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Abstract. Facing the incredible growth of CEO-worker pay gap (CWPG) in business practices across the world, the traditional principal-agent theory and the tournament theory cannot explain it to a satisfied degree. In order to deal with such a research gap, a new perspective named risk aversion is proposed to investigate the forming mechanism of CWPG by building a theoretical model. The model proves that the firm determines CEO compensation level according to the potential loss of firm value that may be produced by the CEO with under-utilizing or misusing his/her discretion, which depends on the relative level of CEO compensation to the average CEO compensation in the professional manager market, while the firm sets employee compensation level according to his/her marginal outputs. The repeated dynamic game among all the CEOs and the firms in various industries would naturally make the average CEO compensation level increase rapidly, while the increase rate of the employee’s marginal outputs is much slower. In this way, EWPG would inevitably and reasonably experience explosive growth.

Introduction

CEO-worker pay gap (CWPG) refers to the compensation disparity between CEO and the common front-line staff (Cowherd, Douglas M., &Levine, David I., 1992)[1]. In macro level, too large EWPG can negatively affect the wealth distribution and further determine the social harmony and stability; while in micro level, extra EWPG may hinder the work effort of employees and further negatively do harm to firm performance to a large degree (Olubunmi Faleye et al., 2013)[2]. Since CWPG has increased to a much high level, and what is more, it is still growing almost at an unlimited pace, CWPG has been receiving ever increasing attention from the scholars across the world, and especially it is true in China. In order to control CWPG reasonably, Chinese government has issued lots of laws and regulations on the setting of CWPG for the state-owned enterprises, which attempt to limit the rapid growth of CWPG in China. However, the effectiveness of such policies is not very good and the quick growth of CWPG in China is still unlimited in practice.

The invalidity of the policies and regulations fighting against the savage enlargement of EWPG may derive from the misunderstanding of the forming and increasing mechanisms of EWPG. Though both the principal-agent theory and the tournament theory have explained the forming and increasing mechanisms of EWPG from their own perspectives (Patrick E. Downes, &Daejeong Choi, 2014; David Gill, &Rebecca Stone, 2010) [3,4], both the extremely high level of EWPG and the incredible increase rate of EWPG cannot be clarified to a good degree. In this case, in order to produce theoretical guidance for the government and the firms in designing more effective countermeasures on limiting EWPG to a reasonable level, some new theoretical perspectives should be initiated by the scholars. In our opinion, risk aversion theory may be a better theoretical perspective in understanding the issue of unlimited EWPG increase.
At present, there are mainly two competitive theories on the forming of EWPG, respectively the principal-agent theory and the tournament theory. The principal-agent theory focuses on the interests divergence between the CEO, i.e. the agent, and the shareholders, i.e., the principal. In this perspective, the CEO has the motivation to be lazy and invest less energy in firm running, while the shareholders have the motivation to monitor the CEO on the proper use of CEO discretion and motivate the CEO based on her performance (Junghyun Lee, & M. Susan Taylor, 2014) [5]. In this way, performance-based compensation would be designed to induce the work effort of the CEO. Since the position of CEO is more special relative to the positions of the employees, in the views of the shareholders, the CEO would produce great value to the firm (Alex Bryson et al., 2014) [6], while the individual employees contribute to the firm value much less than the CEO. According to this logic, there naturally would be a rather large CWPG in firms with better performance.

The scholars holding the tournament theory investigates the two questions on the effectiveness of the principal-agent theory in detail and further provides a much tougher question which can be described as follows: Once a top executive were promoted as the CEO, the compensation level would doubled or even get much higher (Kornelius Kraft, & Antonia Niederprüm, 1999) [7]. Though the tournament theory can explain the large EWPG to a better degree than the principal-agent theory can do, it is a pity that there are still at least two limitations for this perspective. First, though large EWGP can be anchored to the high prize gap between the champion and the other players to a good degree, the ever increasing growth of such a large EWGP cannot be explained by the tournament theory perfectly till today (B. William Demeré et al., 2016; Jing Chen et al., 2011; Bing-Xuan Lin & Rui Lu, 2009) [9, 10, 11]; Second, as we all know, firm running is not the same with the sports tournament. In the situation of the sports tournament, the only winner is the champion, and the only way of winning is to be the champion; However, in the situation of the firm running, the ways of winning are various besides being promoted as the CEO.

Facing with the theoretical gap in explaining EWPG’s forming and increasing mechanisms, the paper proposes a new perspective named “risk aversion theory”, which argues that the firm provides high compensation for the CEO just out of the motivation of minimizing the potential loss due to the under-utilization or/and even abuse of CEO discretion empowered by the CEO position, instead of the marginal performance contribution the firm of the CEO. In order to avoid such bad results, the best choice of the firm is to provide the CEO with much higher compensation than the reasonable level based on the CEO’s marginal performance contribution.

Model on the Forming Mechanism of EWPG from the Risk Aversion Perspective

In this section, we respectively discuss the case of under-utilization of CEO discretion and the case of abuse of CEO discretion. The potential risk of performance loss for a firm is the summation of the negative effects on firm value under the two cases.

The Determination of EWPG under the Consideration of Under-Utilization of CEO Discretion

The CEO has her own expectation on her compensation, which is always built on the comparison with at least the average level of the CEOs’ compensation in this industry or in this region, and sometimes, for some special CEOs, the comparison benchmark is even the highest level of the CEOs’ compensation in the country or the whole world (Bill Francis et al., 2013) [13]. We set this expected compensation level as pay e. When the real compensation level (pay r) is lower than pay e, then the engagement effort would be reduced to certain degree, and the reduced effort level is marked as e r. When the CEO feels that her compensation level is lower than her expected level, the phenomenon of under-utilizing CEO discretion for the interest maximization emerges at a certain possibility (pos u). Under the assumptions above, the potential loss of firm value (lfv u) due to the under-utilization of CEO discretion can be expressed as Eq.1.
In Eq.1, \( pos^a \) can be formulated as Eq.2, which is positively dependent on the relative level of the CEO’s expected compensation to the CEO’s real compensation and negatively dependent on the professional ethics of the CEO (\( pre^a \)).

\[
pos^a = f_a^p \left( \frac{\text{pay}^e}{\text{pay}^r}, \text{pre}^e \right) \quad \frac{\partial f_a^p}{\partial \text{pay}^r / \text{pay}^e} > 0 \quad \frac{\partial f_a^p}{\partial \text{pre}^e} < 0 \quad \frac{\partial f_a^p}{\partial \text{ten}_c} > 0
\]

In Eq.1, \( e_r \) can be expressed as Eq.3, which is positively dependent on the relative level of the CEO’s expected compensation to the CEO’s real compensation and negatively dependent on the monitoring effectiveness of the shareholders on the CEO (\( mon^r \)).

\[
e_r = f_e^c \left( \frac{\text{pay}^e}{\text{pay}^r}, \text{mon}^r \right) \quad \frac{\partial f_e^c}{\partial \text{pay}^r / \text{pay}^e} > 0 \quad \frac{\partial f_e^c}{\partial \text{mon}^r} < 0
\]

In Eq.1, \( size \) means the firm’s size measured by the operating income, which positively determines the potential loss of firm value (\( lfv^u \)). \( \alpha \) represents the degree of the CEO’s capability (i.e. easiness degree) in lowering firm performance, and \( D \) is the CEO discretion empowered to the CEO position by the shareholders. \( \alpha \) and \( D \) co-determine \( lfv^u \) by exponential function of \( e_r \).

CEO faces with great \( size \) and \( D \), and her capability in lowering firm performance (\( \alpha \)) is usually high enough. When \( \text{pay}^r \) is obviously smaller than \( \text{pay}^e \), both \( e_r \) and \( pos^a \) are high enough. In this case, \( lfv^u \) is very impressive in quantity for a firm. In order to minimize \( lfv^u \), the best choice of the firm is to set CEO’s compensation beyond the expected level (\( \text{pay}^e \)). Compared with the extra compensation cost relative to the so-called “acceptable” CEO pay level (\( \text{pay}^a \)) determined based on her marginal performance contribution, the avoided potential loss of the firm value is much higher, i.e., \( lfv^u >> \text{pay}^r - \text{pay}^a \). Therefore, to provide a compensation level (\( \text{pay}^r \)) to CEO is a reasonable choice for a firm.

The Determination of EWPG under the Consideration of Abuse of CEO Discretion

Holding all the assumptions above, several further assumptions are provided for the situation of considering the abuse of CEO discretion. First, when the real compensation level (\( \text{pay}^r \)) is lower than \( \text{pay}^e \), then the CEO would invest negative effort (\( e_n \)) in hurting firm value initiatively with a possibility expressed as \( pos^a \), which is determined by Eq.4.

\[
pos^a = f_n^p \left( \frac{\text{pay}^e}{\text{pay}^r}, \text{pre}^e, \text{ten}_c \right) \quad \frac{\partial f_n^p}{\partial \text{pay}^r / \text{pay}^e} > 0 \quad \frac{\partial f_n^p}{\partial \text{pre}^e} < 0 \quad \frac{\partial f_n^p}{\partial \text{ten}_c} > 0
\]

\[
e_n = f_e^c \left( \frac{\text{pay}^e}{\text{pay}^r}, \text{mon}^r, \text{ten}_c \right) \quad \frac{\partial f_e^c}{\partial \text{ten}_c} > 0 \quad \frac{\partial f_e^c}{\partial \text{pay}^r / \text{pay}^e} > 0 \quad \frac{\partial f_e^c}{\partial \text{mon}^r} < 0
\]

According to Eq.4 and Eq.5, \( \text{ten}_c \) represents the tenure of CEO, which is positively associated with the possibility of the CEO’s abuse of CEO discretion and the effort degree of doing harm to firm value.

The potential loss of firm value due to the misuse of CEO discretion (\( lfv^u \)), which results from the lower CEO’s real compensation level (\( \text{pay}^r \)) relative to the CEO’s expected level determined by the average or even the top of the CEOs’ compensation level (\( \text{pay}^e \)) in the industry, in the region, or even in the whole country, can be expressed as Eq.6.
\[ lfv^u = pos^u * size^u * (e^n)^{\beta u} \]  \hspace{1cm} (6)

CEO faces with high discretion \((D)\) and holds high level of capability \((\beta)\) negatively manipulating firm performance. When \(e^n\) and \(pos^n\) are high and \(size\) is huge, \(lfv^u\) is pretty enormous in amounts. Since both the \(e^n\) and \(pos^n\) decrease sharply with the increase of \(pay^u\) according to Eq.6, each unit of increase of \(pay^u\) would lead to many more units of decrease in \(lfv^u\). Since the CEO has no enough private wealth to take responsibility for the value loss \((lfv^u)\), the firm has to bear it alone. Therefore, according to the model result, the best choice of the firm is to provide the CEO with her expected compensation level in order to minimize the potential loss of the firm value.

In the same logic, the potential loss of firm value \((lfv^p)\) due to the under-utilization of each employee’s discretion \((d)\) and the misuse of each employee’s discretion can be respectively expressed as Eq.7 and Eq.8.

\[ lfv^e = pos^e * \frac{size}{num} * (e^n)^{\alpha, d} \]  \hspace{1cm} (7)

\[ lfv^n = pos^n * \frac{size}{num} * (e^n)^{\beta, d} \]  \hspace{1cm} (8)

In Eq.8 and Eq.9, \(\frac{size}{num}\), \(\alpha, \beta, e\) and \(d\) are all much smaller than the levels of the CEO. First, each employee can manipulate very limited assets share; second, each employee has rather limited capability in passively lowering or initiatively hurting the whole firm performance; and third, each employee has much less discretion than the CEO. Therefore, \(lfv^u\) and \(lfv^e\) would be much smaller than \(lfv^u\) and \(lfv^e\). Under this condition, the marginal contribution to firm value of the employee actually exceeds \(lfv^u\) and \(lfv^e\) at a higher possibility. Therefore, the best choice of the firm is to set the employee’s compensation according to her marginal contribution to firm value in order to get as high motivation as possible for the employee.

**Conclusions**

This paper proposes a new perspective named risk aversion theory on explaining the incredible growth of EWPG in practice. Based on the risk aversion theory, the paper builds a theoretical model which argues and proves that the decision-making logic of the firm on the issue of CEO’s compensation level is to set the level according to the average compensation level of the CEO’s market in order to minimize the potential loss of firm value that may produced by the CEO; while the decision-making logic of the firm on the issue of the employees’ compensation level is to set such a level according to their marginal performance contribution to firm value in order to make full use of the potential productivity of the employees.

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