Management compensation design for a banking firm

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(Preliminary)

"Do we have tools to affect managerial incentives more directly? What do we have to learn to be able to use them effectively?"

-Raghuram G. Rajan[1]

Abstract

The extant of indigenous literature on bad loans concentrate to analyze the factors that would increase efficient credit allocation by public sector banks in India.. RBI, the Central Bank in India, has mostly tried to promote priority sector lending through various policy steps. However, the list has only become longer. The paper proposes an incentive contract based on information asymmetry model to approach the problem.

1.0 Introduction

Theories based on managerial compensation have largely limited itself to cash and equity-linked schemes[2]. These theories were able to justify the extant of literature based on this traditional approach to compensation. However, empirical findings such as Bebchuk and Jackson (2005) and Sundaram and Yermack(2006) showed that for US firms, debt-linked instruments also influenced the pay package of the top management. This stream of analysis had never been formally assessed by the theorist.

Alex Edmans (2006) paper was the first attempt in this direction. He proposed that Inside Debt was a more effective solution to agency cost pertaining to debts than private benefits or bonus. He showed that the model was able to alleviate the insensitivity towards liquidation value of previous performance measures.

This paper directs the theory specifically to banking firms. A manger in a bank-firm has a compensation plan based on a fixed wage and a performance based incentive which is related to his immediate past performance. However, as the nature of competition changes without much change in the basic product portfolio, it is desirable for the managers to be innovative and acquire knowledge to improve productivity. But a backward looking compensation scheme which punishes him if a new knowledge or process fails. He has no incentive to test his newly acquired knowledge and would like to continue with the same process which has a higher probability to give better immediate incentive. Bank-firms due to its structure and regulation have a stratified compensation plan which doesn't give any incentive for failed trials. Therefore, any bank-firm which follows a performance based pay and punishes failed trials may have adverse or no effect in acquiring new knowledge and innovate.

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[1] At the Bank of Spain Conference on Central Banks in the 21st Century, June 8, 2006
SOURCE: http://www.imf.org/external/np/speeches/2006/060806.htm#P9_224

[2] See Gomez-Mejia [1994] and Murphy [1999] for a literature review on compensation. Much of the research on compensation is a part of larger area of research on incentives within industrious firms, like designing of performance measures (e.g., Indjejikian [1999] and also Prendergast [1999]). Some papers incorporate corporate governance variables into the analysis (e.g.,Core, Holthausen, and Larcker [1999] and Talmor and Wallance [2002]) .

A theory of banking firm must incorporate the roles of a firm, a financial intermediary and a regulated enterprise. Unlike an industrial firm, the manager maximizes his utility under constraint by regulatory body and share holder. A compensation theory must be able to justify the interest of all the stakeholders and work without much renegotiation of contract. The contribution of this paper is that those banks which have compensation package which encourages innovative thinking and knowledge application

The paper is organized as follows. Section 2.0 discusses the related literature . Section 3.0 present the bank model and how inside debt reduce the risk sifting behavior of management. Section 4.0 gives a numerical comparison. Section 5.0 concludes the paper. Appendix contains the proofs of the propositions.

2.0 Related Literature

Managerial compensation has mostly been related to equity –linked performance measures. The possibility that debt can be linked to performance has received little attention both for banking firms and industry firms. Sundaram and Yermack were not able to find a theoretical explanation to their empirical analysis.

In the seminal paper, Jensen and Meckling (1976) suggested that the manager's salary must be able to limit risk-shifting and if that is possible, then there is no requirement for inside debt. They theorized the agency cost of debt. Edmans showed that manager's salary was an inadequate solution.

3.0 Model of a Banking Firm

3.1 Assumptions

We propose to model a discrete two state, four time period (t= -1,0, 1, 2) of n (=2) banks having a continuum of exante customers endowed with a unit of consumption goods. At t=-1, the compensation contract is stated to the managers. The bank model is similar to that of Bris and Cantale (1998) and Diamond and Dybvig (1983) with significant differences. Bris and Cantale emphasized on the self interest of the managers; our objective is to model the optimal contract for compensation.

Consider a situation where each bank in the economy can invest in only one project. The project requires an investment of $I_i \in (1, n)$. The project is financed through a deposit $D_{(t=0)}$ or raised through the market $S_{(t=0)}$. The customer has no incentive to "hoard" goods between t =0 and t=1. Only at t=1, their liquidity requirements is revealed. The value of the firm, at t=0, is $V_0 = D_0+S_0$,which is verifiable and publicly observable. If the project is liquidated at t=1, the productive technology returns only the salvage value ($r \leq 1$) .The yield at t=2 is R (>1). Manager chooses the structure of the balance sheet at t=0, Asset is balanced by the loan portfolio[3] and the risk less reserves ($\Re$), if any. The cost of credit[4] is αI_i ,I where ($0 \leq \alpha < 1$). Loan repayment (1+i) I equal:

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[3] Here the "portfolio" comprises of one project only. Later more project choices would be added to the model.

[4] Cost incurred in identification and official procedures associated with the Investment.

$$(1+i)I = \begin{pmatrix} = \text{r}(\leq 1) \text{ at t} = 1 \\ = \text{R}(>1) \text{ at t} = 2 \end{pmatrix}$$

The loan is 'profitable' for the bank only when

$(1+\text{i}) > \alpha$ (=r) .

For tractability, there are only two types of projects to choose from, "high risk" (H) and "low risk" (L). Project H has a probability p_H to be "Good" and the bank has a value of V_{HG}, if the project is "bad" (1- p_H) , the value of the bank is V_{HB}. Similarly for project L, the value of the bank is V_{LG} with p_L if project is good and V_{LB} with (1-p_L) if otherwise. These values are observable only to the managers but after t=1. Assume, $V_{HG} > V_{LG} > V_0 > V_{LB} > V_{HB}$ and $p_H > p_L$. All payoffs will be realized at t=2. Shareholder's interest at time t=1. The expected value of the shareholder at the end of the project (t=2) is:

$$E(S_2) = \max\{\theta(1+i)I - R - D, 0\} \qquad (1)$$

Here, θ = level of repayment.[5]. Let θ_T be the threshold value for which the equity holder has a positive value. Equation (1) can be expressed as :

$$E\left(S_2 / \theta \geq \theta_T\right) = \left[(1+i)\theta I - D\right]\left[\Pr(\theta \geq \theta_T)\right] \qquad (2)$$

Where,

$$\theta_T = \frac{D/I}{(1+i)}$$

if $\Re$ is present at t=1 then ,

$$\theta_T^{\Re} = \frac{(1+\alpha) - S_1/I}{(1+i)}$$

3.2 **managerial compensation and effort**

A manger in a bank-firm has a compensation plan based on a fixed wage and a performance based incentive which is related to his immediate past performance. However, as the nature of competition changes without much change in the basic product portfolio, it is desirable for the managers to be innovative and acquire knowledge to improve productivity. But a backward looking compensation scheme which punishes him if a new knowledge or process fails. He has no incentive to test his newly acquired knowledge and would like to continue with the same process which has a higher probability to give better immediate incentive. Bank-firms due to its structure and regulation have a stratified compensation plan which doesn't give any incentive for failed trials. Therefore, any bank-firm which follows a performance based pay and punishes failed trials may have adverse or no effect in acquiring new knowledge and innovate.

The contribution of this paper is that those banks which have compensation package which encourages innovative thinking and knowledge application.

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[5] $\theta = f\left(default\ probability, manager's\ effort\right)$

Principal –agent models supports pay-for-performance scheme. Harris and Raviv (1976) and Holmstrom(1979) suggested that performance based incentive can encourage efforts put forth by the agents. Empirical evidence supports the above model for example, Lazear(2000) . But it can be argued that the model holds good for routine, repetitive jobs where effort is the main input which determines the output. There is no evidence to support the view when other factors ,besides effort also influences the output .
One strand of literature

Manager's compensation is dependent on the value of the firm, denoted as f (V_0). This endogenous component is strictly monotonic in firm value with an upper limit of $\overline{V}$. This is to prevent managers from destroying firm value and run. The lower bound is denoted by $\underline{V}$. Thus,

$$\overline{V} \geq f(V_{\mathrm{HG}}) \geq f(V_{\mathrm{HG}}) \geq f(V_{\mathrm{HG}}) \geq f(V_{\mathrm{HG}}) \geq \underline{V}$$

Manager's effort can improve the performance of the banking firm and it is visible to the shareholders in the time period (t=0, 1, 2). The effort level $x \in (0, x^*)$ is only constrained by the personal cost of the manager assumed to be a quadratic function ξx^2 . The effort of the manager does not change when the firm is solvent and when the firm is bankrupt. The probability associated with the loan portfolio is un affected by the manager's effort. But the probability to default is influenced by the effort put in by the manager and the polar condition of the probability to default (p_D) can be determined for both the state of the projects as :

$$\left(1-\frac{x}{x^*}\right)(1-p_H)$$

$$\left(1-\frac{x}{x^*}\right)(1-p_L)$$

When $x \to x^*$, p_D (0) and when $x \to 0$,p_D (1). The expected equity value for the long term shareholders at time t=2, can be given as:

$$E(S_2^H) = [(1+i)I - D]\left(1-\frac{x}{x^*}\right)(1-p_H)$$

$$E(S_2^L) = [(1+i)I - D]\left(1-\frac{x}{x^*}\right)(1-p_L)$$

When D > $\Re$, the above equation reduces to:

$$E(S_2^H) = [(i-r)I + S_1^H]\left(1-\frac{x}{x^*}\right)(1-p_H)$$

The expression is similar for the other loan portfolio "L". under solvent condition manager's compensation is a portion of net worth (γ). Hence, it can be assumed that the

manager holds a share (ψ) of the equity where, $\psi \in [0, \max \gamma E(S_2^{H,L})]$. Banks, like a typical firm, has to keep the shareholder's interest into consideration. The performance of the managers is determined by the shareholder's value maximization. So in our model manager's incentive[6] is determined as a proportion (γ) of shareholder's return. This is to be noted that the manager is not credited for meeting their loan (deposit) obligations. But they can be reprimanded for failing to meet the requirements. The incentive is made public at t=2. Shareholders are satisfied with the portion of incentive provided it does not discount that the equity value of the shareholders. At t=1,

$$S_1^{H,L} \geq \frac{(1-\gamma)E(S_2^{H,L})}{(1+K_e)}$$

Where K_e is the cost of equity. Here for our analysis K_e is taken as zero .

Proposition 3.1*: given the proportion of equity* (γ)*, and the effort, the equity value of the firm at t=2 is given as:*

$$E(S_2) = \frac{x}{1+x\gamma}(i-r)I$$

3.2 project selection process

the project is selected (To be Continued…)

[6] Incentive is over the wage received by the manager.

APPENDIX - A

proof of proposition 1:

E(S_2) =$[(i-r)I+S_1](\frac{x}{1+x})$ replacing α with *r*.

arranging for S_1, we obtain ,

$S_1 = E(S2)/p_x - (i-r)I.$

also,

$$S_1 = \frac{(1-\gamma)E(S_2)}{(1+K_e)}$$

equating both ,we obtain

$$E(S_2)/p_x + (r-i)I = \frac{(1-\gamma)E(S_2)}{(1+K_e)}$$

or ,

$$E(S2) = \frac{(i-r)I}{\frac{(1+K_e)-p_x(1-\gamma)}{p_x(1+K_e)} - X} \quad \text{(eqn A)}$$

where X is,

$$X = \frac{(1+K_e)-\frac{x}{1+x}(1-\gamma)}{\frac{x}{1+x}(1+K_e)}$$

rearranging ,

$$X = \frac{1+K_e+x+K_ex-x+x\gamma}{x(1+K_e)}$$

if Ke =0,

$$X = \frac{1+x\gamma}{x} \quad \text{Eqn(B)}$$

using (B) and (A) we get,

$$E(S_2) = \frac{x}{1+x\gamma}(i-r)I \qquad \text{QED}$$

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Appendix

proof of proposition 1: solving for one loan portfolio , H

$$E(S_2^H) = [(i-r)I + S^H{}_1]\left(1-\frac{x}{x^*}\right)(1-p_H)$$

replacing α with r and arranging for $S^H{}_1$, we obtain ,

$$S_1^H = E(S_2^H)/p_H - (i-r)I.$$

also,

$$S^H{}_1 = \frac{(1-\gamma)E(S^H{}_2)}{(1+K_e)}$$

equating both ,we obtain

$$E(S^H{}_2)/p_H + (r-i)I = \frac{(1-\gamma)E(S^H{}_2)}{(1+K_e)}$$

or ,

$$E(S_2^H) = \frac{(i-r)I}{\frac{(1+K_e)-p_H(1-\gamma)}{p_H(1+K_e)} - X} \quad \text{(eqn A)}$$

where X is,

$$\left(1-\frac{x}{x^*}\right)(1-p_H)$$

$$X = \frac{(1+K_e)-\left(1-\frac{x}{x^*}\right)(1-p_H)(1-\gamma)}{\left(1-\frac{x}{x^*}\right)(1-p_H)(1+K_e)}$$

rearranging ,

$$X = \frac{1+K_e+\not{x}+K_e x-\not{x}+x\gamma}{x(1+K_e)}$$

if Ke =0,

$$X = \frac{1+x\gamma}{x} \quad \text{Eqn(B)}$$

using (B) and (A) we get,

$$E(S_2) = \frac{x}{1+x\gamma}(i-r)I \qquad \text{QED}$$