

Erasmus University Rotterdam
International Bachelor Economics and Business Economics (IBEB)
Bachelor Thesis

Effect of Executive Compensation on Worker Motivation and Firm Profitability

Name Student: Sybrand Esbach
Student ID Number: 405999
Email Address: Syesbach@gmail.com

Supervisor: Dr. J.J.A. Kamphorst
Second Assessor: Prof. Dr. O.H. Swank

Date Final Version: 01/07/2018

1. Abstract:

Past studies have often considered the relation between the executive compensation schemes and what these are based on, yet there has been much less attention as to what effect the bonus has on the firm itself. This paper examines how the differences in bonus sizes affect the effort exerted by the bosses and workers and how this affects the expected profitability of firms. Additionally, the signaling power of the bonus is examined. A bonus payment is a useful tool for firms to increase expected profits, as recognizing those who are of more relative importance will increase their effort exertion and in turn improve firm profitability.

Table of Contents

1. Introduction.....	3
2. Model	6
3. Analysis.....	8
4. Extension: Pay without performance	15
5. Results.....	20
6. Discussion.....	22
7. Conclusion	26

1. Introduction:

Following the large wave of corporate scandals in 2001 and the economic crises in 2008, there has been widespread public attention for the structure of executive compensation in large firms (Mehran, 1995; and Erkens, Hung & Matos, 2012). Despite the attention given to the subject, mainly in mainstream media criticizing the size of bonuses the effect on the entire firm remains unclear. For firms it will be valuable to know how its performance will be altered due to the bonus given to the boss in regard to the motivation and performance of all the individuals in the firm. The firm must thus be considerate of the way the bonus implementation will affect its expected profitability (Bebchuk & Fried, 2004). A recent case in the Netherlands depicts the potential effect of a high bonus as ING CEO Ralph Hamers received an increase in wages of 50%. The additional compensation was considered a reward for the good performance of the past years but received resistance from the public¹. Labor Union CNV responded in disapproval stating that the workers of the firm were being left in the cold, as they were the ones truly responsible for the positive performance, and only received an average raise of 1.7% (Dekker, 2018). The large separation between executives and workers compensation led to the discussion of how the bonus given to the boss would actually affect the workers' motivation and in turn the expected profitability of the firm. Very little past literature has examined how the bonus internally affects the firm, thus this paper will examine how the bonus given to the bosses of firms affect the workers. Outcomes of this paper will aim to find how, and to which degree complaints about high bonuses for the bosses are grounded in terms of neglecting the importance of workers, and in turn effect on motivation and expected profits.

The use of bonuses is of importance for the successfulness of firms, and proper use of bonuses will stimulate employees to perform better (Bebchuk, 2008). Firms aim to find a balance of compensating successful executives enough to avoid losing them to competitors but will also be wary of the opinions of external parties criticizing the size of the compensation (Bebchuk & Fried, 2004). Additional arguments made by those supporting the sizable bonuses stressed that the benefits to shareholders by strengthening executive's incentives to perform would

¹ ING onder vuur na forse loonsverhoging topman Ralph Hamers - hij verdient straks meer dan 3 miljoen euro, 2018, <https://www.volkskrant.nl/economie/ing-onder-vuur-na-forse-loonsverhoging-topman-ralph-hamers-hij-verdient-straks-meer-dan-3-miljoen-euro~b87084d6/>

lead to return in increased shareholder value. It will also be necessary to examine how much of the gained value in the firm is due to the executive rather than due to the market itself and the employees within the firm. The bonus will motivate the executives to perform better, but the effect it has on the employees must also be considered as they are the ones who truly perform the core tasks of the firm. A high bonus for the boss will not always demotivate the worker though, as the worker may find motivation in wanting to achieve the high payment which the firm rewards the higher ranks with, as was found by Lazear and Rosen (1981) in their studies on Tournament Theory. Keeping the workers motivated will be of importance to the performance of the firm and thus the firm must be considerate of the signal they are sending to the workers when they are rewarding the boss.

Recognition is important to both the bosses and workers within a firm as a positive stimulus for the individual to keep up the good work (Neckermann, Cueni, & Frey, 2009). For a firm a bonus is one of the many tools it can use for the boss and worker to offer them the recognition they may seek to further motivate them. Neglecting the importance of the workers for example, can lead situations in which performance may suffer and thus decrease expected profitability (Glasscock & Gram, 1995). Bosses and workers are initially intrinsically motivated to achieve success. To increase the probability of success the individuals must be offered certain levels of recognition to further increase their levels of intrinsic motivation. Additionally, the bonus will improve the extrinsic motivation of the boss who receives further monetary reward as well as receiving recognition. If the bonus does not reflect the relative importance of the individuals involved the signal will no longer be believed, and will be passed off as cheap talk, no longer determining the way effort levels are set (Farrel & Rabin, 1996).

Through means of modelling the relationship between the expected profits of a firm and the effort exerted by the boss and worker, as well as modelling how level of effort is determined as a result of the bonus, one can find the relationship of the bonus on expected profitability of a firm. The bonus, which in this model will be conditional of the firm being successful, will act as a signaling tool to provide recognition to the individuals that are of relative importance to the firm. The model concludes that in Bayesian equilibrium the signal can provide individuals with information on their relative importance, and thus allows the boss and

worker to accordingly determine their level of effort in order to reach the outcome with highest expected profits while maximizing their utility.

Furthermore, the paper models a situation in which the bonus is no longer a contingency of success but will be received unconditionally by the boss, as is often the case, as bosses in firms receive sizable bonuses regardless of poor performance² (Bebchuk & Fried, 2004). The extension resulted in that the unconditional bonus will lead to a loss of the ability to use the bonus to signal recognition of importance, meaning there may be uncertainty for the boss and worker in determining their effort levels. Furthermore, the bonus loses its motivational power as it no longer is a contingency of performance, but rather becomes a disguised form of additional wages. Combined these two factors will lead to situation in which the expected profitability will diminish.

² When CEOs Are Paid for Bad Performance, 2005, <https://www.gsb.stanford.edu/insights/when-ceos-are-paid-bad-performance>

2. Model:

The three players included in the model are the board of the firm, the boss, and the worker, examining how they will behave following the introduction of a bonus from the firm as additional compensation for the boss. The firm will attempt to maximize expected profitability and is either successful ($X=1$), or not successful ($X=0$). The probability of the firm being successful will be determined by the effort exerted by the boss (e_B) and worker (e_W) and level of relative importance of effort exertion (λ).

$$\Pr(X = 1) = \lambda e_B + (1 - \lambda)e_W$$

Expected profits of the firm will be the probability of success multiplied by the profits (Y) of which the bonus (b_B) is subtracted.

$$E\pi = (\lambda e_B + (1 - \lambda)e_W)(Y - b_B)$$

The utility of the boss (U_B) and worker (U_W) will be represented by the following equations.

$$U_B = \lambda e_B + Xb_B - \frac{\gamma}{2} e_B^2$$
$$U_W = (1 - \lambda)e_W - \frac{\gamma}{2} e_W^2$$

The utility of the individuals is a result of the effort exerted respectively by the boss (e_B) and worker (e_W). The utility of the individuals is also dependent on the level of relative importance for the firm (λ) as well as the cost the individual will experience to exert effort for the firm, which will be weighted at a heavier cost through gamma (γ). Included in the model is the intrinsic motivation which is also represented by the relative importance and the effort exerted, as this is their internal drive for success of the firm. The utility function of the boss includes an additional variable in the form of a bonus which is conditional to whether the firm is successful or not (X) and their bonus (b_B).

For simplicity, an additional assumption is made in that the level of relative importance of effort (λ) can be high or low, and that the level of the bonus can either be high or low, thus forming a signal for the boss and worker of the appreciation for their work. For relative

importance of effort this means the value of λ is either high at $\frac{3}{4}$, or low at $\frac{1}{4}$. Other variables that can be replaced with fixed variables to allow better analysis include the values of the profit of the firm (Y) and weight of cost of effort (γ). Once the values for the income of the firm is known, the bonus size can be decided by the firm. The profit of the firm (Y) and weight of cost of effort (γ) are assumed at a value of 10. The values of the bonus being smaller than 10 as there would otherwise be a negative expected profit.

Using the following assumptions, one can further interpret the effect of the bonus, and how the level of bonus is decided by the firm as a result of previous knowledge they have acquired.

1. Nature chooses the level of relative importance of effort (λ)
2. Firm has recognized level of relative importance of effort (λ), and chooses level of bonus (b) to give
3. Boss (B) and worker (W) see the height of the bonus and determine the level of effort they are willing to exert

The manner in which the variables are determined sequentially by the other variables means that the model will look for a perfect Bayesian equilibrium. The sequential steps will lead to the players having certain beliefs and have an according strategy to result in the optimal outcome for each player.

3. Analysis:

The effort functions of the boss and worker can be derived using the aforementioned utility functions from Section 2, showing the levels of effort to be exerted following the signal of the bonus. Calculations can be found in Appendix A. The expected level of relative importance of effort given a level of bonus ($E(\lambda|b)$) will be an important variable in setting the level of effort. The bonus will be a signal of relative importance.

$$e_B = \frac{E(\lambda|b) + bE(\lambda|b)}{\gamma}, \quad e_W = \frac{1 - E(\lambda|b)}{\gamma}$$

A high bonus will lead to the boss believing he has a higher level of relative importance of effort. Likewise, a low bonus will lead to the worker believing he has a higher level of relative importance of effort. In this situation this would mean that for example the worker's effort would decrease following a higher bonus, as this would lead to a higher level of relative importance of effort of the boss, demotivating the worker whose effort is deemed of less importance.

As stated in section 2 the relative importance of the individual will either be high or low, as well as the bonus either being high or low. This will lead to the following 4 scenarios, examining how the levels of bonus will alter the profitability of the firm:

$E\pi(b, \lambda)$: Where b will be either high (b_H) or low (b_L), and λ will either be high (H) or low (L)

$$E\pi(b, \lambda) = \left(\lambda \left(\frac{E(\lambda|b) + bE(\lambda|b)}{\gamma} \right) + (1 - \lambda) \left(\frac{1 - E(\lambda|b)}{\gamma} \right) \right) (Y - b_B)$$

The bonus thus indicates the relative importance of the individual. A high bonus will lead to a high relative importance of the boss while a low bonus will reflect a low relative importance of the boss. The bonus will thus be a key signal for the firm to show the individuals involved how important they are to the firm, which in turn will allow the individuals to set their effort levels accordingly. This can be represented using the equations below:

$$E(\lambda|b = b_H) = H$$

$$E(\lambda|b = b_L) = L$$

The 4 scenarios would thus be:

$$E\pi(b_H, H) = \left(\frac{H^2 + b_H H^2 + (1 - H)^2}{\gamma} \right) (Y - b_H)$$

$$E\pi(b_L, H) = \left(\frac{HL + HLb_L + (1 - H)(1 - L)}{\gamma} \right) (Y - b_L)$$

$$E\pi(b_H, L) = \left(\frac{HL + HLb_H + (1 - H)(1 - L)}{\gamma} \right) (Y - b_H)$$

$$E\pi(b_L, L) = \left(\frac{L^2 + b_L L^2 + (1 - L)^2}{\gamma} \right) (Y - b_L)$$

The firm will be aware that to send a credible signal the following conditions must hold:

$$E\pi(b_H, H) > E\pi(b_L, H)$$

$$E\pi(b_L, L) > E\pi(b_H, L)$$

This will mean that the individual of high relative importance is recognized for it. When the worker is of high relative importance the boss receives a low bonus to show the importance of the worker. This condition will also have to hold to form a Bayesian equilibrium. If the bonus does not follow the relative importance the signal will no longer clarify the individual's relative importance.

Using the previous model will allow firms to more accurately find the expected profits of a firm following the level of bonus they introduce to the boss. Using values of high and low levels of relative importance of effort as well as values for the income of the firm (Y) and the size of the bonus will determine expected profit.

Using numeric simulations, the most profitable situation in which all conditions hold is when the high bonus is valued at 6, and the low bonus is valued at 0. These inputs giving the following expected profits as results when the bonus follows the individual of relative importance.

$$E\pi(b_H, H) = E\pi\left(6, \frac{3}{4}\right) = 1\frac{3}{5}$$

$$E\pi(b_L, L) = E\pi\left(0, \frac{1}{4}\right) = \frac{5}{8}$$

Whereas if the firm decides to not follow the relative importance of the boss with the bonus:

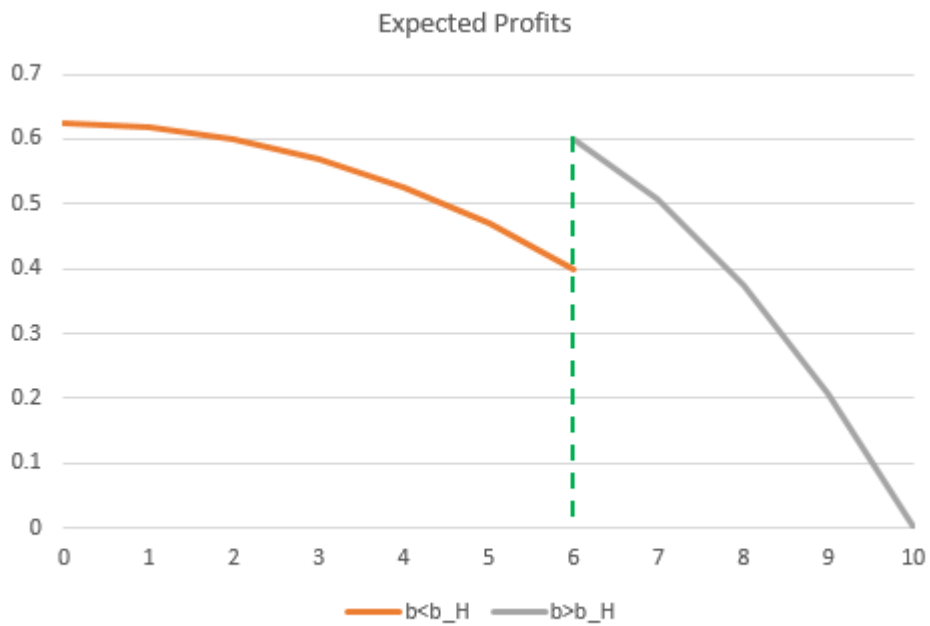
$$E\pi(b_L, H) = E\pi\left(0, \frac{3}{4}\right) = \frac{3}{8}$$

$$E\pi(b_H, L) = E\pi\left(6, \frac{1}{4}\right) = \frac{3}{5}$$

A high bonus given to a high boss importance, and a low bonus given low boss importance will be Nash equilibria over situations in which the bonus does not match level of importance of the boss holding all assumptions stated previously, as can be seen from the results above. For a firm it will thus be most profitable to match their level of bonus to the relative importance of the boss and worker which they will initially recognize. The boss and worker will know that the profitability of the firm is dependent on the effort exerted respectively and will know that matching the bonus to the level of relative importance will be most profitable. Thus, once the firm decides what the bonus is, either 6 or 0, the boss and workers will know who is of more relative importance to the firm and will believe the bonus as a signal of this, as the firm has no reason to give other levels of bonuses as this would only decrease profitability.

Having found that the highest expected profits will be reached while maintaining the signaling power of the bonus was 6, the firm will be interested in finding whether or not a deviation of the bonus will lead to higher expected profits. This would as function as proof that the highest expected profits are earned at a high bonus of 6. The firm will examine how the expected profits of the firm are altered given the bonus is either increased or decreased, while knowing which individual is of higher relative importance

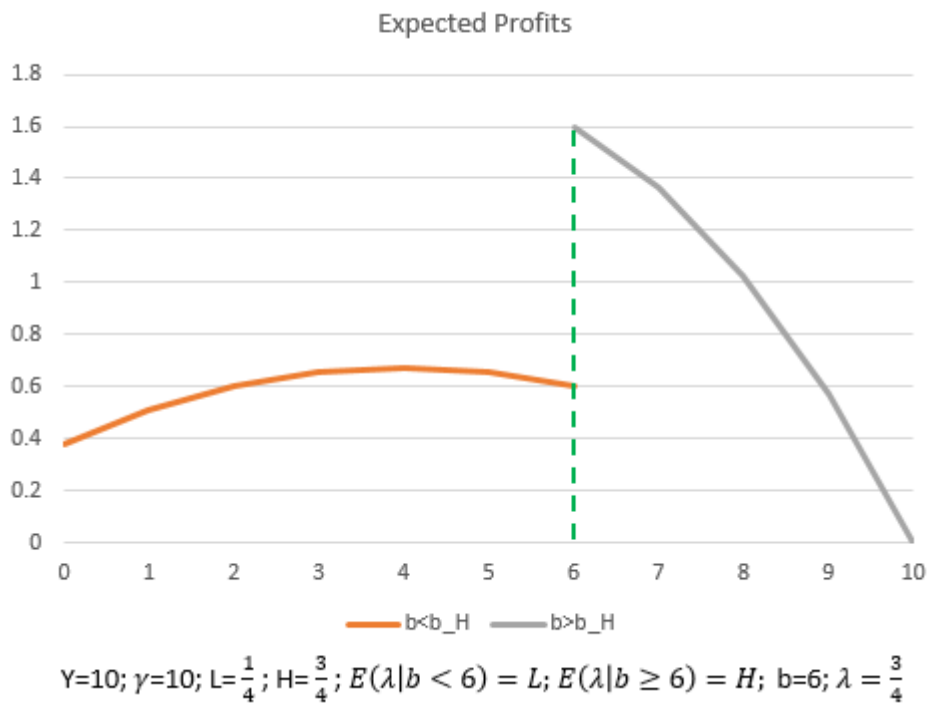
Figure 1.



$$Y=10; \gamma=10; L=\frac{1}{4}; H=\frac{3}{4}; E(\lambda|b < 6) = L; E(\lambda|b \geq 6) = H; b=6; \lambda = \frac{1}{4}$$

Figure 1 shows how the change in bonus would affect the profitability of the firm given that the bonus is 6. The boss and worker both believe that the high bonus is 6, and low bonus is 0. In this situation the boss is of low relative importance shown by the value of lambda (λ), the figure above will show the expected profits of the firm if the firm were to change the bonus. Deviating from the bonus would lead to the most profitable point at a bonus of 0, meaning the low bonus would be best suited for the boss matching his low relative importance. Increasing the bonus to a point above b_H would only be counterproductive and lead to decreased expected profits. Calculations for the numeric simulations can be found in appendix B.

Figure 2.



When the boss is of higher relative importance, as shown in figure 2, the firm would not increase the bonus level as this would lead to a decrease in expected profits. Likewise, decreasing the bonus would lead to decreased levels of profits. The boss is of high relative importance and rewarding him with the bonus of 6 would lead to a Bayesian equilibrium, the firm thus does not deviate their bonus.

As was shown in figure 1 and in figure 2 the firm will examine the effect of slight deviations of the bonus. The expected profits of such deviations can be calculated, such as when lowering the bonus as seen below:

$$E\pi(b_H, H) = E\pi\left(5, \frac{3}{4}\right) = 1.71875$$

$$E\pi(b_L, L) = E\pi\left(0, \frac{1}{4}\right) = \frac{5}{8}$$

This would appear to increase profits, as well as for both conditions in which the bonus does not follow the relative importance of the individuals. The issue that now arises is that in which the boss and worker no longer believe that the bonus is a true representation of their relative importance. An equilibrium will thus no longer exist in which the behavior of the boss or individual can be controlled through the bonus.

$$E\pi(b_L, H) = E\pi\left(0, \frac{3}{4}\right) = \frac{3}{8}$$

$$E\pi(b_H, L) = E\pi\left(5, \frac{1}{4}\right) = 0.65625$$

Both equations above show that the expected profit would be higher if the high bonus was lower, but the firm loses the ability to use the bonus as a signal, and thus the bonus will no longer lead to predictable behavior in the boss and worker. If the high bonus is always given it would mean the boss and worker can no longer deduce information about their relative importance, and thus their effort exerted will no longer be a reflection of the level of the bonus. It would no longer be possible to find a sequential Bayesian equilibrium if the bonus was lower, even though the profits are higher if the behavior of the individuals was held constant and predictable.

If the firm would decide to increase the high bonus to 7:

$$E\pi(b_H, H) = E\pi\left(7, \frac{3}{4}\right) = 1.36875$$

$$E\pi(b_L, L) = E\pi\left(0, \frac{1}{4}\right) = \frac{5}{8}$$

Results if the firm decides to match the bonus height to the relative importance of the boss:

$$E\pi(b_L, H) = E\pi\left(0, \frac{3}{4}\right) = \frac{3}{8}$$

$$E\pi(b_H, L) = E\pi\left(7, \frac{1}{4}\right) = 0.50625$$

Showing that there would be a significant decrease in the expected profits, and the expected profits would continue to decrease as the expense to the total possible profits would become too large while the 0 bonus remains consistent. In this situation the Bayesian equilibrium will hold, but will have lower expected profits compared to when the high bonus was fixed at 6. These calculations above again reflecting what could be seen in figure 1 and figure 2.

The high bonus 6 and low bonus 0 are thus the most profitable point at which the firm can use the bonus as a signal. The firm will have no desire to deviate from these levels of bonuses and will be in Bayesian equilibrium. The signal will be credible to the boss and worker and will allow the firm to maximize expected profitability. The analysis shows how the bonus thus does affect the way profits are earned by the firm, and how the efforts of the workers are affected by the bonus. Changing the bonus to match the individual who is of more relative importance will lead to those individuals who are being recognized to exert additional effort.

4. Analysis Extension: Pay without Performance

In section 3, this paper makes the assumption that the bonus is conditional on the firm being successful, yet evidence has shown that CEO's still receive bonuses, sometimes in disregard to the poor performance of a firm (Lublin, 2005). To further analyze the effect of the executive compensation through bonuses this paper examines the difference in profitability and the levels of effort exerted by the boss and worker as a result of the bonus being unconditional. Analyzing the relationship between the existing variables in a situation in which the bonus is often unconditional, where the size of the bonus may vary, will alter the model to attempt to give a more realistic representation of executive compensation (Bruce, Buck, Fattorusso, & Skovorda, 2007).

When examining the extension using all assumptions made in the prior section, one can find that for the firm it may no longer be beneficial to use a high bonus as a means of increasing expected profitability. The high and low bonus will still be a tool to increase the intrinsic motivation of the individuals involved, but the boss will no longer experience the additional forms of extrinsic motivation of the bonus. The bonus is no longer rewarding good performance, but rather has become a disguised form of wage. In section 3 the boss would exert higher levels of effort to increase the chance of success and in result get the bonus.

The new utility functions for the boss and worker represented as shown below:

$$U_B = \lambda e_B + b_B - \frac{\gamma}{2} e_B^2, \quad U_W = (1 - \lambda) e_W - \frac{\gamma}{2} e_W^2$$

The new utility function of the boss shows that the bonus is no longer conditional of the probability of success. In turn this will lead to the effort functions of the boss and worker to no longer be determined by the bonus in terms of extrinsic motivation. The bonus will still offer recognition to both the boss and the worker, thus still influencing their exertion of effort.

$$e_B = \frac{E(\lambda|b)}{\gamma}, \quad e_W = \frac{1 - E(\lambda|b)}{\gamma}$$

Calculations to find new expected profits and effort functions are shown in Appendix B.

As simulated in section 3, the firm will be interested in examining how deviations from the expected bonus will alter the expected profits. Giving a high bonus like 6 would lead to the firm always wanting to deviate to a low bonus. Changing the expected bonus from 6 to 1 will allow better analysis of a more realistically sized bonus given that it is unconditional. Given the expected bonus is 1, the firm can examine in which situations they are better off deviating or not deviating.

Figure 3.

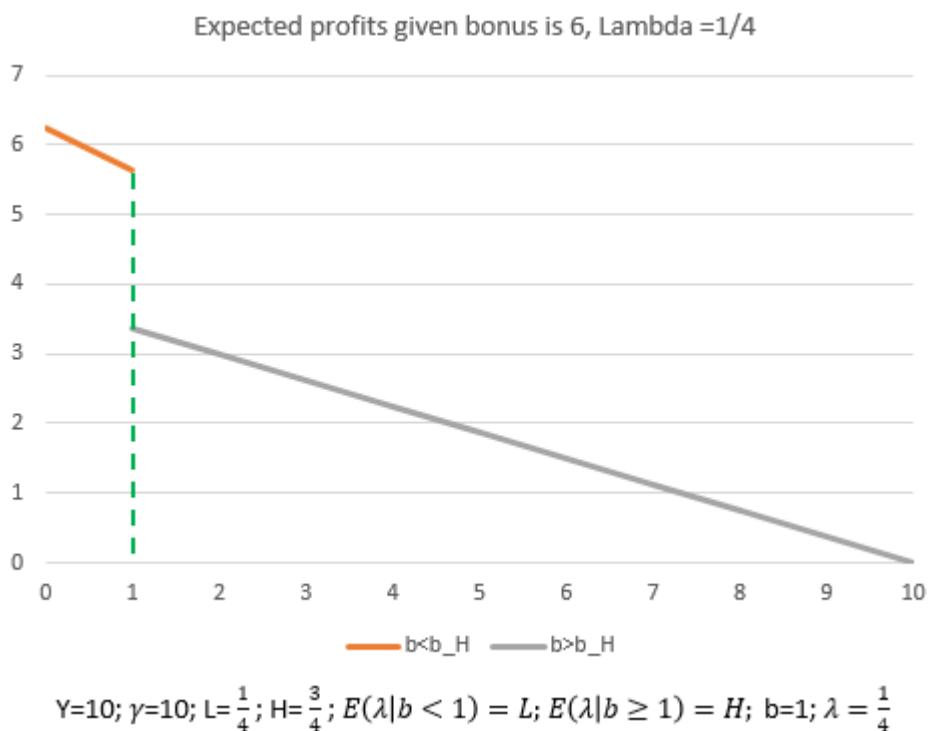


Figure 3 shows how increasing the bonus would lead to further decreases in expected profits. While when the boss is of low relative importance the firm earns the highest profit when the bonus is decreased to 0. Again, this shows how the bonus of the boss should be decreased to 0 when he is of low relative importance. In this case thus, the firm would deviate to offer a bonus of 0 to maximize expected profits.

Figure 4.

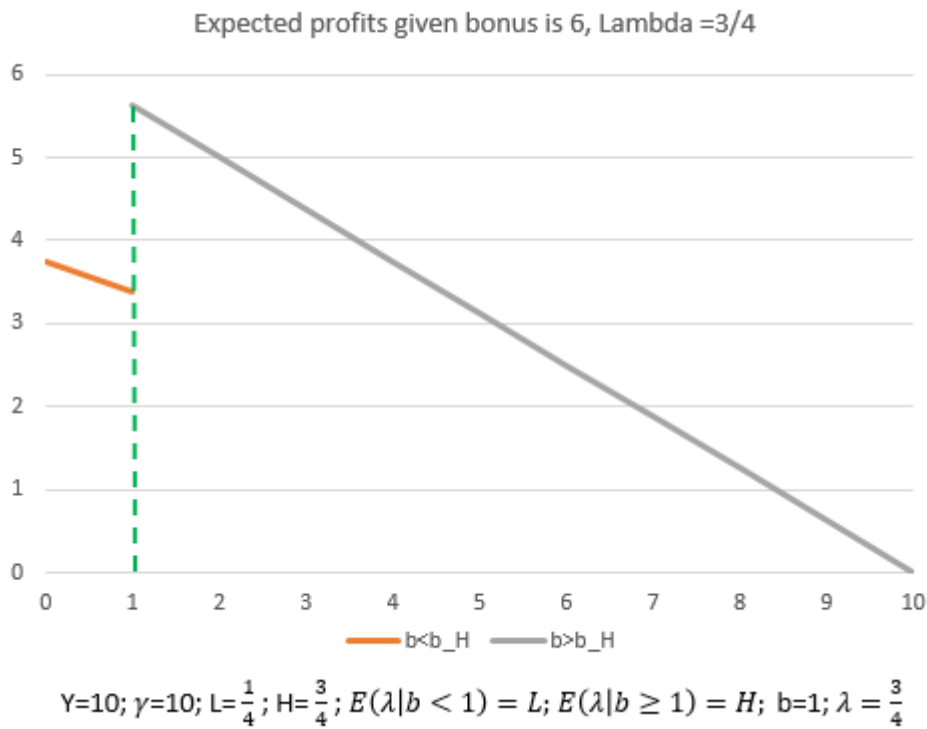


Figure 4, holds the same conditions as figure 3 except now the boss is of high relative importance to the firm. In this situation it is no longer beneficial for the firm to deviate to a lower bonus. For the firm to be able maintain their signaling power and thus better determine expected profits the firm is best off having a low bonus of 1. In this situation the firm will be able to indicate to the boss and worker who is of higher relative importance successfully, thus leading to the situation with the highest expected profits.

For high relative importance of the boss, the expected profits are as follow when the bonus is 0:

$$E\pi(b_H, H) = E\pi\left(0, \frac{3}{4}\right) = 0.625$$

$$E\pi(b_L, H) = E\pi\left(0, \frac{3}{4}\right) = 1.125$$

If the boss had low relative importance, the expected profits would be the following:

$$E\pi(b_H, L) = E\pi\left(0, \frac{1}{4}\right) = 0.625$$

$$E\pi(b_L, L) = E\pi\left(0, \frac{1}{4}\right) = 0.875$$

These results show that there is no longer a Bayesian equilibrium in which the bonus truthfully signals the relative importance of the boss and worker. A new pulling equilibrium arises as the firm is best off offering a low bonus regardless of the relative importance of the individuals.

In section 4 where the bonus was conditional of success, the boss offered additional levels of effort as the bonus increased to achieve a successful outcome. As the bonus has become unconditional the boss no longer strives to achieve this, but still, like the worker places value on the recognition aspect of the bonus. The boss and worker will still aim for success as there are intrinsically motivated to do so, but the individuals involved will only offer additional effort if their efforts are recognized through the signaling means of the bonus.

Due to the bonus costs being too high for the firm to compensate the additional effort, the firm could opt to avoid monetary bonuses, and aim for more interaction-based kinds of rewards to offer recognition. Issues that would arise if the bonus that was offered was always low, it would mean that the individuals involved would no longer believe that it was a truthful signal, and would no longer be able to determine what level of effort to determine as a result of the chosen level of bonus. What the firm could do to compensate this is to offer a high bonus of 1.

Offering a bonus of 1 to differentiate in types of bonuses the results would be as follows:

$$E\pi(b_H, H) = E\pi\left(1, \frac{3}{4}\right) = 0.5625$$

$$E\pi(b_L, H) = E\pi\left(1, \frac{3}{4}\right) = 1.125$$

$$E\pi(b_H, L) = E\pi\left(0, \frac{1}{4}\right) = 0.5625$$

$$E\pi(b_L, L) = E\pi\left(0, \frac{1}{4}\right) = 0.875$$

The results show that there would be equal or lower profits in each of the scenarios, still the firm no longer has trustworthy signals for the boss and worker. The loss of signaling power will mean that it will not be possible to achieve a Bayesian equilibrium as throughout the sequential decision-making steps the individuals will no longer know what the bonus means

in regard to their relative importance for the firm. The boss and worker may thus not know what levels of effort they wish to exert as they do not know whether they are or aren't being truthfully recognized for their relative importance. The bonus will no longer be considered a signal as it was in section 3 but be perceived as "cheap talk" and not taken seriously (Farrel & Rabin, 1996). Given that the high bonus is expected to be 1 by all involved, the firm would not want to deviate from this situation, as they would still have the signaling ability to reward and recognize the individual of more relative importance.

5. Results:

The model showed clear results in terms of looking for a Bayesian equilibrium in which a firm uses a bonus to signal the relative importance of individuals within the firm, to motivate them to exert more effort in an attempt to increase expected profitability. The expected profitability of the firm could be maximized by altering the bonus levels but could then risk losing the ability to signal to the boss and worker what their relative importance was. Losing the ability to signal through the bonus would mean that the effort levels exerted by the individuals would also be more randomized and thus mean no certain equilibrium could be reached. This paper finds that, with the assumptions made, that a high bonus of 6 and low bonus of 0, the highest expected profitability can be found in Bayesian equilibrium where the firm can then maximize its profits by using the bonus as a tool to recognize relative importance. When the high bonus was set at 6, the firm found that if the boss was of relative importance there was no desire to deviate from the bonus. Meanwhile if the worker was of high relative importance, the firm would maximize its expected profit by deviating from the high bonus of 6 to a bonus of 0. There are other points at which the firm could achieve higher levels of expected profits but would then no longer be able to use the bonus as a signaling tool as it is not believable for the boss and workers. This would lead to irrational behavior of the individuals involved could lead to situations which would be less beneficial to the firm. The loss of signaling ability, and no longer being able to determine an outcome using the bonus also being costly to the firm.

When the bonus is made unconditional of the success of the firm, the firm loses the ability to truthfully signal the relative importance of the boss and worker. The expense linked to the bonus being too substantial to be compensated by the additional performance of the boss. The boss no longer sees the bonus as a bonus, but rather as a disguised form of wage, and thus now only has improvements in effort when he is recognized for his relative importance, but it is no longer possible for the firm to do so. The firm is always best off offering the lower bonus thus both the boss and worker no longer believe what the firm is trying to signal and thinks that the recognition affect from the firm is cheap talk. When the high bonus was at 6, the firm always had the desire to deviate to a bonus of 0 regardless of the relative importance of the boss.

As a result it is best for the firm to offer a conditional bonus as a contingency of the success of the firm. Doing so allows the firm to achieve a Bayesian equilibrium in which all parties involved know that the bonus is a truthful representation of the relative importance of the boss and worker. Doing so will lead to the outcome with the highest expected profits outcome where the firm knows that the signal they send will determine the levels of effort exerted by the boss and worker.

6. Discussion:

The topic of boss and worker motivation through bonuses has been one that has been widely discussed in the past and will remain widely discussed for years to come (Core, Guay, & Larcker, 2008). This paper has considered several reasons explaining how the bonus will affect the expected profitability, but there are several aspects which were neglected in the model but would have significant effect on the way the bonus and effort levels were determined.

An aspect that is important to consider is the way the bonuses are formulated for bosses in a realistic setting. Past studies by Baumol (1967) and Marries (1963) found that where one would expect that executive compensation is a result of increased performance or increased profits it is often not the case. They argued that the reason for this was that executives are often more concerned with the growth rate of the firm and the size of the firm. Loomis (1982) also found that the compensation given to the bosses was not necessarily related to any measure of profitability, or to stock price performance. Firms will aim to remain profitable and to create value for its shareholders, and thus it must continue to find ways to motivate bosses to work for increased levels of expected profitability, their key tool as discussed before being the use of bonuses. As in Section 5, this is one of the reasons why unconditional bonuses are relatively unsuccessful in increasing the profitability of a firm, even though it appears that many firms are doing so anyways, as was found in a Stanford study (2005).

The firm should be considerate of what the bonus means for all the individuals involved, and how each of them may interpret it. The bonus would be paying an additional price to further motivate the boss if they believe he is of greater relative importance compared to the worker. The signal the firm sends by paying the additional price for the boss thus reflects his quality of being able to help the firm increase its chances of being successful, but also further drives the boss to use his qualities to actually achieve success (Wolinsky, 1983). For all the employees of a firm it is important to see the signal the firm gives about the importance of the boss and worker. The bonus will reveal who is more important to the firm, the bonus will thus also provide a degree of recognition to the boss or worker. It is critical for employees to be recognized for their ability and performance to continue exerting effort, as well as find enjoyment in work (Bishop, 1987). This is why, if a worker feels he is of importance, but the

bonus shows that the firm does not recognize this this may lead to the lower levels of effort exertion in future periods.

Additionally, the wages and bonuses of CEO's have been on the rise for an extended period of time, this being one of the reasons why it is being covered so extensively in economic papers (Core, Guay, & Larcker, 2008). In 1991 the average large company payed executives approximately 140 times the pay of an average worker, which has vastly increased to 500 times the wage of the average worker in 2003 (Bebchuk & Fried, 2004). As mentioned previously the trend of executives having increasing wages and bonuses making it increasingly important to see how the sizable rewards are affecting the rest of the firm such as the workers who are carrying out the work required from the firm.

Moreover, one of the arguments which is used for why the bonus is not clearly linked to the performance of the firm is that the bonus is also being used as a signal to outsiders of the firm. The firm may sometimes excessively show that they are in a strong position to compensate to outsiders that the firm is in a strong position. This may be the case when they are trying to scare competitors from certain industries, or to signal the faith of the firm to the stockholders. By offering excessive bonuses to executives the firm's board will be able to show they expect to earn superior profitability in the near future (Lukose & Sapar, 2002). The board must be considerate of all these different aspects when determining the bonus, and may thus decide on bonuses which may be less related to increasing expected profitability through maximizing effort exerted of the boss and worker.

As mentioned in the introduction, another possible reason for high wages at higher ranks could be the concept of tournament theory. The theory is explained by the higher wages being paid at higher levels to reward those who have exerted high levels of effort to work themselves into higher positions (Lazear & Rosen, 1981). This effect is not considered in the paper, but could be a variable which further motivates employees when the bonus is offered, and could thus further increase expected profits when the bonus is increased, as not only the boss is then motivated by the height of the bonus.

Furthermore, it is important to consider the intrinsic motivation of the boss and worker during the situation presented. The intrinsic motivation defined as being the reward an individual earns from an activity without any external rewards except for the activity itself (Deci, 1971). It is often considered that external rewards decrease intrinsic motivation (deCharms, 1968). The initial explanation of financial rewards reducing the intrinsic motivation follows the concept that the external financial reward is used to control the individual and thus is no longer working in his own interest (Festinger, Hiroshi, & Burnham, 1967). In the model currently presented the differences for the boss and worker include that the boss is offered a financial compensation as a reward, and thus more directly has its intrinsic motivation affected by the bonus. For the worker the bonus is merely a signal of appreciation and importance of the effort exerted, meaning the worker is not controlled to perform in the same manner as the boss. Studies have shown that the social approval given to people will not necessarily crowd out the intrinsic motivation of the individual and may continue to be intrinsically motivated regardless of the external factors (Deci, 1971). For the boss the bonus will significantly affect the effort exerted as the financial reward is great enough, for the worker the extrinsic motivation must come in the form of recognition which may retain his intrinsic motivation, whereas the boss is likely to lose his intrinsic motivation as a result of the further introduction of the bonus.

Extrinsic motivation will be controlled by monetary reward, Festinger (1967) stated, whereas the intrinsic motivation can be empowered through means of recognition. As discussed previously, one way in which a firm can motivate its employees is through means of monetary rewards such as a bonus. This is the most measurable and tangible way in which the reward can be given, as most other ways in which recognition for good performance are made through interactions between the boss and workers. As Nelson (2005) concluded, he could “confirm what almost every employee already knows: that recognition for a job well done is the top motivator of employee performance”. Other rewarding means other than monetary are neglected in this paper but if considered would have a significant effect on the level of effort exerted by the workers. The boss receives a monetary reward, but part of his job would include the management of the workers and making sure they are put in a situation in which they are more likely to exert increased levels of effort (Bradler, Dur, Neckermann, & Non, 2016). This means that as the boss would exert more effort it would mean they would perform

their job better in the motivating of workers, who in turn would also increase their level of effort exerted. There would be a constraint in an amount of thoughtful and truthful recognition that the boss could offer the workers, but would still have a significant effect on worker motivation (Bradler, Dur, Neckermann, & Non, 2016). The model neglects how better management would further increase workers effort exertion. The effort exerted by the boss is positively correlated to that of the worker, meaning that increasing the bonus for the boss would be one way to increase the worker motivation (Karia & Asaari, 2006).

A continuation of rewards for the boss and worker should also include that monetary rewards are not the only or most effective way to motivate individuals as stated by Nelson (2005) before. The different ways in which individuals can be recognized range from simple personal discussions with management, to public mentions in newspapers of the individual's performance. Interaction-based recognition may be what the boss and worker want, leading to them increasing their levels of effort exertion in an attempt to achieve recognition they desire (Nelson, 2012). Levels of recognition and the way they receive personal recognition through interaction, such as those mentioned before which are not of monetary value are difficult to measure. Therefore, these interactions are difficult to distinguish. There are many variables which influence how a certain action by management is interpreted by the workers, aspects such as whether they are the only one receiving the recognition, whether they receive it beforehand or afterwards, whether it is believable, but also how much effort management had to exert to show the recognition (Bradler, Dur, Neckermann, & Non, 2016). These are only a few of the many ways that the recognition could be altered by the individual in how they feel it comes across and whether or not it will actually influence their levels of motivation. Accordingly, it is thus important to note that monetary rewards are not the only way to increase motivation within a firm, and that personal touches which can be added through interactional recognition will also be effective if performed well.

7. Conclusion:

The primary aim of this paper was to find what the effect of executive compensation is on worker motivation and the profitability of a firm. This question had arisen as there was increasing amounts of attention for executive compensation schemes, yet less attention was given to the effect it would have on the firm itself as well as the motivation of the employees within the firm. Aspects which were considered included the impact of the recognition effect of the bonus, and the bonus being a tool to signal the relative importance of the boss and worker.

Modelling the relationship of the bonus to the expected profitability and the effort determination of the boss and worker found that through achieving a Bayesian equilibrium in which the bonus followed the relative importance the bonus could be used as a signaling tool. When the signal was believable and truthful in equilibrium, it allowed the firm to maximize the effort exertion of the individuals of most relative importance to maximize expected profits. Furthermore, having a bonus that was conditional of success led to improved amounts of effort exertion by the boss, leading to higher levels of expected profits.

Modelling the relationship of the bonus to expected profitability when the bonus was unconditional of success led to situations in which the bonus could no longer be used as a tool to recognize relative importance. Losing the bonus as signaling tool meant that the bonus could be considered cheap talk which did not truthfully represent the relative importance of the individuals involved, who thus no longer used the bonus as a determinant in their levels of effort exertion.

While the bonus was a tool to improve the expected profits, the boss and worker were intrinsically motivated to attempt to achieve success. For the boss, the intrinsic motivation may be crowded out by the additional reward they receive in monetary means, but will also gain motivation due to the recognition effect of the signal the bonus sends. Likewise, for the worker, their intrinsic motivation will improve when the boss is not offered a bonus as this signals their importance.

In the future, it is advisable for firms to consider the importance of the signals they send to their employees, and the levels of recognition they offer them. When the boss and worker are recognized for their relative importance it leads to them to increase their willingness to exert additional effort leading to improvements of expected profits. The credibility of the recognition will be required as the lack thereof would lead to the boss and worker not using the bonus signal as a determinant of their effort. This would mean that the firm no longer has the ability to reach an equilibrium in which they can affect the way the expected profits of the firm are determined.

Bibliography

- Baumol, W. J. (1967). *Business behavior, value and growth*. New York: Harcourt, Brace & World.
- Bebchuk, L., & Fried, J. (2004). *Pay without performance*. Cambridge: MA: Harvard University Press.
- Bishop, J. (1987). The recognition and reward of employee performance. *Journal of Labor Economics*, S36-S56.
- Bradler, C., Dur, R., Neckermann, S., & Non, A. (2016). Employee Recognition and Performance: A Field Experiment. *Management Science*, 3085-3099.
- Bruce, A., Buck, T., Fattorusso, R., & Skovorda, R. (2007). Executive bonus and firm performance in the UK. *Long Range Planning*, (pp. 280-294).
- Coles, C. (2017, September 19). *Average Weekly Earnings, bonus payments in Great Britain: 2017*. Retrieved from Office for National Statistics: <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/averageweeklyearningsbonuspaymentsingreatbritain/2017>
- Core, J., Guay, W., & Larcker, D. (2008). The power of the pen and executive compensation. *Journal of financial economics*, 1-25.
- Core, J., Guay, W., & Thomas, R. (2005). Is US CEO compensation broken? *Journal of Applied Corporate Finance*, 97-104.
- deCharms, R. (1968). *Personal causation: The internal affective determinants of behavior*. Routledge: Academic Press.
- Deci, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. *Journal of personality and Social Psychology*, 105.
- Dekker, W. (2018, March 8). *ING onder vuur na forse loonsverhoging topman Ralph Hamers - hij verdient straks meer dan 3 miljoen euro*. Retrieved from De Volkskrant: www.volkskrant.nl
- Erkens, D., Hung, M., & Matos, P. (2012). Corporate governance in the 2007-2008 financial crisis: Evidence from financial institutions worldwide. *Journal of corporate finance*, 389-411.
- Farrel, J., & Rabin, M. (1996). Cheap Talk. *Journal of Economic perspectives*, 103-118.
- Festinger, L., Hiroshi, O., & Burnham, C. A. (1967). Efference and the conscious experience of preception. *Journal of Experimental Psychology*, 74.
- Glasscock, S., & Gram, K. (1995). Winning ways: Establishing an effective workplace recognition system. *Global Business and Organization Excellence*, 91-102.
- Karia, N., & Hasmi Abu Hassan Asaari, M. (2006). The effects of total quality management practices on employees' work-related attitudes. *The TQM magazine*, 30-43.
- Lazear, E., & Rosen, S. (1981). Rank-order tournaments as optimum labor contracts. *Journal of political Economy*, 841-864.
- Loomis, C. J. (1982). The madness of executive compensation. *Fortune*, 42-52.
- Lublin, J. S. (2005). CEO bonuses rose 46.4% at 100 big firms in 2004. *Wall Street Journal*.
- Lukose, J., & Sapor, N. R. (2002). Does bonus issue signal superior profitability? A study of the BSE listed firms.
- Marris, R. (1963). A model of managerial enterprise. *Quarterly Journal of Economics*, 185-209.
- Mehran, H. (1995). Executive compensation structure, ownership, and firm performance. *Journal of financial economics*, 163-184.

- Neckermann, S., Cueni, R., & Frey, B. S. (2009). What is an award worth? : an econometric assessment of the impact of awards on employee performance.
- Nelson, B. (2012). *1501 ways to reward employees*. Workman Publishing.
- Stanford GSB. (2005). When CEOs Are Paid for Bad Performance. *Graduate School of Stanford Business*.
- Wolinsky, A. (1983). Prices as signals of product quality. *The review of economic studies*, 647-658.

Appendix

Appendix A:

Calculations Section 4. Conditional Bonus

Expected profits of the firm are defined as:

$$E\pi = \Pr(X = 1)(Y - b_B)$$

Where probability of success is:

$$\Pr(X = 1) = \lambda e_B + (1 - \lambda)e_W$$

This results in the following expected profit function for the firm:

$$E\pi = (\lambda e_B + (1 - \lambda)e_W)(Y - b_B)$$

Using the utility function of the boss and worker one can derive the effort levels:

$$U_B = \lambda e_B + X b_B - \frac{\gamma}{2} e_B^2, \quad U_W = (1 - \lambda)e_W - \frac{\gamma}{2} e_W^2$$

Effort function for boss derivation:

$$\begin{aligned} U_B &= \lambda e_B + X b_B - \frac{\gamma}{2} e_B^2 \\ X &= \lambda e_B + (1 - \lambda)e_W \\ U_B &= \lambda e_B + (\lambda e_B + (1 - \lambda)e_W)b_B - \frac{\gamma}{2} e_B^2 \\ \lambda_{boss} &= E(\lambda|b)_{boss} = 1 - b \\ U_B &= E(\lambda|b)e_B + (E(\lambda|b)e_B + (1 - \lambda)e_W)b_B - \frac{\gamma}{2} e_B^2 \\ U_B &= (1 - b)e_B + ((1 - b)e_B + (1 - \lambda)e_W)b_B - \frac{\gamma}{2} e_B^2 \\ U_B &= e_B - b e_B + (1 - b)e_B b_B + e_W b_B - \lambda e_W b_B - \frac{\gamma}{2} e_B^2 \\ \frac{d}{d e_B} &= 1 - b + (1 - b)b_B - \gamma e_B = 0 \\ e_B &= \frac{E(\lambda|b) + b E(\lambda|b)}{\gamma} \end{aligned}$$

Effort function for worker derivation:

$$\begin{aligned} U_W &= (1 - \lambda)e_W - \frac{\gamma}{2} e_W^2 \\ \lambda_{worker} &= E(\lambda|b)_{worker} = 1 - b \\ U_W &= (1 - (1 - b))e_W - \frac{\gamma}{2} e_W^2 \\ U_W &= b e_W - \frac{\gamma}{2} e_W^2 \\ \frac{d}{d e_W} &= b - \gamma e_W = 0 \\ e_W &= \frac{1 - E(\lambda|b)}{\gamma} \end{aligned}$$

Using the effort functions which were derived previously, this can be used to further analyze the expected profits function:

$$E\pi = (\lambda e_B + (1 - \lambda)e_W)(Y - b_B)$$

$$e_B = \frac{E(\lambda|b) + bE(\lambda|b)}{\gamma}, \quad e_W = \frac{1 - E(\lambda|b)}{\gamma}$$

Combined lead to:

$$E\pi(b, \lambda) = \left(\lambda \left(\frac{E(\lambda|b) + bE(\lambda|b)}{\gamma} \right) + (1 - \lambda) \left(\frac{1 - E(\lambda|b)}{\gamma} \right) \right) (Y - b_B)$$

As discussed in Section 4. Analysis this leads to 4 different scenarios:

- High bonus: b_H
- Low bonus: b_L
- High relative importance boss: H
- Low relative importance boss: L

$$E\pi(b_H, H) = \left(\frac{H^2 + b_H H^2 + (1 - H)^2}{\gamma} \right) (Y - b_H)$$

$$E\pi(b_L, H) = \left(\frac{HL + HLb_L + (1 - H)(1 - L)}{\gamma} \right) (Y - b_L)$$

$$E\pi(b_H, L) = \left(\frac{HL + HLb_H + (1 - H)(1 - L)}{\gamma} \right) (Y - b_H)$$

$$E\pi(b_L, L) = \left(\frac{L^2 + b_L L^2 + (1 - L)^2}{\gamma} \right) (Y - b_L)$$

APPENDIX B:

Numeric Simulation Conditional Bonus

Numeric Simulation of possible deviation of bonus for firm given expected bonus of 6 when the bonus is conditional

Using the expected profits and effort functions of the boss and worker:

$$E\pi = (\lambda e_B + (1 - \lambda)e_W)(Y - b_B)$$

$$e_B = \frac{E(\lambda|b) + bE(\lambda|b)}{\gamma}, \quad e_W = \frac{1 - E(\lambda|b)}{\gamma}$$

And adding the assumptions:

$$Y=10; \gamma=10; L=\frac{1}{4}; H=\frac{3}{4}; b=6$$

$$E(\lambda|b \geq 6) = H$$

$$E(\lambda|b < 6) = L$$

This allows finding values for the effort levels of the boss and worker given whether the bonus is less than or greater or equal to 6.

$$e_B = (1 + b)\frac{1}{40} \text{ when } b < 6$$

$$e_W = \frac{3}{40} \text{ when } b < 6$$

$$e_B = (1 + b)\frac{3}{40} \text{ when } b \geq 6$$

$$e_W = \frac{1}{40} \text{ when } b \geq 6$$

This allows the formulation of the following expected profits functions:

$$\lambda = 0.25; b \geq 6; E\pi = \frac{-3b^2 + 24b + 60}{160}$$

$$\lambda = 0.25; b < 6; E\pi = \frac{-b^2 + 100}{160}$$

$$\lambda = 0.75; b \geq 6; E\pi = \frac{-9b^2 + 80b + 100}{160}$$

$$\lambda = 0.75; b < 6; E\pi = \frac{-3b^2 + 24b + 60}{160}$$

The equations above will allow numeric simulation of the effect of the deviation of the bonus on the expected profits given the bonus is conditional and valued at 6.

Appendix C:

Calculation Section 5. Unconditional Bonus

Using the utility function of the boss and worker one can derive the effort levels. Unlike in section 4 the bonus is no longer a contingency of success:

$$U_B = \lambda e_B + b_B - \frac{\gamma}{2} e_B^2, \quad U_W = (1 - \lambda)e_W - \frac{\gamma}{2} e_W^2$$

Effort function for boss derivation:

$$\begin{aligned} U_B &= \lambda e_B + b_B - \frac{\gamma}{2} e_B^2 \\ \lambda_{boss} &= E(\lambda|b)_{boss} \\ U_B &= E(\lambda|b)e_B + b_B - \frac{\gamma}{2} e_B^2 \\ \frac{d}{de_B} &= 1 - b - \gamma e_B = 0 \\ e_B &= \frac{E(\lambda|b)}{\gamma} \end{aligned}$$

Effort function for worker derivation is unaffected by the unconditional bonus:

$$\begin{aligned} U_W &= (1 - \lambda)e_W - \frac{\gamma}{2} e_W^2 \\ \lambda_{worker} &= E(\lambda|b)_{worker} = 1 - b \\ U_W &= (1 - (1 - b))e_W - \frac{\gamma}{2} e_W^2 \\ U_W &= b e_W - \frac{\gamma}{2} e_W^2 \\ \frac{d}{de_W} &= b - \gamma e_W = 0 \\ e_W &= \frac{1 - E(\lambda|b)}{\gamma} \end{aligned}$$

This leads to:

$$\begin{aligned} E\pi &= (\lambda e_B + (1 - \lambda)e_W)(Y - b_B) \\ e_B &= \frac{E(\lambda|b)}{\gamma}, \quad e_W = \frac{1 - E(\lambda|b)}{\gamma} \end{aligned}$$

Combined into:

$$E\pi(b, \lambda) = \left(\lambda \left(\frac{E(\lambda|b)}{\gamma} \right) + (1 - \lambda) \left(\frac{1 - E(\lambda|b)}{\gamma} \right) \right) (Y - b_B)$$

As discussed in Section 4, in Section 5 this also leads to 4 different scenarios in which the following options exist:

- High bonus: b_H
- Low bonus: b_L
- High relative importance boss: H
- Low relative importance boss: L

This results in the following 4 equations showing the expected profits given the varying scenarios:

$$E\pi(b_H, H) = \left(\frac{H^2 + (1 - H)^2}{\gamma} \right) (Y - b_H)$$
$$E\pi(b_L, H) = \left(\frac{HL + (1 - H)(1 - L)}{\gamma} \right) (Y - b_L)$$
$$E\pi(b_H, L) = \left(\frac{HL + (1 - H)(1 - L)}{\gamma} \right) (Y - b_H)$$
$$E\pi(b_L, L) = \left(\frac{L^2 + (1 - L)^2}{\gamma} \right) (Y - b_L)$$

APPENDIX D:

Numeric Simulation Unconditional Bonus

Numeric Simulation of possible deviation of bonus for firm given expected bonus of 1 when the bonus is unconditional.

$$E\pi = (\lambda e_B + (1 - \lambda)e_W)(Y - b_B)$$

$$e_B = \frac{E(\lambda|b)}{\gamma}, \quad e_W = \frac{1 - E(\lambda|b)}{\gamma}$$

And adding the assumptions:

$$Y=10; \gamma=10; L=\frac{1}{4}; H=\frac{3}{4}; b=1$$

$$E(\lambda|b \geq 1) = H$$

$$E(\lambda|b < 1) = L$$

This allows finding values for the effort levels of the boss and worker given whether the bonus is less than or greater or equal to 6.

$$e_B = \frac{1}{4} \text{ when } b < 1$$

$$e_B = \frac{3}{4} \text{ when } b \geq 1$$

$$e_W = \frac{3}{4} \text{ when } b < 1$$

$$e_W = \frac{1}{4} \text{ when } b \geq 1$$

This allows the formulation of the following expected profit functions:

$$\lambda = 0.25; b \geq 1; E\pi = \frac{60-6b}{16}$$

$$\lambda = 0.25; b < 1; E\pi = \frac{100-10b}{16}$$

$$\lambda = 0.75; b \geq 1; E\pi = \frac{100-10b}{16}$$

$$\lambda = 0.75; b < 1; E\pi = \frac{60-6b}{16}$$

The equations above will allow numeric simulation of the effect of the deviation of the bonus on the expected profits given the bonus is conditional and valued at 1.