest unit in the enterprise

hierarchy is led by a team or group leader, and that production groups usually number no more than a dozen workers. For linear payment schemes in the extended LEN model, individual effort decreases, ceteris paribus, in proportion to team size. The larger the team, the more inefficient individual effort owing to the free-rider problem (Proposition 2). With a team size of twelve or less and an output-based incentive bonus, it would seem that free-riding could be kept in check depending upon the specific production technology and the nature of the output. In the current Chinese enterprise, however, the advantage of small group size and whether or not individual or group performance provides the basis for rewards is moot, since the incentive bonus has degenerated into a general wage supplement.

Although greater group size induces more risk sharing between agent and principal (Proposition 3) owing to reduced risk premiums, agency costs nevertheless increase (Proposition 6) owing to free riding. Thus, an increase in group size works in favor of an incentive payment based on output by increasing the optimizing share proportion; however, efficiency losses increase with team size owing to the free-rider problem. This suggests that nonlinear payment schemes that punish a team unless stated (and reasonable) output levels are achieved may be the best solution for the Chinese enterprise with its multiagent teams.

## 4. SUMMARY AND SOLUTIONS

### The CMI and Egalitarianism

Why did the CMI fail to correct egalitarianism? The internal contract system (ICS), as part of the CMI reform package, "was introduced to create a more effective internal incentive system" (Lee 1990, p. 389). This more

effective system was designed to increase economic efficiency by eliminating egalitarianism and reestablishing the link between worker performance and compensation.

The cure was to be administered by employing a "trickle down" method. Division, subdivision, and team responsibilities were delineated by dividing and assigning main contracts with the state. At the same time, internal accounting systems were developed so that the newly delegated responsibility could presumably be monitored and enforced by top and middle-level management. Thus, the primary emphasis of the ICS was to motivate these managers with incentive contracts. In this manner, the proper incentives ultimately were to be instilled in the workers at the lowest level of the enterprise hierarchy. Incentive contracts and the associated motivation were, however, never translated down the enterprise hierarchy to the workers, and worker effort remained minimal. In other words, even though the ICS prescribed incentive bonuses for the principal and for the agents, in practice the agents ended up primarily receiving fixed augmentations to their wages and any variable proportion of a worker's wage was so small as to be insignificant. The evidence suggests that worker "bonuses" were not sufficiently based on productivity and, hence, workers were not properly motivated.

## Two Interpretations of Chinese Egalitarianism

One interpretation of Chinese egalitarianism has its roots in worker attitudes. In an extreme version, it is an ethos of the working population that is difficult, if not impossible, to change. Chinese egalitarianism manifests itself, among other ways, as a systematic and ubiquitous worker resistance or contentiousness displayed towards incentive bonuses and other

payment schemes that generate differential wages. Another interpretation, and the one taken here, is that Chinese egalitarianism arises out of the arbitrary and capricious manner in which bonuses have been delivered. Workers were not paid in accordance with their performance and, therefore, bonuses were perceived as being unfair. This perceived unfairness gave rise to worker contentiousness that disrupted production stability in the Chinese enterprise.

There is evidence to suggest that the latter interpretation is more accurate. In a questionnaire developed to ascertain factors influencing worker motivation, Henley and Nyaw (1987, p. 145) found that, out of 20 material and nonmaterial factors, increases in wages and bonuses were ranked one and two, respectively. In a Shanghai electronics factory, differential wages and selective bonuses were employed without reported worker resistance. In particular, Wong (1989, p. 138) observes that, "Bonuses are not identical. They are dependent on such factors as attendance record, type of job, and production-group performance." Additionally, piece-rate payment schemes have been extensively utilized in China without apparent worker contention (Walder 1986, p. 111).

## Restoring Incentive Bonuses: Problems and Prospects

The communist party exercises power in China through an extensive and complex nomenklatura system which permeates many aspects of the Chinese socio-economic system. Nomenklatura concerns the rights of the party to appoint key economic agents, including managers. Problems arise when nomenklatura leads to the appointment of managers who attempt to preserve the existing distribution of income and, hence, seek to maintain the status quo (Winiecki 1990, p. 195). Burns (1987, p. 46) has estimated that the 5,553,151 communist

party members are involved with enterprises, service units, and other work organs. In the Chinese enterprise, the shop director most directly, and the group leader indirectly, are responsible for implementing the bonus systems. Furthermore, they are likely to be a part of, or influenced by, the nomenklatura system. They wield considerable discretion and, as such, are in a position to extract rents from the system (Walder 1986, pp. 104, 237). Therefore, the shop directors and the group leaders are expected to resist any attempts to base incentive bonuses on specific and objective measures, since this would usurp their rent extraction ability. A supervisor-worker coalition of the kind mentioned at the end of Section 2 is relevant here.

In addition to the nomenklatura difficulty, there is the problem of worker shirking. There are two reasons why workers shirk in the extended LEN model: the absence of incentives (i.e., $s = 0$) and free riding owing to group size. Rectifying the shirking and the nomenklatura problem can play a critical role in enhancing labor productivity. Since an incentive payment scheme is a necessary condition for increasing efficiency, the initial focus is on considerations pertinent to its implementation.

There are two important ingredients for the successful implementation of an incentive payment scheme. The first is to embed discretion regarding incentive payment schemes in staff offices. An example would be to lodge incentive-reward decisions in the personnel office. The group leader and shop director could independently submit production figures to staff officers for verification. Staff officers could also randomly monitor group output on the site to ensure accurate reporting if this was deemed to be a problem. Incentive-reward decisions will then tend to become impersonal and, therefore, more objective since, in a large enterprise, a personnel staff member is

typically not involved with the worker in the same manner as a team leader or shop director (e.g., the team leader accepts personal favors in return for a good recommendation).

The second factor is alluded to by Williamson (1988, p. 17) when he specifies a critical trade-off: ". . . , the adaptive gains that a discretionary governance structure permits can only be realized by sacrificing the incentive intensity properties of rules governance." While the advantages of discretionary governance (e.g., adaptability) may outweigh rules governance in some systems, in the Chinese case with its extensive nomenklatura system, this does not appear to be a viable strategy. At some levels of the enterprise, selective discretion may be warranted by the magnitude of adaptability gains, or rules may be impossible to establish depending upon production technology, the measurability of output, or other factors.

On the other hand, an incentive scheme specified as a rule, based on specific, objective criteria and monitored/enforced by a "remote" staff office, would attenuate the nomenklatura problem and that of exchanging personal favors by virtually eliminating more immediate supervisor discretion. The closest approximation to s(y) in reality may be the piece-rate bonus or wage. The piece-rate payment schedule is both specific and objective. The straight piece-rate scheme, however, should not be construed as a panacea for Chinese labor productivity in medium-to-large industrial enterprises. There are numerous problems with any payment-by-result schemes, since these schemes work best when there is a clear connection between worker effort and output and the output can be readily measured for individuals or group. In a straight piece-rate scheme, product cost and quality may be sacrificed.

These considerations notwithstanding, in many instances, modifications

can be made to the straight piece-rate scheme that correct for many of its shortcomings. Cost and/or quality penalties can be introduced into the remuneration equation and output can be defined in a more adequate manner. Wong (1989, pp. 138-139) describes bonuses that are not straight piece-rate, but seem to work. These schemes provide incentives, corrected for several shortcomings in straight piece-rate schedules, and apparently are specific and objective enough so that workers do not become contentious. Referring to China, Walder (1986, p. 111) indicates that, "In 1957, 42 percent of its workers were on piece rates." The absence of worker contentiousness during this period suggests that a piece-rate payment scheme, or some variation thereof, could be employed in a substantial portion of the economy.

If a viable and effective piece-rate payment schedule or some other incentive bonus were introduced into the system, then worker productivity would rise for two reasons: a work incentive exists (i.e., s is not equal to zero and, therefore, effort is not minimal) and group size is small so that the free-rider problem is not as critical as it might be. Additionally, to the extent that egalitarianism is cured, the manager's incentive to collude at the lower and upper-tiers of the enterprise hierarchy would be significantly diluted.

In summary, rules governance can dilute collusion, circumvent the nomenklatura problem, and restore worker incentives on two accounts when a modified piece-rate payment scheme is effectively employed. Past experience indicates that it can be applied to a significant number of industrial enterprises. If, therefore, the Chinese authorities revive a true incentive bonus system that links worker compensation with performance, enterprise productivity will likely be enhanced.

## 5. CONCLUSION

Lee (1990) provides empirical evidence that the CMI reform package failed to achieve its potential and that Chinese egalitarianism exists (Lee and Mark, 1990). The LEN model highlights the fundamental reason the CMI reform package failed; the package did not adequately address the worker incentive problem. The "trickle down" method, whereby top and middle-level managers are stimulated with incentive contracts, was not translated down to the lowest level of the enterprise hierarchy, so that the condition $s = 0$ remained. In fact, the model shows that any reform that does not take this issue into account may fail to achieve its full potential.

The LEN model also demonstrates that the lowest possible worker productivity results if $s = 0$ when the incentive bonuses turned into general wage supplements. Furthermore, even if $s$ is not equal to 0, the theoretical model indicates that incentive problems emerge from the free-riding phenomena associated with group size.

Additionally, the principal-agent framework with multi-levels is important in the Chinese case. Coalitions were formed at both the lower and upper tiers of the enterprise hierarchy and these coalitions were responsible for thwarting enterprise efficiency. This appears to be an interesting area for future research. A related area of future research concerns the study of monitoring schemes and input-related incentive schemes. In conclusion, the paper puts forth a solution strategy that could mitigate the principal-agent problems confronting medium and large Chinese enterprises.

## FOOTNOTES

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1. A Rand study, ". . . estimated that given an average growth rate of 4.6 percent, China's GNP will have surpassed Japan by 2010 to make it the world's second largest, just behind the United States." See SCRO (1989, p. 20).

2. Liu (1990, p. 17), the deputy director of the Chinese Academy of Social Sciences, has stated that, "Reform will be the focus of the economic work in the late period of the 'Eighth Five-Year Plan (1991-1995).'"

3. The bulk of the pioneering economic research over the decade of reform has centered on describing how the Chinese economy worked, suggesting the economic reforms that should be undertaken, identifying optimal sequencing, and specifying the efficient pace and extent of the reform process. See, e.g., Chow (1985), Perkins (1988), Dong (1987), Fei and Reynolds (1987) and Wu and Reynolds (1988). Recently, there have been a number of papers that are generally oriented along the line taken here in that these papers analyze and evaluate the reforms as they currently exist (Lee 1990; Lee and Mark 1990; Lal 1990; and Byrd 1990).

4. In 1984, medium and large state-owned enterprises represented less than one half of one percent of total industrial enterprises, about 6,400 in absolute number. However, these enterprises accounted from over 42 percent of

gross value of industrial output. See Levy,, et. al. (1988, pgs. 60-62).

5. ". . . , the decentralization of microeconomic decisions in favor of enterprise managers is a central element of enterprise reform, which, in many ways, drives the rest of the reform process." See, Levy, et. al. (1988, p. 92).

6. In reality, the Chinese people were the bearers of this risk, but the Party bore a political risk.

7. The model was named by Lee. The following discussion of the CMI model relies heavily on Lee's (1990, pp. 386-390) detailed presentation of it.

8. In a small or medium-sized enterprise, the division head may be called the shop director and functions in many respects as a foreman. In larger enterprises, shops are divided into sections and the section chiefs become the foremen. See Walder (1986, pp. 88-113).

9. In general, the certainty equivalent utility level is

$$U(\cdot) = E[\tilde{w}] + U''var(\tilde{w})/2U',$$

in which $E[\cdot]$ is the expectation operator and $var(\cdot)$ is the variance. The ratio $-U''/U'$ denotes the Arrow-Pratt definition of absolute risk aversion, which for (4) equals $\alpha$. (Deaton and Muellbauer, 1980, pp. 396-400.)

10. As Krozec (1988, p. 3) puts it, "In the most extreme interpretation the introduction of floating wages means that the fixed wages for state employees should be replaced by incomes that fluctuate with enterprise profits and individual effort. According to a weaker version the floating wage is a variable wage incentive paid in addition to fixed standard wages."

11. Lee and Mark (1990, p. 383) provide empirical evidence of this as they show that, ". . . retained profits and bonuses per worker became more or less level across firms."

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