Dynamic Innovation of Incentives, Risk Management and Banking Performance: State-owned Commercial Banks in China

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Abstract Effective incentive and discipline mechanism act an important role in commercial banks' governance. We design a two-period dynamic agent model with asymmetric information to highlight the relationship between Central SAFE Investment Co., (SAFE) and the manager of state-owned banks. We assume there are two types of risk management: easy and difficult. The manager would have four strategies to choose. Our results focus on both parties' equilibrium targets. Comparisons between deterministic environment and stochastic setting are also related. The results also suggest the ratchet effect occurs overtime under easy type and SAFE has two conflicting incentives when designing contract.

Key words state-owned commercial banks, dynamic Innovation, risk management

1 Introduction

The banking sector is so importance to the country's economy. The government then launched several reforms to spark a radical turnaround in the Big Four[1]. The framework of corporate governance in banking sector has existed, even so, much work remains to be done[2]. Recent experience in both China and other economies in transition indicate that corporation does not guarantee that professional, rather than political managers will be appointed[3]. Therefore, we focus on examining the dynamic incentives, risk management and banking performance.

There are three interesting questions involved in banking managers' contracts. First, what kind of incentive scheme can short-term contracts provide? Second, how does the ratchet effect affect the banking managers' effort and risk management costs of banking cases? And third, what is the role that the uncertainty position change plays? In one word, the relationship between SAFE and the banking manager is the key. Our results focus on both parties' equilibrium targets. Comparisons between deterministic environment and stochastic setting are also related. The results also suggest the ratchet effect occurs overtime under easy type and SAFE has two conflicting incentives when designing contract.

The paper is divided into four parts. Next section develops a two-period stochastic dynamic model. After that, section three, the main part of the paper, separating equilibriums and semi-separating equilibriums are follow-on. The final part summarizes our conclusions and gives some outlooks for future research.

2 The Two-period Model

In this section, we analyze the relationship between the SAFE and banking manager in banking management cases in a two-period model. We also assume that for the same banking manager the difficulty of the case does not change in any court level. We define banking management cases only have two types for the banking manager: the easy type and the difficult type. When handing in a case, a banking manager would have four strategies. First, if the case is easy type, he can report it honestly. Second, if the case is easy type, the banking manager can exaggerate the difficulty and therefore get more pay from the Stockholders. Third, if the case is difficult type, the banking manager reports the difficulty truthfully. Fourth, if the case is difficult type, the banking manager may lighten the difficulty. The last strategy is a little bit difficult to be understood. If the banking manager does so, he will lose a part of pay in this case. But when we consider the reputation incentive, the banking manager may boast

his ability and hence gain more offers from clients. Shock term will be introduced to explain uncertainty in the case.

2.1 The Two-Period Basic Model under Perfect Information

Consider a two-period banking management case. Assume that contracts are short-term and designed at beginning of each period. The SAFE has not enough power to commit to future contracts. That is a necessary condition for the ratchet effect to be a concern. Moreover, risk management cost is affected by unobservable noise, as is in the general model of Jeitschko et al (2002).

In period t, $(t=1,2)$ a hired banking manager reports to the SAFE the risk management risk management costs involved in running the case. The risk management cost is: $c_t = \beta - e_t + \varepsilon_t$, $t=1,2$

Each period the banking manager's pay is $U_t = s_t - \psi(e_t)$,

where s is the net monetary transfer he receives from the SAFE and $\psi(e)$ is his disutility of effort ($\psi'(e)>0$, $\psi''(e)>0$).

Note that both the SAFE and the banking manager are risk-neutral. The social performance is defined as following:

$$W = D + U_t - (1+\lambda)\left[c_t + s_t\right]$$

where D is the value of the case.

The SAFE seeks to maximize expected financial safety and banking performance. Under perfect information ($\beta = \underline{\beta} = \overline{\beta}$), each period t, the SAFE would solve:

$$W = \max_{s,e}\left\{D + U_t - (1+\lambda)\left[c_t + s_t\right]\right\}$$

s.t. $U_t = s_t - \psi(e_t) \geq 0$

The individual rationality constraint $U_t = s_t - \psi(e_t) \geq 0$ implies that the utility level of the banking manager must be enough to participate. The optimal solution is characterized by

$s_t = \psi(e_t)$, $e_t = e^*$, where $\psi'(e^*) = 1$.

Thus, under perfect information the effort of the banking manager is optimal and the marginal disutility of effort is equated to marginal risk management cost saving[4].

2.2 Two-Period Contracts under Asymmetric Information

In this section, we apply our basic model to a two-period, two-type asymmetric information case. The ratchet effect cannot be avoided since we suppose that the SAFE cannot commit to a two period contract. The sequence of events for the game is given by:

(1)The banking manager estimates the case (after estimation he knows the "exact" level of the difficulty of the case) and reports the case's difficulty, which has two values $\underline{\beta}$ and $\overline{\beta}$ ($0 < \underline{\beta} < \overline{\beta}$), to the SAFE. (According to the risk management cost function $c_t = \beta - e_t + \varepsilon_t$, the more difficult the case, the more risk management costly the case.)

(2)Based upon the banking manager's report the SAFE offers a contract that consists of an incentive schedule $s_1(c_1)$. The banking manager either accepts the contract or rejects it. If he rejects the contract he will receive his reservation utility of 0 and the relationship is dissolved.

(3)If the banking manager accepts the contract, in the first-period, he participates in the case; the random shock ε_1 and hence the risk management cost c_1 are realized and observed by SAFE.

(4)The SAFE updates her beliefs and offers a second-period contract. In new contract, the SAFE may discount the expected monetary transfer. The banking manager either accepts the new contract or rejects it.

We start with the second-period contract. The contracts offered by the SAFE must satisfy individual rationality and incentive compatibility constraints for each type.

$$\overline{IR_2}: \overline{s_2} - \psi(\overline{e_2}) \geq 0, \qquad \underline{IR_2}: \underline{s_2} - \psi(\underline{e_2}) \geq 0,$$

$\overline{IC_2}: \overline{s_2} - \psi(\overline{e_2}) \geq \underline{s_2} - \psi(\overline{e_2})$, $\underline{IC_2}: \underline{s_2} - \psi(\underline{e_2}) \geq \overline{s_2} - \psi(\underline{e_2})$

Incentive compatibility implies the contract designed for the type the one preferred by the type. Individual rationality ensures the participation of banking manager[5].

The equilibriums in which the banking manager deceives should be considered.

Type I: $\underline{IC_1}$ and $\overline{IR_1}$ bind and the banking manager may aggrandize the difficulty of the easy case with probability x.

Type II: $\overline{IC_1}$ and $\overline{IR_1}$ bind and the banking manager may lighten the difficulty of the difficult case with probability y.

Type III: $\underline{IC_1}$, $\overline{IC_1}$ and $\overline{IR_1}$ bind and the banking manager may either aggrandize (the easy case) or lighten (the difficult one) the difficulty of the case.

In the situation of the case is difficult and the banking manager may lighten the difficult (Type II), it is obvious that if this happens the pay of the banking manager decreases. Type II cannot be optimal for the SAFE for the case where $\alpha = 1$. Hence we concentrate on equilibrium of Type I and Type III in this paper. In the rest of this paper we choose disutility of banking manager as a quadratic, $\psi(e) = \frac{\alpha}{2}[\max(e,0)]^2$. For simplicity, we assume $\alpha = 1$ and $2\eta > \overline{c_1} - \underline{c_1}$ (there is a "no learning zone").

3 Semi-separating Equilibriums

We now allow for the possibility that the banking manager cheats in the first period; in particular, he reports $\underline{\beta}$, the case's true difficulty, with probability $x \in [0,1]$. Accordingly, the SAFE updates her belief in the second period, so her posterior belief that the case is easy type is: $\rho_2 = \frac{\rho_1(1-x)}{1-\rho_1 x} \leq \rho_1$

In the stochastic setting, the actual risk management cost observed by the SAFE is subject to noise. Thus, regardless of the banking manager's strategies, the SAFE might not observe risk management costs different to those associated with the strategies. As we discussed before, the probability of observing a revealing risk management cost of the easy case (excluding the banking manager's strategies for a moment) is θ, which is defined as:

$$\theta = \Pr(\underline{c_1} + \varepsilon_1 < \overline{c_1} - \eta) = \Pr(\overline{c_1} + \varepsilon_1 < \underline{c_1} + \eta) = \frac{\Delta\beta + \underline{e_1} - \overline{e_1}}{2\eta}$$

Similarly, the probability of a non-revealing risk management cost is

$$1 - \theta = \frac{2\eta - (\Delta\beta + \underline{e_1} - \overline{e_1})}{2\eta}$$

Therefore, the expected Period 2 performance is given by:

$$EW_2 = \rho_1 \cdot x \cdot \theta \cdot \underline{W_2} + (1-\theta) \cdot W_2^{AI}(\rho_1) + (1 - \rho_1 \cdot x) \cdot \theta \cdot W_2^{AI}(\rho_2)$$

This expression is based upon that the SAFE's beliefs do not change in second period if she can observe the non-revealing risk management cost, while she can update her beliefs if $\overline{c_1} + \varepsilon_1 > \underline{c_1} + \eta$.

In the first period, there are three possibilities:The case is easy type, and the banking manager reports truthfully, with probability $\rho_1 \cdot x$, that yields performance: $\underline{W_1} = pD - (1-p)(1+\lambda)(C^d + \underline{\beta} - \underline{e_1}) - \lambda \cdot \underline{s_1} - \frac{\underline{e_1}^2}{2}$.

The case is easy type, the banking manager cheats, with probability $\rho_1 \cdot (1-x)$, that yields performance: $\underline{\overline{W_1}} = pD - (1-p)(1+\lambda)(C^d + \overline{\beta} - \underline{\overline{e_1}}) - \lambda \cdot \bar{s} - \frac{(\underline{\overline{e_1}} - \Delta\beta)^2}{2}$.In the situation of the case is difficult type, with probability $1-\rho_1$. The banking manager truthfully reports the difficulty, performance is: $\overline{W_1} = pD - (1-p)(1+\lambda)(C^d + \overline{\beta} - \overline{e_1}) - \lambda \cdot \overline{s_1} - \frac{\overline{e_1}^2}{2}$.

In period 1, the expected performance is given by

$EW_1 = \rho_1 \cdot x \cdot \underline{W_1} + \rho_1 \cdot (1-x) \cdot \underline{\overline{W_1}} + (1-\rho_1)\overline{W_1}$.

The relevant constraints are $\overline{\beta}$'s individual rationality constraint $(\overline{IR_1})$ and $\underline{\beta}$'s incentive compatibility constraint $(\underline{IC_1})$.

Solve the SAFE's problem in semi-separating equilibrium:

$$\max_{\underline{e_1}, e_1} EW = EW_1 + \delta_R \cdot EW_2$$

Hence, the SAFE adjusts the banking manager's effort level for the easy case relative to that demanded in the separating equilibrium. The sign of this adjustment is determined by $\delta_S - \frac{\delta_R}{2}$: when this is positive.This is interesting since, as we have seen, a relatively long-sighted SAFE ($\delta_R > \delta_S$) is required for experimentation when $x = 1$ (Result 2). As experimentation involves widening the effort gap, the second effect we have now discovered reduces this effect on $\underline{\beta}$'s effort level when $x < 1$. Combining this observation with Result 2, we have

Lemma 1: In a semi-separating Type I equilibrium, a necessary condition for $\underline{e_1}$ to increase in the stochastic case, relative to the deterministic one, is $\frac{1-\frac{\Delta\beta}{2}}{1-\Psi\frac{\Delta\beta}{2}} < \frac{\delta_R}{\delta_S} < 2$.

Lemma 2: In a semi-separating Type I equilibrium, a necessary condition for $\overline{e_1}$ to increase in the stochastic case, relative to the deterministic one, is $\frac{1-\frac{\Delta\beta}{2}}{1-\Psi\frac{\Delta\beta}{2}} < \frac{\delta_R}{\delta_S} < 2$.

4 Conclusions and Outlook

The conclusions can be divided by two situations. First, the case is an easy type. It is obvious that in this situation the banking manager can increase his profit through exaggerating the case's difficulty. The performance analysis brings two interesting results. The former is that when the SAFE and the banking manager discount future at same rate, the SAFE has to increase the easy case's risk management cost and reduce the difficult case's risk management cost. By this way, the SAFE encourages banking manager report truthfully. In fact, as a SAFE, the SAFE has more concerns about future. This gives the latter result: When the discount factors are different and the SAFE discounts future heavily, the easy case's risk management cost is reduced and the difficult case's risk management cost is increased. The conflict of these two results implies a dilemma: The SAFE gives less future pay to identify the difficulty of the case , but this action exacerbates the ratchet effect. The banking manager therefore has more incentives to cheat. If the banking manager can cheat in the first period, the SAFE adjusts the banking manager's effort levels, with respect to the difficulty of the case, relative to that demanded in the separating equilibrium.

Second, the banking manager may cheat whatever the case's type. This is the situation that the banking manager may either exaggerate or lighten the difficulty of the case. As we discussed, this is possible because, due to reputation incentive, the banking manager may boast his ability and hence lightens the case's difficulty. There are three results to emphasize. First, non-experimentation occurs when the probability that the banking manager lightens the difficulty is bigger than the probability of aggrandizing the difficulty. Second, when the banking manager's discount rate rises, it does not affect whether experimentation takes place, but it does affect the extent of experimentation or non-experimentation. Third, the SAFE's discount rate now plays no role in whether experimentation takes place. Summarily, in this situation, the SAFE's concern about the future does not affect targets of the banking manager. The ratchet effect occurs and if the banking manager has good first period performances he will have increased expectations of pay.

In addition, the state-owned banks must be commercialized to make profit-seeking their primary reason for existence. Entire new mechanisms must be put in place to ensure that political figures are supplanted by professional managers in key positions[6]. Finally, proper internal incentives that basic salaries on market rates and include performance incentives must be put in place.

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