ERASMUS UNIVERSITY ROTTERDAM

Erasmus School of Economics

Master Thesis – Strategy Economics

Explaining firm performance by the tournament theory in combination with stock-based compensation

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Abstract

This paper examines the impact of tournament value on firm performance and how this interacts with stock-based compensation. The tournament theory describes that differences in wages are explained by differences in rank instead of output. Contradicting, incentive-based compensation schemes are linked to the output or performance of an employee and are often used to align the interest of the shareholders and employees. It is argued that due to the uncertainty of stock compensation, a larger share of the salary consisting of stocks could work demotivating. Consequently, the positive impact of a rank-based compensation scheme is lowered. On a sample of 142 US listed firms over a period of 2007 to 2022 an OLS fixed effects and IV model are used. The OLS estimates show that a larger share of stock compensation does not to lower the effect of the tournament value, instead it seems to decrease feelings of inequity, making the tournament theory more effective. The IV estimates show the same directions of the relationships. So overall, it is concluded that the share of stock compensation does impact the influence of the tournament value on firm performance. Although this research is too limited to make further interpretations, it suggests that the equity theory dominates in explaining firm performance by the compensation schemes. A larger share of stock compensation is, due to its uncertainty or other negative values, seen as less unequal, diminishing the negative tournament value on firm performance.

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1. Introduction

The compensation of high-placed executives is a topic which has always sparked a lot of fuss, both within firms and in society. Large compensation packages or increases in CEO pay have often resulted in discussions about whether the compensation is still appropriate (Benson, 2020; Tonti, 2022; Miller, 2018). In 2021 a CEO of an US firm received on average 27.8 million dollars of compensation, which is 399 times as much as the pay of an average employee (Bivens & Kandra, 2022). There are even several US firms with a CEO-to-employee pay ratio of more than 1,000 to one, even though the average US civilian mentions that an CEO should receive no more than seven times as much as an average employee. In line with these findings, a striking 87% of the American population indicates that CEOs are paid too much (Anderson, 2021). Over time, several different policies and laws were introduced to limit these extraordinary pays. Nevertheless, it is still a common thought that these pays should be majorly determined by the market. Despite these policies, discussions and overall disagreement, CEO compensation has only increased over time. It is important to question whether these high compensations are actually paying off and whether they serve a purpose within a firm, especially as it can be a relatively large cost item for a company.

There are multiple theories for setting and explaining the compensation schemes of firms, one commonly used theory that provides a suggestion for why the wages of the top positions within an organisation are generally high is the tournament theory. This theory suggest that employees are compensated based on their rank within an organisation, this should create an incentive to work hard to obtain and maintain a higher rank and corresponding pay. To keep this incentive going, the pay has to increase more substantially when coming higher in an organisation, which provides an explanation for the high CEO pays (Rosen, 1985). However, another often used compensation item are stocks, this type of compensation is based on an incentive theory. By connecting the pay with firm performance, the incentives of employees are aligned with those of the shareholders, which generally strive to a high firm performance. Consequently, employees are incentivised to act in favour of the firm and achieve an as high as possible firm performance (Chong & Eggleton, 2007). Although these compensations schemes are researched extensively and proven to work, it remains unclear how they interact and what their contribution is when a firm use both compensation schemes (Heyman, 2005; Conelly, Thihanvi & Crook, 2014; Hochberg & Lindsey, 2010; Brent & Addo, 2012). Since obtaining a good firm performance is of essential interest for a firm and the commitment of employees can significantly contribute to this, it is interesting and relevant to

assess the impact and contribution of different compensation packages to firm performance. This gives the following research question:

"How does the impact of rank-based compensation on firm performance depend on stock-based compensation?"

In order to answer this research question, several sub-questions are drafted. First, more insight in the effect of both compensation schemes separately on firm performance is needed to be able to assess how they depend on each other. Therefore, to see whether the results from previous literature hold in this sample as well, the effect of rank-based compensation on firm performance is investigated. So, the first sub-question is:

SQ1: What is the effect of rank-based compensation on firm performance?

Besides the effect of rank-based compensation, the effect of a stock-based compensation is investigated. So, the second sub-question is:

SQ2: What is the effect of stock-based compensation on firm performance?

Contradicting to the tournament theory, a negative relationship between the wage gap and firm performance is shown in this research. While, consistent with the discussed theory, a positive relationship is found in the OLS model. However, a negative relationship is observed when using a IV analysis. This suggest that, since the IV analysis is more convincing, not strong enough evidence is obtained that supports a positive relationship. This implies that, in the researched sample, both compensation schemes seem not to work accordingly. Additionally, more insight in the impact of firm performance when both compensation schemes are used is required to be able to conclude on the research question. Because it is possible that both schemes reinforce each other, for example when the negative sides of the tournament are covered by the positive elements of stock compensation. While on the other hand, the effect on firm performance could weaken when both schemes are applied as well, for example when a positive effect of a large wage gap is diminished by a larger uncertainty due to a larger share of stock compensation. Therefore, the last sub-question is:

SQ3: How does the impact on firm performance differ when a firm uses both rank-based and stock-based compensation compared to the use of one scheme?

It is shown that a larger share of stock-based compensation diminishes the negative impact of rank-based compensation, which is in line with the equity theory. As mentioned, there is

already done relatively much research to compensation schemes and firm performance and more specific, the tournament theory is extensively described by previous literature as well. The same holds for the relationship between stock-based compensation and firm performance. However, not a lot of research is performed to the interacted effect when multiple compensation schemes are used. Investigating the specific case of the effect of rank-based compensation at firm performance combined with a stock-based compensation scheme is thus scientifically relevant and a contributing to the existing literature since it is not researched before in this way. Additionally, if both compensation schemes indeed interact and influence the extent to which the theories contribute to firm performance, this would imply that studies which only consider one compensation scheme fail to include an important explanatory variable. This would result in an omitted variable bias which could significantly impact the interpretation of the previous obtained results. This research could thus provide insight into the extend to which this is the case as well.

Additionally, as the world, economy and views of what is an appropriate level of compensation change constantly, new research could add worthful insights to existing literature. Furthermore, eventual applications that might follow from this research could be of interest for companies as it could give more insight into the role of compensation to firm performance. However, this research is too limited to make further implications to construct to optimal compensation scheme, further research is needed to do so. Furthermore, more insight in the role of both compensation schemes and their effectiveness could contribute to the public debate about CEO compensation. As mentioned, a large part of society has the opinion that CEOs and other high-placed executives are overpaid and there is an increasing attention to implement policies to limit their pays. Therefore, understanding how the pay of these high-placed executives contributes to firm performance could help in the construction of appropriate and effective policy implications, such as a policy that limits extraordinary pays or stimulate companies to implement a policy that is optimal for firm performance. These contributions make this research besides scientific relevant, socially relevant as well.

The rest of this paper is structured as follows; first, relevant literature on the tournament theory and stock-based compensation schemes is discussed. Afterwards, the data and methodology are discussed, followed by the results and the appurtenant analysis. Lastly, a conclusion and discussion on the limitations and recommendations for future research is provided.

2. Literature review

This section reviews the main findings from existing literature that is related to this research. Furthermore, the main theories that are used to answer the research questions are discussed, this concerns the theory behind the tournament and incentive-based compensation schemes. Based on this theory several hypotheses are constructed.

2.1 Related literature

There is done a lot of research to the effect of the tournament theory on firm performance. So did Heyman (2005) investigate the relationship between the use of rank-based compensation and firm performance on Swedish firm data. However, he did not examine the effects of stock-based compensation. He finds a positive and significant relation between the wage dispersion of executives and profits, which is thus in line with the tournament theory. However, he finds a negative relationship between the number of managers, the participants in the tournament, and wage dispersion. This is not in line with the tournament theory because the tournament theory suggests that the chances of winning decreases when the number of participants is higher. When there are more participants the effort an employee makes gives a lower probability of winning, so to maintain the same level of effort, the prize has to be higher, so a higher wage gap is needed (Conyon, Peck & Sadler, 2001). A possible explanation for the contradicting results regarding the number of employees is that from a certain number of employees values such as fairness and cooperation are considered more important. Especially when the difference in pay is large, employees could feel a kind of inequity, this could be disadvantageous for the productivity as employees might adjust their behaviour to compensate their feeling of inequity. This could in the end make the wage dispersion have a negative effect instead. Grund and Sliwka (2005) find in line with this that the utility of a person gets lower when either the other employees earn more or less than that individual. Additionally, puzzling experimental findings on the tournament theory can be explained when inequity among participants is considered (Fehr & Schmidt, 1999). Lee, Lev and Yeo (2008), which did as well a research to pay dispersion and firm performance, found results largely in line with the results of Heyman (2005). They looked into two theoretical models of pay dispersion, the tournament theory and equity fairness theory, which suggest that pay dispersion leads to greater envy and difunctional behaviour between employees, negatively effecting the firm performance. These results suggest that it is useful to integrate both theories and consider the possible feelings of

inequity when examining the tournament theory. Nevertheless, several other authors, such as Eriksson (1999), found a positive relationship between the number of employees and the pay spread.

However, Backes-Gellner and Pull (2013) performed a research to tournament compensation on firm performance, in the situation where employee heterogeneity is taken into account, and find some evidence against the agency theory. They argue that under heterogeneity certain employees may know they have a competitive disadvantage and that they have no or significant less chance in winning the contest. This may take away the incentive to put in any additional effort. Additionally, those who have a competitive advantage will now know they will win anyways and have therefore no incentive to work harder as well. They find that employee heterogeneity indeed weakens the relationship between wage dispersion and firm performance. Nevertheless, the effect does not disappear completely, there still seems to exist an incentive from the tournament compensation scheme. Similar results were found by Conelly, Thihanyi and Crook (2014), which considered in their research to firm performance and the tournament theory, the size of the wage dispersion as well. They concluded that a too large or too small gap will make the tournament effect work less effectively. When the difference between the high paid executives and 'regular' employees is too big, it can give the signal that the effort an employee must give has to be very high as the compensation is high as well, which can work demotivating for certain employees. If the difference is too small, employees might not want to compete for it as the reward is not high enough. Eriksson (1999) investigated the relationship between tournament theory and firm performance within firms in Denmark and considered the effect of firm environment as well. He considered the distinction of a noisy or risky firm environment, in those sectors random factors have a greater impact, which implies that the employees are dependent at factors they cannot control themselves. This implies a greater risk and uncertainty about the chances of winning the tournament. He finds, in line with his expectations, that the relationship between the tournament theory and firm performance is weaker in a noisy or risky firm environment.

Besides the research to the relation between firm performance and rank-based compensation, several authors considered stock-based compensation and firm performance as well. Hochberg and Lindsey (2010) investigated the effect of stock option compensation of non-executive employees and firm performance. They found, in line with the agency theory, a positive relationship between firm performance and stock-based compensation. However, the effect was the strongest in firms with fewer employees or firms with high growth potential.

Lastly, they concluded that the effect is stronger for firms that grant the options broadly to their employees as well, which is in line with the equity theory. Cordeiro, Veliyath and Romal (2007) investigated the impact of stock-based compensation on firm performance. However, they considered the impact of the firm environment as well. They find a positive relationship, which is stronger for firms operating in an environment with greater investment opportunities. They suggest that those firms have generally a high future growth value, which is represented in the future share value, the potential reward is thus high. On the other hand, the asymmetric information is high as the environment of those firms is often turbulent and uncertain, making monitoring more difficult, which makes stock compensation more effective. The positive effect of stock-based compensation on firm performance and its relationship with information asymmetry is showed by Brent and Addo (2012) as well. They found a stronger relationship between stock-based compensation and firm performance for small firms, which they explain by the higher information asymmetry in smaller firms. Larger firms are more efficient in minimizing information asymmetry since they have a greater transparency and quality of information streams, adopt more often general accepted financial reporting and disclosure mechanisms, and implement regulations and disclosures by themselves as well. This gives a lower information asymmetry and thus a reduced positive effect of stock-based compensation on firm performance. Similar to the other described literature about the tournament theory, the above discussed previous literature of Hochberg and Lindsy, Cordeiro, Veliyath and Romal, and Brent and Addo, focus only on one compensation scheme and do not take into account a possible interaction. Not considering both schemes could possibly lead to a bias, making the results less robust.

Xia and Meng-Lei (2017) investigated the relationship between compensation structure and firm performance. They concluded that both stock-compensation and rank-based compensation schemes can contribute to a higher firm performance. So, in line with this research, they considered both compensation schemes. However, they did not consider how both interact and whether the effect of the tournament theory weakens when it is combined with stock-compensation, which could detract their findings. Furthermore, Conyon and Sadler (2001) did a research to the relationship between compensation and performance and focussed on compensation based on the tournament theory and stock-based compensation. They find a positive relationship between stock-based compensation and firm performance. However, they use a sample of UK firms which were subject to a reporting constraint law and are not able to conclude on the exact incentive and contribution to firm performance of stock-based

compensation. Their result does support the tournament theory as well since they find a positive relationship between firm performance and rank-based compensation.

2.2 Theoretical framework

In this section the underlying theory that is used to answer the research question is developed. Consequently, the hypotheses are formed, based on this theory.

Tournament theory

Lazear and Rosen (1981) were one of the first to describe the tournament theory. They analysed compensation based on the rank in an organization and the more traditionally approach based on the output level and found that rank-based compensation is equally efficient and, in some situations, even more effective than the output-based compensation. A high compensation of a top executive might provide an incentive for employees to work hard, give a lot of effort, as they may win one of those top, high paid positions. The incentive to work hard arrives thus from the chances to win the contest instead of from the direct output, as in output compensation schemes. This approach is especially beneficial when output is hard to monitor, costly to measure or when free-riding and moral hazard is a problem. Rosen (1985) builds on this theory and attempts to explain the generally high compensation of CEOs. He concludes that the wages have to become higher when the rank increases to keep the employees motivated. Otherwise, an employee which has achieved a relatively high rank will not have any incentive anymore to work hard to achieve the next rank if the compensation is not much higher. So, the further an employee gets in rank, the higher the rewards must be. Elevating the prize for the highest ranks keeps up the competition in the higher stages as the ladder to climb seems longer, which give the idea that, regardless of how high on the ladder you are, you always have the same length to climb. This will keep the employees motivated to work hard and compete for the highest ranks. The tournament theory suggests thus that when compensation increases with the rank, this provides a motivation of employees to work harder, which has a positive effect on firm performance. Therefore, the first hypothesis is:

H1: Rank-based compensation is positively related with firm performance.

Stock based compensation

Another common way of compensation are incentive-based compensation schemes. These compensation schemes are used to align the interest of the employees and shareholders. The way this should work is largely derived from the agency theory, which suggest that agents, the employees, make decisions that are in line with their self-interests and often conflicting with the goals of the principals, the shareholders. This behaviour is more likely to occur when the information asymmetry is high because in that situation it is harder for the principal to observe and know what the agent is actually doing and whether the agent acts is line with their goals or based on self-interest. This problem can be solved by aligning the interest of both the agent and principal, by using an incentive-based compensation scheme, this should motivate employees to work harder and achieve a higher performance as their compensation is based on this (Chong & Eggleton, 2007). So, contradicting to the tournament theory, the motivation is not derived from a higher salary when making a promotion, but instead trying to receive a higher salary by increasing the output or performance. A common way of executive compensation is compensation that includes stocks. By giving the executives a certain number of stocks of the firm itself, there should arise an incentive to act in favour of the firm because when the firm performance improves, their stocks will become more valuable. The interests of the employees and shareholders are thus aligned by the motivation to increase the value of the whole firm instead of individual performance. Another difference with the tournament theory is that this form of compensation is focused largely on the higher levels in an organisation, while the tournament theory applies to the entire firm (Buck, Bruce, Main & Udueni, 2003).

Besides the agency theory, the equity theory is another important fundament for the theory behind stock-based compensation. The equity theory is based on cooperation and equality and suggest that when employees experience inequity they will act in such a way that they can correct the inequity, according to their perspective (Al-Zawahreh & Al-Madi, 2012). This can imply that employees will decrease their efforts and lower their productivity or quality of work when they feel that they receive too less compensation. In an organization equity in pay is an important factor to achieve satisfaction, even if an employee is dissatisfied with other factors in a job, the feeling of equity in pay could compensate for these feelings. According to Tekleab, Bartol and Liu (2005), giving employees stock options could even be more effective than a pay increase, especially when they are offered broadly to their employees. As described above, stock-based compensation can help to align the incentives of executives and the

shareholders, executives should act more in line with the interest of the shareholders and the firm, which could generate a higher firm performance. Therefore, the second hypothesis is:

H2: Stock-based compensation is positively related with firm performance.

Interaction

Although both the rank-based and stock-based compensation schemes can have an impact on firm performance, it is relevant to consider the governance of a firm as well. A weak governance structure can impact the firm performance negatively, this can diminish the effect that both compensation schemes have on firm performance (Bebchuck, Cremers & Peyer, 2011). On the other hand, the governance of a firm and power of a high-placed executives can have an influence on the creation and existence of those compensation schemes. This is especially relevant for the stock-based compensation since it might be hard to change the entire compensation scheme in an organisation, but easier to award stock-based compensation, especially as this is most beneficial for those executives themselves and less obvious. Executives with a lot of power and influence in the decision process might be able to influence the extent to which stock-compensation is used. However, this extra compensation is less likely to add an extra motivation for them to increase firm performance, which is in line with the findings that a weak governance structure is related with a higher compensation and a worse firm performance. Consequently, this will thus decrease the relative impact of stock compensation on firm performance (Bebchuck, Fried & Walker, 2002; Core, Holthausen & Larcker, 1999). The choice to use stock-based compensation instead of an increase in cash compensation is in line with the above-mentioned equity theory. As described before, the equity theory is an important fundament of the stock-based compensation. Giving stock-based compensation has a positive effect on the feeling of equity and cooperation within a firm. Even when the stock compensation is provided in only the higher levels of an organisation, it could give a feeling of less inequity compared to when the compensation would be mainly in cash. The underlying reason is that stock compensation is more abstract and it is less clear what the compensation exactly is, since the exact value is only known at the moment of exercising. On the other hand, using rank-based compensation has a negative effect on feeling of equity and fairness, based on the equity theory. Which is disadvantageous as it could decrease firm performance. This could imply that using stock-based compensation in combination with rank-

based compensation could help to improve overall feelings of equity because the stock compensation is valued less unequal. This would thus be beneficial for the firm performance.

Although the use of stock compensation could decrease feelings of inequity, there is a downside of the abstractness of stock compensation as well. The actual value of the stock compensation is not certain but depends on the stock price of the company which is dependent on firm performance but on external factors as well. If a large part of the compensation consists of stocks, it is thus uncertain which amount of compensation an employee actually realizes, this uncertainty could work demotivating for employees (Gibbs, 1994). In other words, by implementing stock compensation, the rewards for promoting in rank decreases. Consequently, the ladder to climb, as described by Rosen (1985), shrinks for the higher ranks in a company, which is detrimental for the motivation. A wage gap that achieved certain levels of stimulation to employees' sufficives not anymore when a part of the compensation consists of stocks, so a higher wage gap might be needed to achieve the same level of stimulation. In general, the top of an organisation receives the most significant amounts of stock compensation. This implies that for the layer under the top executives, commonly the managers, a part of the incentive to put more effort in is taken away. A decreased incentive for managers to try to achieve a promotion could as well have consequences for the motivation of the top executives. They face less competition for their position, which could imply that they feel less pressure to put extra effort in themselves. Therefore, when a stock-based compensation scheme is used and a large part of compensation consists of stocks, this could have a demotivating effect on several layers in the organisation, which is disadvantageous for the firm performance.

In sum, the equity theory suggest that the use of both schemes could increase firm performance because employees feel less inequity which is beneficial for the overall firm performance. Contradicting, a higher share of stock-based compensation for the highest ranks could be detrimental for firm performance. However, as stated in hypothesis one and two, both rank-based and stock-based compensation are expected to have a positive relationship with firm performance. Therefore, it is expected that even though both schemes might not reinforce each other, it is unlikely that when both schemes are considered the positive, motiving effect disappears entirely. Therefore, hypothesis 3.1 is:

H3.1: Providing both rank-based and stock-based compensation has a positive relationship with firm performance.

Even though in total, a positive effect is expected, the motivating effect of a rank-based scheme might decrease when adding a stock-based compensation scheme. Despite that the combination of both compensation schemes could increase a feeling of equity, the uncertainty of stock compensation could decrease the motivation of employees. Additionally, it is possible that the new incentives provide by a stock-based compensation scheme take over a part of the existing incentives as provided by the tournament theory. For example, employees might become more focussed on acting in favour of the firm because they have stocks, focusing less on the rank-based incentives. Therefore, it is expected that when both schemes are used and, especially, when a larger share of the compensation consists of stock compensation, the motiving effect of rank-based compensation will decrease, this leads to the final hypothesis:

H3.2: A larger share of stock-based compensation of the top executives has a decreasing effect on the tournament value on firm performance.

3. Data & Methodology

3.1 Data

For this research data about the compensation, firm performance and firm characteristics are obtained. All data is extracted from three databases; namely from the Execucomp database, which is part of the Compustat database, the Compustat database itself and the Institutional Shareholder Services (ISS) database, which are all available at the Wharton Research Data Service (WRDS). The sample consists of publicly listed firm in the United States, over a period of fifteen years, from 2007 to 2022.

Compensation schemes

The compensations schemes form the basis for the independent variables. To test the relationship between rank-based compensation and firm performance, the tournament value is used. The tournament value is defined as the wage gap between the compensation of the CEO and the average wage in the firm. Data on the CEO compensation is retrieved from the Execucomp database and data on the number of employees and their wages is obtained from the Compustat database, both available via WRDS. In line with previous literature and to make it possible to measure the relative effect of an increased share in stock compensation, the wage used in this metric consist solely of cash-based compensation and excludes thus compensation expressed in, for example stocks. For the effect of a stock-based compensation scheme on firm performance, the independent variable is defined as the total amount of stock compensation a CEO receives, this data is extracted from the Execucomp database on WRDS. Besides the total stock compensation, the proportion of stock compensation of the total salary is obtained as well. This variable is used to test the combined effect of both compensation schemes and to provide more insight their interaction. It is measured as the total stock compensation divided by the total salary, defined as the salary received in cash and other compensation means such as stocks, received and expressed as a percentage.

Firm Characteristics

The firm performance is used as the dependent variable and is measured by the total amount of sales. Total sales are used as a metric for firm performance because if compensation

schemes influence firm performance, this is reflected by an increase or decrease in the total sales. Data for this variable are obtained from the Compustat database, via WRDS. Furthermore, data on the year and sector of a firm are obtained from the same database, which is used to control for firm and year fixed effects. Additionally, data on other firm characteristics that impact firm performance as well are obtained to act as control variables. There is controlled for the size of the firm, which is defined as the natural logarithm of total assets, the number of employees, Return on Assets (ROA), defined as the operating income, after depreciation of a firm divided by the total assets, Capex ratio, which is the ratio of Capex divided by total sales and lastly, Leverage, defined as the long-term debt to the total assets. Lastly, the turnover of employees is obtained and this variable is defined as the difference in the total number of employees compared to the previous year. Data for all these variables is obtained from the Compustat database on WRDS as well.

Governance

As described before, the governance structure of a firm can impact the firm performance but might as well have an impact on the compensation structure. Factors such as the number of insiders on a board, whether there is a recent turnover or the manner in which promotions are made; based on performance or other, personal, interests, might influence the chances of entrenchment and the level of governance and influence the performance of a firm. A higher number of insiders or interlocked relationships are likely to decrease the governance of a firm (Cahuc, Carcillo & Zylberberg, 2014; Kale, Reis & Venkateswaran, 2009). The included controls related to the governance are; the number of insiders on a board, recent turnover, which is a dummy equal to one if there was a CEO turnover in the last year and zero otherwise, other linkages, a dummy equal to one if the CEO has interlocked relationships within the firm, such as family relationships within the organisation, and zero otherwise, and lastly, the percentage of control of voting power of the board. Besides the governance characteristics, there will be controlled for gender, a dummy equal to one when the gender is male and zero otherwise, because firm performance might differ per gender since diversity of the board can contribute to a better firm performance (Vieito, 2012). Data to construct these control variables are obtained from the Institutional Shareholder Services (ISS) database which is available at WRDS.

3.2 Data modification

Before running the models and analysing the results, the extracted data is modified, so that is appropriate to do the analysis on. First, the three distinct databased are merged into one database that includes all variables. Next, all variables that are not necessary are removed from the dataset and the variables as described above are created. Observations that have a value that is impossible, such as a negative number of employees, are deleted from the dataset. Furthermore, for several variables some large outliers were observed, although this concerned only a few observations, it can still influence the results. To limit their impact on the results and prevent biased results, those large outliers were removed from to dataset. Lastly, some of the variables do not have a normal distribution, which is not favourable for the regression models since it decreases the efficiency. The variables size, leverage, capex and number of employees are all skewed to the right, to solve this skewness, the logarithm of these variables is used. This gives a final dataset with a total number of 11,291 observations, 142 firms with 2,089 unique directors.

Potential biases

Biases can severely impact the results of a research and can consequently lead to a wrong conclusion. Even though the data is obtained from the Wharton Research Data Service (WRDS), which is a renowned data platform that provides high quality databases, it is still possible that certain biases arise. First, certain variables contain only a limited number of observations, while for the regression analysis it is required that a firm has observations for all variables included. So, despite the large sample used it is possible that due to omitting of the firms that do not have observations for all variables, unintentionally firms with certain characteristics might become overrepresented in the sample, which would imply that the results are subject to a sample selection bias. In addition, a part of the data is acquired by WRDS by taking surveys from the executives of a certain company. It is thus possible that due to human mistakes wrong or less correct answers are included that can influence the estimations and would thus result in a response bias. Although it is not expected that these biases will form a large problem, as a robustness check a random sample is drawn to assess whether sample selection bias is likely to be a problem. A different source of bias is the omitted variable bias and reverse causality. As it is still possible that certain factors that influence firm performance are not taken into account, such as experience or the quality of an executive, omitted variable

bias could arise. In that case, a part of the observed effect might incorrectly be attributed to the variables that are included, this could thus give an over- or underestimation of the estimated effect. Reverse causality is a problem when the independent variable is dependent on the dependent variable as well and as a consequence give non-representable results. However, as the IV regression controls for the latter two biases, it is not expected that these biases do form a problem. Nevertheless, by interpreting the results it is important to take these possible biases into account.

Descriptive statistics

The descriptive statistics of this dataset are shown in Table 1, total sales has a mean of 11,045 million with a standard deviation of 1.026. The average wage gap in this sample is 474,063 dollars, with a minimum of approximately minus 100,000 dollars, which implies that for that firm the average salary of the employees in the organisation is higher compared to the compensation of the executives. Although, this might seem striking, an explanation could be that some CEOs or other high placed executives are working against relatively low wages because of principal reasons or to achieve tax benefits. Instead of receiving regular cash-based compensation, they are instead compensated by, for example, stocks. The average amount received as stock compensation is approximately 1.6 million dollars. The minimum is zero, so in certain companies it seems that there are no stocks used in the compensation, the maximum stock compensation an executive has received in this sample is slightly above 240 million. The average percentage stock compensation of the total salary is 53 percent, with a standard deviation of 27.705, which implies that half of the salary is obtained via stocks, with some executives receiving a compensation consisting of only stocks. The distribution of the compensation schemes over time are shown in Figure 1. Furthermore, the average company in this sample has around 31 thousand employees, 90% of the CEOs and other high-placed executives in this sample are male and the average voting power of the CEO is almost ten percent. Lastly, there is an employee turnover of almost minus 2.5 percent, which implies that, on average, the number of employees increased with 2.5 percent. However, some companies faced a turnover of 164 percent, which implies that more employees left the company than were employed by that company. Important to note is the significantly lower number of observations for the wage gap, which is a consequence of limited data on the number of

employees. As a result, the number of observations included in the regressions is much lower than 128 thousand as well.

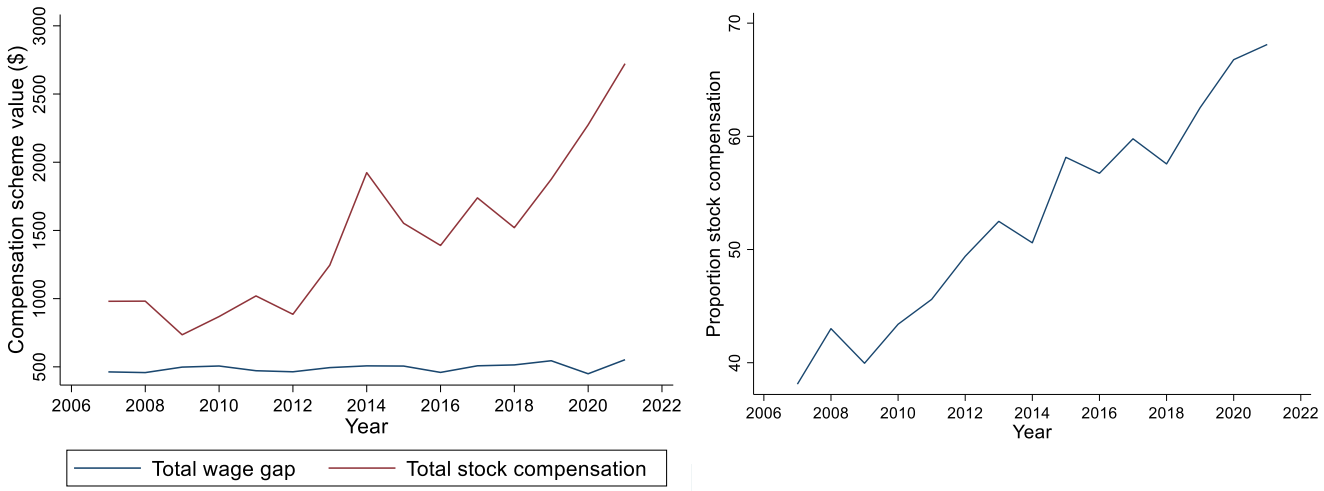

Figure 1: Distribution of the compensation schemes over time.

Table 1: Descriptive statistics.

Variable	Observations	Mean	Std. Dev.	Min	Max
Total sales	128,215	11,044.57	31,191.615	0	569,962
Wage gap (x1000)	11,291	479.630	286.907	-99.943	1,728.926
Stock compensation (x1000)	128,275	1,642.11	3,833.655	0	242,499.14
Proportion stock compensation (%)	128,122	53.238	27.705	0	100
Size	128,225	8.277	1.616	3.762	13.59
# Employees (x1000)	128,018	31.65	105.188	0	2,300
ROA	128,215	.095	.098	-2.757	1.179
Capex	128,120	.045	.045	0	.545
Leverage	127,759	.243	.201	0	3.852
Employee turnover (%)	114,300	-2.469	16.993	-189.305	164.579
Gender	128,275	.901	.299	0	1
Voting Power (%)	128,001	9.728	11.499	0	49.992
Recent turnover	128,275	.022	.146	0	1
Other link	128,275	.024	.152	0	1
Insiders	128,275	9.685	2.177	0	22

Note: Total sales are the measure for firm performance, in millions. The wage gap and stock compensations are measured in thousands of dollars, the proportion of stock compensation of the total salary is measured as a percentage, Size is the logarithm of total assets, the number of employees and the employee turnover are measured in thousands. ROA, Capex and Leverage are measured in million dollars. Gender, recent turnover and other link are dummies and voting power is expressed as a percentage. Although the logarithm of the number of employees, Capex and Leverage is used, this table shows the original values for a more intuitive interpretation of their descriptive statistics.

Although the descriptive statistics provide already some information about the distribution of the wage gap and total stock compensation in this sample, it is useful to get more insight into this. Therefore, a more detailed overview of the distribution of the wage gap, stock compensation and proportion stock compensation of total salary in the sample is provided in Table 2.1 to 2.3. The categories are chosen based on the respective percentiles of 25, 50, and 75 percent. The results in Table 2.1 show that the firm performance, as measured by total sales, increases as thew age gap increases. Furthermore, the number of employees is increasing with the size of the wage gap, which is in line with the tournament theory that suggest that when there are more employees the wage gap should be larger to keep the motiving effect. Lastly, the total stock compensation and the proportion received as stocks is increasing with the size of the wage gap, implying that when the wage gap is larger, the executives receive more stock compensation and a larger portion of their compensation consists of stocks as well. To obtain insight in the distribution between industries, Figure A1 in Appendix A shows the distribution of the total wage gap per industry. The differences between industries are quite big which implies that the effect of an compensation scheme might differ by industry. Although there is controlled for the corresponding fixed effects, exploring the exact differences and implications per industry is beyond the scope of this research and are not further discussed.

The detailed descriptive statistics about the total stock compensation are shown in Table 2.2 and show that the average firm performance is higher in the percentiles with a higher stock compensation. The number of employees is increasing with the amount of stock compensation and the same holds for the average wage gap and the proportion of stock compensation. Table 2.3 shows that total sales increase when a larger part of the compensation consists of stocks, which is similar to the above-described results. In line with those results, the wage gap, amount of total stock compensation and number of employees increases when a larger proportion of the salary consists of stocks. A possible explanation could be that when a larger part consists of stocks, the total compensation should be higher to compensate for the uncertainty of stock compensation, which leads to a larger wage gap. Furthermore, it seems that when the stock compensation increases, this replaces thus a part of the common compensation, leading to a higher percentage.

Table 2.1: Detailed descriptive statistics wage gap.

Variable	# Observations	Total sales	# employees	Stock compensation	Proportion stock compensation
		Mean			
Wage gap					
<290	2,670	3,487.412	13.723	553.902	42.951
290-420	2,928	6,512.952	38.783	919.508	51.340
420-620	2,708	10,006.02	50.048	1,294.447	55.832
>620	2,790	17,205.08	100.090	2,466.603	59.061

Note: The wage gap is in thousands of dollars, total sales is measured in millions, the employees are measured in thousands, the total stock compensation in expressed in thousands of dollars and the proportion stock compensation is expressed as a percentage.

Table 2.2: Detailed descriptive statistics total stock compensation.

Variable	# Observations	Total sales	# employees	Wage gap	Proportion stock compensation
		Mean			
Stock compensation					
<230	2,727	4,417.686	22.554	323.357	15.435
230-710	3,026	6,856.528	47.436	414.978	48.292
710-1,820	3,067	10,428.65	60.320	513.170	65.802
>1,820	2,413	16,847.73	75.758	684.358	81.937

Note: The total stock compensation is in thousands of dollars, total sales is measured in millions, the employees are measured in thousands, the wage gap in expressed in thousands of dollars and the proportion stock compensation is expressed as a percentage.

Table 2.3: Detailed descriptive statistics the proportion of stock compensation.

Variable	# Observations	Total sales	# employees	Wage gap	stock compensation
		Mean			
Proportion Stock compensation					
<35	2,494	5,981.351	34.907	388.105	75.526
35-60	3,693	7,781.595	52.007	461.577	529.807
60-75	2,575	8,962.459	44.186	512.466	1,258.857
>75	2,475	15,766.38	74.912	576.613	3999.672

Note: The proportion stock compensation is expressed as a percentage. Total sales are measured in in millions, the employees are measured in thousands, the wage gap and stock compensation are expressed in thousands of dollars.

To get more insight in the relation between the different variables, the correlation between several variables is obtained, as shown in Table 3. Looking at the main variables, firm performance, the wage gap, total stock compensation and proportion of stock compensation,

there is concluded that both compensation schemes seem to have a positive relation with firm performance. Of which the wage gap shows the highest correlation with total sales and the percentage of stock compensation of the total salary the lowest. However, for all three variables, the correlation is not very strong. On the other hand, the correlation between the wage gap and total stock compensation is moderate, with a coefficient of almost 0.5. Therefore, as these variables are not highly correlated, multicollinearity seems not a problem. Lastly, the relationship of all variables, is stronger with the wage gap, compared to the total stock compensation and the percentage of stock compensation received, which implies that factors such as firm specific characteristics of the governance structure might have larger impact at the wage gap compared to firm performance. However, none of the independent and control variables shows a high correlation with each other, implying that multicollinearity is probably not an issue.

Table 3: Correlations

Variable	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
[1] Total sales	1.0000								
[2] Wage gap	0.3235	1.0000							
[3] Stock compensation	0.2531	0.4812	1.0000						
[4] Proportion stock compensation	0.1853	0.1951	0.6193	1.0000					
[5] Employee Turnover	-0.0102	0.0016	-0.0546	-0.0687	1.0000				
[6] #Employees	0.6174	0.4196	0.2341	0.1632	0.0068	1.0000			
[7] Size	0.7019	0.4115	0.3629	0.3496	0.0292	0.6408	1.0000		
[8] Recent turnover	-0.0191	0.1241	0.0479	0.0085	-0.0048	-0.0171	-0.0276	1.0000	
[9] Insider	-0.0626	0.1173	0.1100	0.0059	0.0030	0.0058	-0.0749	0.0951	1.0000

3.3 Method

To test the above-described hypotheses, several Ordinary Least Squares (OLS) regressions with fixed effects are used. Firm performance, measured by total sales, is the dependent variable and the independent variables are, depending on the regression, the tournament value, the stock-based compensation or the proportion stock-based compensation of the total salary. In all regressions there is controlled for firm and time fixed effects. These fixed effects are included because firm performance might, because of various reasons

unrelated to the compensation, change over time or differ per industry of sector. By including time- and firm fixed effects, there is controlled for these possible differences which makes it possible to estimate the effect of compensation on firm performance, without that those effects explain a part of the estimation. Furthermore, several 'normal' control variables are added, such as the size or ROA of a firm and as well some governance controls are added, such as the number of insiders. Equation *(1)* shows the corresponding regression, with the independent variable *Compensation Scheme* being either the tournament value, the compensation consisting of stocks or the proportion of stock compensation of total salary:

$$(1)\ Firm\ Performance = \beta_0 + Compensation\ Scheme * \beta_1 + Size * \beta_2 + Number\ of\ Employees * \beta_3 + ROA * \beta_4 + Capex * \beta_5 + Leverage * \beta_6 + Employee\ Turnover * \beta_7 + Gender * \beta_8 + Voting\ Power * \beta_9 + Recent\ Turnover * \beta_{10} + Insiders * \beta_{11} + Firm\ FE + Time\ FE + \varepsilon$$

To test the last two hypotheses, how the effect on firm performance of the tournament value depends on stock compensation of a CEO, a similar regression is performed, but now with both compensation schemes included. Besides this regression a second regression with both schemes included is performed, but now with an interaction term added between the tournament value and proportion of stock compensation, as shown in equation *(2)*:

$$(2)\ Firm\ Performance = \beta_0 + Tournament\ Value * \beta_1 + Size * \beta_2 + Number\ of\ Employees * \beta_3 + ROA * \beta_4 + Capex * \beta_5 + Leverage * \beta_6 + Employee\ Turnover * \beta_7 + Gender * \beta_8 + Voting\ Power * \beta_9 + Recent\ Turnover * \beta_{10} + Insiders * \beta_{11} + Tournament\ Value * Proportion\ Stock\ Compensation * \beta_{12} + Firm\ FE + Time\ FE + \varepsilon$$

In this regression the interaction between the wage gap and the proportion of stock compensation is assessed. Whereas the first regression is performed with total stock compensation as a dependent variable as well, this variable is not considered in the second regression with the interaction term. Although the total stock compensation can give some insight into the overall effect of a stock-based compensation scheme on firm performance, it is difficult to assess the interaction and relative effect with the wage gap on firm performance. Since the proportion of stock compensation is likely to interact with the wage gap on the effect on firm performance, this is a more appropriate measure. Therefore, only this measure is used to assess the interaction with the wage gap on firm performance and the total stock compensation is excluded.

Endogeneity

When assessing the relationship between CEO compensation and firm performance it is important to consider the eventual endogeneity that might be present. As described by Roberts and Whited (2013), endogeneity arises when the explanatory variables are correlated with the error term in a regression. As a result, the relationship found cannot be interpreted as a causal effect, because it might be partly explained by factors in the error term. For this specific case, endogeneity is thus a problem if the tournament value or stock-based compensation variables are correlated with a factor in the error term. The first source of endogeneity in this case could arise from omitted variable bias. If there are omitted variables that are not observed but are a determinant of firm performance, and the compensation schemes variables are correlated with those omitted variables, endogeneity will become a problem. The direction of the bias depends on the sign of the correlation between the compensation scheme and the omitted variable, a positive correlation would lead to an upward bias which would imply an overestimation of the result of the compensation scheme on firm performance. An example of a source that can lead to endogeneity via omitted variable bias is experience or the education background. Highly experienced employees or employees which are highly educated could earn more because of this, while at the same time it could make them more successful in achieving a high firm performance. Furthermore, another source of endogeneity could be simultaneity and reverse causality, since it could be that the compensation schemes are adjusted based on the achieved firm performance, making firm performance a determinant of the compensation scheme as well. This would give biased results and forms thus a second possible source of endogeneity in this research.

To overcome this endogeneity problem and being able to obtain causal estimates, an Instrumental Variables (IV) approach is applied. In this method an instrument is used to estimate the part of the independent variable that is exogenous, which is used to estimate the relationship between the dependent and independent variable. This results in an estimation with only exogenous variables, resulting in a causal estimate. A good instrument should satisfy two properties, first, it should satisfy the relevance condition; the instrument should be correlated with the endogenous variables and this correlation has to be strong. Secondly, the instrument has to be exogenous; it should be uncorrelated with the error term. This implies that the instrument does not have any direct effect on the dependent variable or any indirect effect, through omitted variables or determinants of the dependent variable (Martens, Pestman, de Boer, Belitser & Klungel, 2006). Despite that the underlying assumptions of valid instruments

are not testable, there are several tests that can test some parts of the assumptions and provide more insights in whether it is likely that the assumptions are met. First, there is tested for the relevance of the instruments by identifying whether they are weak or not, this is done by examining the F-statistic in the first stage regression or the t-statistic in the case of a single instrument. Furthermore, the reduced form test, which consists of a standard joint-Wald test, or a regular t-test in the case of only one instrument, and is performed on an OLS regression of the dependent variable on all instruments and therefore also correct if the instruments are weak, and lastly, the Durbin-Wu-Hausmann test, which tests whether the regressors are actually endogenous, are performed (Schmidheiny, 2022).

A suitable instrument to overcome the endogeneity for the independent variables in this research should thus be correlated with the compensation scheme, but uncorrelated with any other determinants of firm performance. The instrument that is used is a dummy variable based on a law related to compensation. In 2015 the US government accepted a law for pay ratio disclosure. It requires public companies to disclose the ratio of the compensation of the CEO to the average employee compensation in that company. The underlying idea of this law is to help shareholders when voting on the compensation of executives (US SEC, 2015). Consequently, this increased transparency in the compensation within an organisation could have consequences for the height of the compensation. Shareholders could decide to vote against any additional salary increases of CEOs because they find the ratio too high. Additionally, eventual negative publicity about a possible high ratio could make shareholders decide to lower CEO compensation schemes (Eavis, 2015). It is argued that a dummy whether a firm is subject to this law is an appropriate instrument because it is likely to be related with the compensation, through the described mechanisms. Furthermore, it is expected to have not a direct effect on firm performance since this law only concerns the compensation. However, an indirect effect on firm performance via the main independent might be possible, for example when employees get insight in this pay ratio, the feeling of inequity might increase, which is detrimental for firm performance. Nevertheless, the two conditions of a good and valid instrument allow for this indirect impact. Additionally, it is unlikely that firm performance influences the introduction of this law, which rules out a reverse effect.

This CEO pay disclosure law makes disclosure of the ratios mandatory from the beginning of 2017, however, for companies whose fiscal year start later than January, there is an exception. For those companies, the disclosure is mandatory from 2018 onwards. Additionally, a few companies are excluded from this law and are thus not obligatory to

disclose any CEO pay ratios from 2017 onwards (Pearl Meyer, 2015). Emerging Growth Companies (EGCs) and smaller reporting companies are excluded from this law. A company is defined a EGC the first five years after its IPO, unless its total annual gross revenue is more than 1.07 billion dollars, when it has issued more than one billion non-convertible debt in the last three years or when it becomes a 'Large Accelerated Filer'; when the company has a public float of more than 700 million dollars (US SEC 2023a; US SEC, 2020). A company is classified as a small reporting company when the public float of the company is less than 250 million dollar or when the annual revenues are less than 100 million and the public float is less than 700 million dollars. The public float is defined as the number of common shares of a company multiplied by the market price (US SEC, 2023b). In constructing the dummy for the instrument 'Disclosure Law', these exceptions are considered. Therefore, the dummy takes a value of one when an observation is after 2017 and the fiscal year starts in January and when an observation is after 2018 and the fiscal year start later than January, otherwise the dummy will have a value of zero. Additionally, the dummy will have a value of zero when the company is either a EGC or a small reporting company. Equitation *(3)* shows the two regressions of the IV approach:

$$\textit{(3.1)}\ \widehat{Compensation}\ Scheme = \phi_0 + Disclosure\ law * \phi_1 + Controls * \phi_i + \upsilon$$

$$\textit{(3.2)}\ Firm\ Performance = \beta_0 + \widehat{Compensation}\ Scheme * \beta_1 + Size * \beta_2 +$$
$$Number\ of\ Employees * \beta_3 + ROA * \beta_4 + Capex * \beta_5 + Leverage * \beta_6 +$$
$$Employee\ Turnover * \beta_7 + Gender * \beta_8 + Voting\ Power * \beta_9 +$$
$$Recent\ Turnover * \beta_{10} + Insiders * \beta_{11} + Firm\ FE + Time\ FE + \varepsilon$$

The regression with the interaction term included between the wage gap and share of stock compensation contains two endogenous variables which implies that at least two instruments are needed to be able to perform this IV regression. As only one instrument is available in the main model, this regression cannot yet be performed. However, in the robustness check multiple instruments are used, which makes it possible to run the regression with the interaction term under those conditions, see below.

Robustness

Although the above-described method could provide a good insight in the relationship between the compensation schemes and their impact on firm performance, it is important to

check whether the results are robust as well. To test whether the results are robust and hold under different conditions, another measure for firm performance is used as well. Instead of total sales, all regressions are performed with net income (or loss) as a measure of firm performance. Net income is defined as the revenue minus the costs, taxes and interest and shows thus the total profit that remains when accounting for all costs made. It is an important and commonly used metric to assess the performance of a firm and can be used to assess whether the compensation schemes actually lead to a higher profit (Lockert, 2022).

Additionally, a second robustness check related to the instrumental variable analysis is performed. The same analysis is performed but now based on a different instrument to assess the sensitivity of the instrument. A possible weakness of the main instrument is that is hard to control whether the firms in the sample that are classified under the law, are actually subject to the law. Therefore, for the robustness check the underlying values that determine whether a firm is targeted by the law are used as an instrument. The main underlying values determining whether a company is targeted by the law in theory, and that are used as instruments in the robustness analysis, are the public float, company age and non-convertible debt of a company. Now that more instruments than endogenous regressors are included, an additional test is performed; the J-test for overidentifying restrictions, which empirically tests whether all included instruments are exogenous. However, a weakness of this test is the underlying assumption that at least one of the instruments is exogenous (Schmidheiny, 2022). Furthermore, the regression with the interaction term included contains two endogenous regressors, this regression is now performed as well since there are at least as much instruments as endogenous variables. The summary statistics of the instruments are reported in Table A2 in Appendix A.

Lastly, to assess whether sample selection is likely to form a problem, a random sample from the database is drawn and the OLS and IV regressions are performed again on this sub-sample. This sub-sample contains 5000 observations and if the results are comparable to the main output, this would suggest that sample selection bias is not likely to form a problem.

4. Results

This section discusses the results of the performed analysis. First, the results of the OLS regression of the wage gap and stock compensation on firm performance are discussed. Next, the interaction between both compensation schemes is analysed to answer hypothesis three and four, whereafter there the results of the IV analysis are discussed. Lastly, there is assessed whether the results are robust.

4.1 OLS regressions

Wage gap

Table 4 shows the results from the first regression analysis to estimate the relationship between the wage gap and firm performance. Column 1 of Table 4 shows the results with only firm specific control variables included and column 2 shows the results with the other control variables included as well. In both models the wage gap shows a negative relationship with total sales, implying that a larger wage gap leads to a worse firm performance. This is not in line with the findings of previous literature on the tournament theory. It may suggest that feelings of inequity are dominating the motivating effect. However, the results of the regression with the other schemes included will provide more insight in the underlying reason. In addition, the size, number of employees, ROA, capex and leverage show all a positive relationship with firm performance, all significant at one percent. The employee turnover shows a positive relationship as well but is not significant. Its positive coefficient suggests that when the turnover is high, so when relatively many people leave the company, this is beneficial for firm performance.

The results suggest that a bad governance structure has a negative impact on firm performance as well, which is in line with the expectations based on previous literature. A high voting power and a high number of insiders are both indicators of a worse governance and show a negative relationship with firm performance (significant at one percent). A recent turnover is positively related with firm performance, an explanation could be that it indicates a better governance structure since the chance of entrenchment is lower when recently a new CEO is accepted. This could be beneficial for firm performance, however, the coefficient is not significant. Contradicting, the existence of other linkages is positively related with total sales, while this could be an indicator of a bad governance structure. When the governance control

variables are added to the model, the coefficients of the other variables change slightly. The biggest change is observable in the coefficient of the wage gap, it halves in size and becomes insignificant. The governance structure of a company seems to explain a part of the firm performance and should thus be considered.

Concluding, these results suggest that the wage gap has a negative relationship with firm performance. This is the opposite as expected and therefore, hypothesis 1 is rejected.

Table 4: OLS regression wage gap.

Variables	Total sales	
	(1)	(2)
Wage gap	-0.723***	-0.338
	(0.263)	(0.283)
Size	4,643***	4,600***
	(214.2)	(217.4)
Ln(#employees)	3,271***	3,256***
	(235.6)	(241.8)
Employee turnover	0.863	0.101
	(4.743)	(4.825)
ROA	19,265***	20,120***
	(1,392)	(1,421)
Ln(capex)	1,198***	1,207***
	(128.4)	(130.6)
Ln(leverage)	606.3***	593.4***
	(56.18)	(58.10)
Gender		-434.9**
		(182.9)
Voting power		-46.19***
		(6.635)
Recent turnover		90.76
		(260.5)
Other link		1,258***
		(395.4)
Insider		-92.53***
		(19.24)
Constant	-42,578***	-41,788***
	(1,529)	(1,551)
Observations	10,147	9,693
Adjusted R-squared	0.824	0.826
Year & Firm FE	Yes	Yes
Normal controls	Yes	Yes
Governance controls	No	Yes

*Note: Total sales is the dependent variable and the wage gap the independent variable. The wage gap is measured as the difference between the CEO compensation and average employee compensation. Size, the number of employees, ROA, Capex, Leverage and employee turnover are included in as normal control variables. The governance controls are Gender, Voting power, Recent turnover, Other link and Insider. For the exact variable definitions see the description in section 3. Robust standard errors are between parentheses, * < 0.10, ** < 0.05, *** < 0.01.*

Stock compensation

The estimates of the effect of stock compensation on firm performance are shown in Table 5. In the first two models, with the total amount of stock compensation as independent variable, a positive relationship, significant at one percent, is observed. This implies that a higher stock compensation leads to a higher firm performance, which supports the incentive theories. The percentage stock compensation of the total salary shows a positive relationship with total sales as well, see column 3 and 4. However, both coefficients are insignificant. When the governance controls are included, the coefficients of both total stock compensation and the proportion stock compensation increase, the governance variables seem thus, similar to the regression between the wage gap and firm performance, to explain a part of this relationship.

The estimates of the coefficients of the control variables are largely similar to those of the regression of the wage gap on firm performance. However, some differences are observable, in model 4 the employee turnover has a much lower coefficient compared to model 2, the same holds for a recent turnover. Nevertheless, there should be noticed that both coefficients are insignificant which makes interpretation difficult. As well the coefficient of gender shows some differences. Being a male CEO has a much larger negative impact on total sales in the regression with total stock compensation compared to the model with the proportion of stock compensation and the wage gap. The same holds for being an insider, this has a much more negative influence when the total stock compensation measure is used. Lastly, whereas recent turnover had a positive coefficient in the model with the wage gap included, this coefficient shows a negative relationship in the regressions with total stock compensation and proportion stock compensation as independent variables, which implies that a recent turnover leads to a lower firm performance.

So overall, as both the total stock compensation and proportion of stock compensation seems to have a positive coefficient, there can be concluded that an increase in stock compensation is positively related with firm performance. This is in line with the stated hypothesis and therefore, hypothesis 2 is not rejected.

Table 5: OLS regression of stock compensation.

Variables	Total sales			
	(1)	(2)	(3)	(4)
Stock compensation	0.261***	0.309***		
	(0.0443)	(0.0460)		
Proportion stock compensation			2.274	4.321
			(2.653)	(2.782)
Size	4,379***	4,340***	4,567***	4,545***
	(211.2)	(214.0)	(211.6)	(214.3)
Ln(#employees)	3,279***	3,272***	3,260***	3,248***
	(236.5)	(242.5)	(236.0)	(242.1)
Employee turnover	3.111	2.965	1.216	0.732
	(4.682)	(4.785)	(4.750)	(4.850)
ROA	19,539***	20,440***	19,307***	20,096***
	(1,388)	(1,416)	(1,395)	(1,421)
Ln(capex)	1,129***	1,131***	1,187***	1,197***
	(128.6)	(130.3)	(128.7)	(130.7)
Ln(leverage)	615.4***	589.1***	622.4***	604.5***
	(55.89)	(57.77)	(56.46)	(58.41)
Gender		-617.6***		-456.4**
		(179.7)		(179.7)
Voting power		-46.18***		-46.54***
		(6.517)		(6.610)
Recent turnover		-205.9		-27.73
		(248.9)		(248.0)
Other link		1,383***		1,289***
		(395.2)		(394.0)
Insider		-127.2***		-99.64***
		(19.45)		(19.21)
Constant	-41,033***	-39,985***	-42,358***	-41,676***
	(1,514)	(1,531)	(1,523)	(1,540)
Observations	10,147	9,693	10,139	9,685
Adjusted R-squared	0.824	0.827	0.824	0.826
Year & Firm FE	Yes	Yes	Yes	Yes
Normal controls	Yes	Yes	Yes	Yes
Governance controls	No	Yes	No	Yes

*Note: Total sales is the dependent variable. Column (1) and (2) show the estimates with total stock compensation, measured in thousands of dollars, as the independent variable and in column (3) and (4) the proportion of stock compensations, expressed as a percentage, is the independent variable. Normal control variables are included in all regressions. The governance controls are Gender, Voting power, Recent turnover, Other link and Insider. For the exact variable definitions see the description in section 3. Robust standard errors are between parentheses, * < 0.10, ** < 0.05, *** < 0.01.*

Interaction

To see how the impact of the wage gap on total sales changes when a larger share of the compensation of the top executives consists of stocks, both variables are added to the regression, as shown in Table 6. As mentioned, the proportion of stock compensation is considered instead of the total stock compensation as this measure is more informative about

the interaction with the wage gap. When both compensation schemes are added, as in model 1, the coefficients do not change much compared to the results of the regression that only covered one scheme. However, the coefficient of the proportion of stock compensation turned significant, at ten percent. Model 2 in Table 6 includes an interaction term between the wage gap and the proportion stock compensation to assess the impact on each other. Now the coefficient of the wage gap is much more negative and significant at one percent. Additionally, the coefficient of the proportion stock compensation turned negative (significant at one percent). The interaction term itself is positive and significant at one percent. This implies that when a higher percentage of stock compensation is used, the negative effect of the wage gap on total sales becomes smaller.

These results are partly in line with the theory because a higher percentage of stock compensation could work demotivating for the lower ranks due to its uncertainty. Which would be detrimental for total sales. The negative coefficient of the proportion of stock compensation is thus in line with this argument. However, the coefficient of the wage gap is not in line with the expectations. The obtained results suggest that a large wage gap does not motivate employees to work harder to achieve the next rank. An explanation for this result could be found in the equity theory. If the differences in pay between ranks are too large in the opinion of the employees, a larger wage gap could imply a larger feeling of inequity between employees which is detrimental for the firm performance. Additionally, this could potentially explain the positive interaction term as well. As a higher percentage of stock compensation is seen as more uncertain and, in that sense, less valuable, a higher percentage of stock compensation could decrease the feeling of inequity, which diminishes the negative effect of a large wage gap. However, it is possible as well that the used metric is not a suitable proxy for the wage gap, which could lead to less representative results.

In addition, the control variables are largely similar to those of previous regressions. The sign of the relationships is the same as those observed in the regression with the wage gap as independent variable, as shown in Table 4. A striking difference with the wage gap model is the coefficient of employee turnover, which has become much larger in the regressions with the interaction term. This implies that it seems to have a more important contribution to firm performance when accounting for both compensation means. Another notable result is that of the coefficient of recent turnover, in model 1 of Table 6 the coefficient has a value of approximately 81, while in model 2 the coefficient has decreased to around 2.3. The latter is as well significantly lower compared to the previous performed models. This suggest that a recent

turnover has a less important or large contribution when accounting for the combined effect of the wage gap and the share of stock compensation.

In sum, based on these results, the sign of the independent variables does not change when they both are added to the regression, only when the interaction term is added, a sign change is observable. This suggest that the effect of the schemes separately does not disappear entirely. Although this is in line with the expectations of hypothesis 3.1, not sufficient evidence for a positive relationship on total sales is found. This implies that hypothesis 3.1 is rejected. Furthermore, a larger proportion of stock compensation makes the effect of the wage gap on firm performance less negative, which is thus contradicting to the expectations. This could suggest that the inequity argument is dominating and that either the value of stock-based compensation is abstract to employees or the uncertainty of stock-based compensation is valued negatively, as a result of which they value a compensation consisting for a larger part of stocks is less high, generating a lower feeling of inequity which results in beneficial effect on firm performance. Hypothesis 3.2 stated that a higher share of stock-based compensation had a negative effect, however, based on these results no evidence in favour of this hypothesis is found.

Table 6: OLS regression of wage gap and stock compensation.

Variables	Total sales	
	(1)	(2)
Wage gap	-0.410	-2.394***
	(0.287)	(0.678)
Proportion stock compensation	4.935*	-7.885*
	(2.823)	(4.308)
Wage gap*Proportion stock compensation		0.0317***
		(0.00912)
Size	4,574***	4,556***
	(217.2)	(215.4)
Ln(#employees)	3,253***	3,267***
	(241.7)	(240.1)
Employee turnover	0.717	1.392
	(4.861)	(4.854)
ROA	20,040***	20,355***
	(1,426)	(1,432)
Ln(capex)	1,201***	1,195***
	(131.2)	(131.0)
Ln(leverage)	600.6***	593.0***
	(58.32)	(58.46)
Gender	-418.6**	-420.8**
	(182.4)	(181.7)
Voting power	-46.14***	-44.44***
	(6.624)	(6.603)

Recent turnover	81.93	2.320
	(258.7)	(253.6)
Other link	1,296***	1,347***
	(394.4)	(394.6)
Insider	-94.13***	-96.36***
	(19.36)	(19.55)
Constant	-41,824***	-40,986***
	(1,552)	(1,543)
Observations	9,685	9,685
R-squared	0.826	0.826
Year & Firm FE	Yes	Yes
Normal controls	Yes	Yes
Governance controls	Yes	Yes

*Note: Total sales is the dependent variable and the wage gap and the proportion of stock compensation are the independent variable, measured in thousands of dollars and as a percentage, respectively. Both normal and governance controls included in model (1) and (2). For the exact variable definitions see the description in section 3. Robust standard errors are between parentheses, * < 0.10, ** < 0.05, *** < 0.01.*

4.2 IV regressions

To address the endogeneity issues, all regression will be performed under an instrumental variable (IV) approach as well. This section shows the results of the IV regression and assesses to what extent the results are influenced by endogeneity.

Wage gap

Table 7 shows the second stage results of the IV regression, for the first stage results, see Table A3 in Appendix A. Column 1 shows the estimates with the wage gap as independent variable. Its coefficients show, similar to the OLS model, a negative relationship with total sales. However, the coefficient has become much larger but is still significant at one percent. These results provide thus even stronger evidence that a larger wage gap is detrimental for firm performance. Additionally, the coefficients of size, number of employees, capex, recent turnover and other linkages have increased in magnitude as well. Similar to the main independent variable, the wage gap, recent turnover shows a large increase in the coefficient, while the other variables only show a minor increase in magnitude. Contradicting, the magnitude of ROA, leverage, gender, voting power and number of insiders has decreased. Lastly, the sign of the coefficient of the variable employee turnover has changed, now it shows a negative coefficient as well. This suggest that when less employees leave the company, this has a positive effect on firm performance, a possible explanation could be that when a firm

attracts new employees this is a sign that a firm is growing and performing well, which is reflected in a higher firm performance as well.

Stock compensation

Column 2 of Table 7 shows the results with stock compensation as the dependent variable. It shows a negative relationship with total sales, significant at one percent. This is quite striking as the OLS regression showed a positive coefficient. Moreover, the coefficient doubled in size. The coefficient of the proportion of stock compensation in column 3 of Table 7 is negative and significant at one percent as well. Compared to the OLS model, it has the opposite sign and it became significant. Furthermore, the magnitude of the coefficient has increased from approximately 4.3 to 168.8. Both models show thus the opposite relationship, which implies that a higher amount or share of stock compensation is detrimental for total sales. These estimates provide support for the uncertainty argument discussed in the literature; a higher share or amount of stock compensation loses its motivating purpose as the actual value for the employee or executive is too uncertain. For both models the coefficient of size, capex and voting power increased in magnitude as well. In the second model, on the total amount of stock compensation, leverage increased in size as well, while in the model on the share of stock compensation, the variables ROA and gender increased in magnitude. In addition, in both models, the sign of employee turnover and recent turnover changed. Additionally, in the third model, the sign of other linkages became negative. This supports the argument that a worse governance is detrimental for firm performance. The other variables decreased in magnitude, but the sign remains the same as in the OLS model, this is thus largely similar to the changes that were observable between the IV and OLS models with the wage gap as independent variable.

Comparison OLS vs IV

The results of the IV regression are thus quite different compared to the OLS model, however, it is common for IV estimates to be larger compared to OLS estimates (Jiang, 2017). Multiple underlying reasons could explain the large difference in the magnitude of the coefficients. First, it could be that the OLS estimates are heavily biased due to an omitted variable, if the IV approach accounts for this bias, it could give a more accurate, and thus larger,

estimate. In this case this would imply that the effect of each of the main independent variables is heavily underestimated. Second, there could be a measurement error that biases the OLS estimates towards zero, this is not a problem for the IV model and consequently the coefficients are much larger. Furthermore, it could be that the independent variables are endogenous and that the IV model overcomes this, providing more accurate estimates of the real effect.

Important to note is that the standard errors did not increase disproportionately much compared to the OLS model. A strong increase in the standard errors suggest that the model has become less appropriate and makes that a model is less informative about any actual effects (Kenton, James & Kvilhaug, 2022). If the standard errors increase much in the IV model compared to the OLS model, this could imply that the instrument is not working as it should and could thus indicate that the instrument is inappropriate. However, as the standard errors do not increase disproportionately in the IV model, a wrongly defined instrument seems not to be the main explanation of the increase of the magnitude of the coefficients. This suggest that the OLS model is subject to either endogeneity or another bias. The IV model might therefore give more accurate results. In addition, a Durbin-Wu-Hausman test is performed to test whether the OLS model is endogenous (Anderson, 2018). The test statistics of this test are shown in Table B4 in Appendix B. For all three regressions, the p-value is smaller than 0.05 which indicates that the null-hypothesis is rejected. This suggest that the estimates are subject to endogeneity and that the OLS estimates might thus be biased. However, as the underlying IV assumption cannot be tested, the results of the IV regression should be interpreted with caution as it is still possible that these results might be biased due to an incorrect instrument as well. As the test is not valid when the instrument is not valid. Moreover, the relevance of the instruments is assessed by examining the t-value of the instrument in the first-stage regression. For all three models, both the t-value and p-value meet the rule of thumb set, which implies that the instruments are not weak, the exact t- and p-values are reported in Table B2 in Appendix B.

Nevertheless, these results still suggest that a larger wage gap has a negative effect on total sales, which is supporting the equity theory. Contradicting, no evidence is found for the motivating effect of stock compensation. This might suggest that the uncertainty of stock compensation dominates the motivating effect to benefit from an eventual increase in stock value. Additionally, a higher proportion of stock compensation has a negative effect on firm performance.

Overall, based on the IV estimates, hypothesis 1 is rejected as no positive relationship between the wage gap and firm performance is observed. Furthermore, hypothesis 2 is rejected as well since again no evidence for a positive relationship is found. Since the regression with both the wage gap and proportion of stock compensation is not yet performed, due to the lack of enough instruments, there cannot be concluded on hypothesis 3. The IV outcomes regarding hypothesis 2 are thus different compared to the OLS estimates. Nevertheless, based on both models it is concluded that there is not sufficient evidence that supports an positive relationship between stock compensation and firm performance. The IV model is, based on the discussed weaknesses of the OLS model, thus found to be leading and hypothesis 2 is, based on both models, rejected.

Table 7: Second stage IV regression.

Variables	Total Sales		
	(1)	(2)	(3)
Wage gap	-2.859***		
	(0.732)		
Stock compensation		-0.310***	
		(0.0799)	
Proportion stock compensation			-168.8***
			(49.55)
Size	4,806***	4,807***	5,794***
	(196.7)	(198.0)	(417.0)
Ln(#employees)	3,287***	3,232***	3,215***
	(178.7)	(179.7)	(204.7)
Employee turnover	-0.516	-2.611	-23.47***
	(4.367)	(4.450)	(8.542)
ROA	19,842***	19,873***	23,245***
	(1,133)	(1,140)	(1,578)
Ln(capex)	1,241***	1,275***	1,640***
	(119.5)	(121.3)	(186.4)
Ln(leverage)	567.8***	604.6***	554.5***
	(61.97)	(61.96)	(72.15)
Gender	-205.5	-313.0	-573.8**
	(226.4)	(221.3)	(250.2)
Voting power	-43.80***	-46.84***	-51.83***
	(7.627)	(7.645)	(8.841)
Recent turnover	786.2	202.0	895.6
	(546.4)	(513.7)	(638.9)
Other link	1,272***	1,128***	-17.20
	(387.5)	(391.4)	(580.4)
Insider	-56.76**	-67.25***	-15.93
	(22.58)	(21.62)	(33.19)
Constant	-24,967***	-25,348***	-21,966***
	(1,499)	(1,503)	(1,964)
Observations	9,693	9,693	9,685

R-squared	0.825	0.823	0.770
Year & Firm FE	Yes	Yes	Yes

*Note: Total sales is the dependent variable, the wage gap, stock compensation and proportion stock compensation are the independent variables in models (1), (2), (3) respectively. The Disclosure Law dummy is used as the instrument. Both normal and governance controls are included in all regression. For the exact variable definitions see the description in section 3. Robust standard errors are between parentheses, * < 0.10, ** < 0.05, *** < 0.01.*

4.3 Robustness

To assess the sensitivity of the results, several robustness checks are performed. First, the analysis is done with a different measure for firm performance. Second, another instrument in the instrumental variable analysis is used and analysed. Lastly, a random sample is drawn to assess to probability of a sample selection bias.

Net income

Table 8 shows the results with net income as performance measure. The coefficient of the wage gap shows a striking difference with the results with total sales as the dependent variable since now it shows the opposite sign. However, as the coefficient in both models was insignificant, it is hard to interpret this difference. In model 2, with the amount of stock compensation as independent variable, a negative coefficient is observable, significant at ten percent. Again, this is the opposite sign compared to the original model with total sales as dependent variable. For the third model with the proportion of stock compensation as independent variable, the coefficient has become negative and significant at one percent. These results suggest that the measure of firm performance has quite some impact at the relationships that are observed.

The last model in Table 8 shows the results of the regression with the interaction term included. These results are more in line with the results of the original model. Both the wage gap and the proportion of stock compensation have a negative coefficient, while the interaction term has a positive coefficient, all significant at one percent. However, the magnitude of the wage gap coefficient has become much smaller. Nevertheless, the negative coefficients of the proportion of stock compensation could still suggest that a higher percentage of stock compensation of the total salary is demotivating for the lower ranks, due to its uncertainty, which is detrimental for firm performance. The equity theory suggests that a larger wage gap is seen as demotivating, a higher proportion of stock compensation could limit this, due to its

uncertainty. These results, in line with the estimates of the main model suggest that the equity theory is dominating on how both schemes interact. However, the effect seems less strong as the coefficients are lower compared to the main models, this may suggest that the feelings of inequity are relevant for a direct measure such as sales, but its demotivating effects are less severe for a more indirect measure such as net income.

In sum, the results are not entirely in line when another measure for firm performance is used. This could suggest that the impact of compensation schemes is different when the costs aspects of an organisation are considered as well.

Table 8: OLS regression on Net Income.

Variables	Net Income			
	(1)	(2)	(3)	(4)
Wage gap	0.0212			-0.488***
	(0.0752)			(0.110)
Stock compensation		-0.0180*		
		(0.0103)		
Proportion stock compensation			-2.469***	-6.057***
			(0.480)	(0.793)
Wage gap*Proportion stock compensation				0.00866***
				(0.00170)
Constant	-5,078***	-5,184***	-5,086***	-4,838***
	(428.4)	(418.4)	(423.9)	(428.7)
Observations	9,693	9,693	9,685	9,685
Adjusted R-squared	0.511	0.511	0.512	0.513
Year & Firm FE	Yes	Yes	Yes	Yes
Normal controls	Yes	Yes	Yes	Yes
Governance controls	Yes	Yes	Yes	Yes

*Note: Net income is the dependent variable and the wage, total stock compensation and the proportion stock compensation are the independent variable of which both the first two are measured in thousands of dollars and the latter as a percentage. Both normal and governance controls are included in all displayed models, but not displayed because of clarity. For the exact variable definitions see the description in section 3. Robust standard errors are between parentheses, * < 0.10, ** < 0.05, *** < 0.01.*

Lastly, the instrumental variable analysis with the dummy for the implemented Disclosure Law as instrument is performed as well with net income as independent variable. Table 9 shows the results from this estimation and show, similar to the IV regression on total sales, a large increase of the magnitude of the coefficients. For the first stage results, see Table A3 in Appendix A. Compared to the OLS model with net income as dependent variable, the sign coefficient of the wage gap has turned negative and significant. The sign of the relationship

of the other two main independent variables has not changed, however, the variable stock compensation has become slightly more significant. Furthermore, in the model with the interaction term, see column 4, the coefficient of wage gap has turned negative. The model shows some similarities with the IV model with total sales as dependent variable as well. The sign and significance of the coefficients are the same. Moreover, the magnitude of the coefficient is, like the OLS models, much smaller in the regression with net income as dependent variable. However, important to note is that for this regression different instruments are used, instead of the Disclosure Law instrument, the underlying values, so the company age, public float and non-convertible debt, are used as due to the interaction term there are multiple endogenous regressors. Similar to the main model, a Durbin-Wu-Hausman test is performed to assess whether the original model is endogenous, see Table B4 in Appendix B. Again, for all three models the null-hypothesis is rejected, suggesting that the OLS model is indeed endogenous. The t-statistic of the instrument in the first stage is for all models larger than 3.2 with a p-value below 0.0016, this satisfies the rule of thumb used in this test and implies that no evidence is found that the instruments are weak (See Table B2). The reduced form test shows a not significant p-value, which implies that the null-hypothesis is not rejected. This suggest that the instruments do not have a direct effect on the outcome variable of interest. However, this test is most suitable when the instruments are weak, which seems not the case for this regression.

Although there are some differences observable compared to the other models, these results are in line the implication derived from the IV model on total sales. The results show again evidence for a possible dominating effect of inequity, which lowers the firm performance by a large wage gap. Additionally, the uncertainty of stock compensation lowers the firm performance which is in line with the expectations. Nevertheless, as with the OLS models, the effect on net income is much smaller, which could suggest that the cost aspect is important to consider as well and that the compensation schemes not only affect output but have consequences for costs as well.

Table 9: Second stage IV regression.

Variables	Net Income			
	IV – Law 2017			Split IV
	(1)	(2)	(3)	(4)
Wage gap	-0.733**			-7.745***
	(0.293)			(1.454)
Stock compensation		-0.0795**		
		(0.0319)		
Proportion stock compensation			-43.27**	
			(18.25)	
Interaction				0.154***
				(0.0221)
Constant	-3,047***	-3,145***	-2,278*	3,608***
	(386.0)	(373.3)	(546.6)	(948.7)
Observations	9,693	9,693	9,685	4,598
R-squared	0.503	0.508	0.296	-
Year & Firm FE	Yes	Yes	Yes	Yes
Normal controls	Yes	Yes	Yes	Yes
Governance controls	Yes	Yes	Yes	Yes

*Note: Net income is the dependent variable, the wage gap, stock compensation and proportion stock compensation are the independent variables in models (1), (2), (3) respectively. The Disclosure Law dummy is used as the instrument. Both normal and governance controls are included in all regression. For the exact variable definitions see the description in section 3. Robust standard errors are between parentheses, * < 0.10, ** < 0.05, *** < 0.01.*

Different instrument

Besides the robustness check with another measure for firm performance, a different instrument is used as well. Table A4.1 and A4.2 in Appendix A, show the results of the first and second stage IV regressions, respectively.

For all three models a positive and significant coefficient for the main independent variable at one percent is obtained. These results are thus contradicting to the estimates of the IV model with the Disclosure Law dummy as instrument. However, like the main IV models, the standard errors are not exceptionally high and did not increase disproportionally much compared to the OLS model. These results suggest that a larger wage gap does work motivating, the same holds for a larger amount of stock compensation. This supports the general tournament theory and the incentive theories as well. A larger share of stock compensation contributes to a higher firm performance as well, which is contradicting to the uncertainty argument. Similar, no evidence is found in favour of the equity theory. These results show that the instrument choice does have a large impact on the results and that, as there

is a likely possibility that in both IV models the instruments are not perfectly valid, the estimates should be interpreted with caution.

The results of the overidentifying test, shown in Table B1, show that the null-hypothesis is only rejected for the last model, implying that only for that model evidence is found that suggest that all included instruments are exogenous. Furthermore, these results suggest that it is likely that at least one of the included instruments is not exogenous, which makes the results less strong. The F-statistics, to test the relevance of the instruments, is for all three models larger than ten, suggesting that the instruments are not weak. Lastly, the results of the Durbin-Wu-Hausman test show that the null-hypothesis of all three models is not rejected. This implies that in all regression endogeneity is expected to be a problem.

Interaction

As mentioned, by using the underlying determinants of the law and thus multiple instruments, it is possible to perform the IV regression with the interaction included as well. The coefficient of the wage gap is negative and significant at one percent. The interaction term itself is positive and significant at one percent as well. This relationship is thus in line with the relationship observed in the OLS model and similar to the previous models, the magnitude of the coefficients increased relatively much. These results support thus the equity argument, due to the feeling of inequity a larger wage gap is detrimental for firm performance. The abstractness of stock compensation or the more negative value employees attach to it, makes that a larger share of stock compensation decreases the feeling of inequity which is beneficial for firm performance. Based on these results the same conclusion as on the OLS model is made, no sufficient evidence for the uncertainty argument of stock compensation is found, instead the equity theory seems to dominate.

Sample selection bias

The results of the regression analysis based on the randomized sub-sample are presented in Table C1-C3 in Appendix C. The estimates of the OLS regressions are largely in line with those of the full sample, except for the wage gap variables. The sign of the wage gap has changed direction when using the randomized sub-sample in both the regression with only the wage gap included and the regression with the proportion of stock compensation included

(models 1 and 3). However, the other independent variables are largely in line with the full model, showing the same sign and significance. In the IV regressions, the direction of the relationship of the main independent variables are the same as in the full-sample regressions. However, the coefficients in full-sample regression have a much higher magnitude and are significant. These results imply that, although the sample might bias the results slightly, the used sample is probably still able to give a representable indication of the relationship between compensation schemes and firm performance.

5. Conclusion

In sum, based on the literature on the tournament theory it was argued that a higher compensation in higher ranks works motivating for employees since they might put more effort in to achieve those higher ranks and higher compensation. In addition, the same effect was expected for a higher stock compensation, as this links effort and compensation to each other. However, the impact of the interaction of those two effects on firm performance is an underexposed topic in research. This research performed an attempted to fill this gap in the literature and examined what the impact of a higher share of stock compensation is on the tournament value on firm performance. Besides the general literature on the tournament theory and stock-based incentives, two other concepts play an import role in the explanation. First, the equity theory which states that the feeling of inequity among employees is detrimental for firm performance. This could imply that a higher wage gap could be disadvantageous for firm performance, but as well that a higher share of stock compensation could diminish this effect as it is harder to assess the exact value of stock compensation for employees. Second, the uncertainty and risk-aversion of employees could play a role. The exact value of stock compensation is only known when the stocks are exercised, which brings a lot of uncertainty for the exact value. A higher share of stock compensation could thus lower the motivating effect of a large wage gap consisting for a large part of stocks.

The OLS estimation provided no evidence for a positive relationship between a larger wage gap and firm performance. This suggest that feelings of inequity dominate the motivating effect of the tournament theory. Furthermore, a positive relationship was found between stock compensation and firm performance, which is in line with the expectations. Lastly, when examining the interaction of both schemes, evidence in favour of the equity theory is found, a large wage gap is detrimental for firm performance, but a larger share of stock compensation diminishes this effect. The IV results differ somewhat compared to the OLS results. For the wage gap is a similar relationship found, but now a negative relationship between stock compensation and firm performance is observed. This provides some first evidence that the uncertainty argument plays a role, as this could dominate and rule out the initial positive effect by demotivating the lower levels of a company. When examining the interaction between both schemes, similar to the OLS estimates evidence in favour of the equity theory is found. The wage gap has a negative effect, but the interaction term is positive, which implies that a larger share of stock compensation diminishes the negative effect of the tournament theory.

Overall, there is concluded that the share of stock compensation of the total salary does play a role in the effect of the tournament theory on firm performance. Despite that the results of the OLS and IV estimations are slightly different, it is concluded that firm performance can be explained by the equity argument underlying the compensation schemes. Either due to the uncertainty of stock compensation or other negative valuations of it, a compensation consisting of a larger share of stocks, is seen as less unequal. Which diminishes the negative effect of a large wage gap.

5.1 Limitations and Recommendations

Although this research provides some interesting insights in the role of stock compensation on the tournament value and makes, by doing so, an important contribution to the existing literature, it does not come without limitations. As described, it is likely that the OLS estimations are subject to endogeneity which can cause biased results. To solve this issue, an IV estimation is performed, however, as the underlying assumptions of the instrument cannot be tested, it is possible that the IV estimates are biased as the consequence of an inappropriate instrument as well. Additionally, it could be that firms that fulfil the requirements of the law do actually not report the ratios or that firms that are not required to report do still report the ratios. This could influence the results. Instead of using the requirements as the basis of the instrument, future research could investigate which firms do actually report those ratios as a consequence of the law. This will give a more accurate measure of the instrument. Furthermore, in future research it is recommended to extent this analysis with a different instrument.

Besides, this research has focussed on stock compensation and the tournament value, however, there are more incentivizing compensation schemes that companies use, such as pension or other long-term plans. So even though this research includes a seemingly important interaction, it neglects at the same time many other forms of compensation. To get to a complete and full understanding of the exact interaction and drivers of compensation schemes and their relation to firm performance, those other manners of compensation should be considered as well. Additionally, in this research the stock compensation of the upper levels is examined, no distinction in rank is made. However, it could be that the impact of a larger share of stock compensation is more significant for certain ranks, for example when this concerns the direct rank above the employee. As the data was too limited to include this, the examination of the

impact of stock compensation is rather general. This prevents from making specific recommendations and implications to firms about which levels of shares of stock compensation might work the most motivating, as the conclusions only go about the overall stock compensation in a company. Therefore, in future research it is recommended to extend this research by including other means of compensation, such as options or pension plans, as well or to consider the interactions and kind of compensation specific by rank. Additionally, there should be accounted for whether a firm actually uses a compensation scheme. Due to a lack of data, it is not included in this research, but by including data or performing a survey on whether and if so, which compensation schemes an organisation uses, the results can increase in accuracy. Some firms might not use any compensation scheme or an alternative scheme as well, not accounting for this might give biased results.

Despite these limitations, this research provided some insights in the interaction and role of stock compensation and rank-based compensation, two commonly used compensation schemes. The results of this research could thus provide worthful implications for companies, it suggests that firms should revise and think carefully about their compensation schemes, not only separately, but as well consider the aggregated impact on firm performance. Furthermore, it is a good starting point for future research to investigate what the exact interaction is and to determine which ratio is beneficial for firms to achieve an as highest possible firm performance in the most efficient way. Lastly, it adds an important contribution to the debate and policy implications on the CEO pay, as stock compensation has a detrimental influence on the tournament value on firm performance, an effective policy might want to target high stock compensation, this will likely decrease the CEO-employee pay ratios and costs, while it does not affect firm performance negatively.

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Appendix A

Table A1: Variable definitions and data source.

Variable	Definition	Source
Total sales	Total sales of a firm, in US$	Compustat
Wage gap	The difference between the average compensation in a firm and the executive's compensation, in US$ (x1000)	Execucomp & Compustat
Stock compensation	The total amount of stock compensation received, in US$ (x1000)	Execucomp
Proportion stock compensation	The share of stock-based compensation of total compensation	Execucomp
Size	(Log) Total assets	Compustat
# Employees	Total numbers of employees in a firm	Compustat
ROA	(Log) The operating income after depreciation divided by total assets	Compustat
Capex	(Log) Ratio of Capex divide by total sales	Compustat
Leverage	(Log) The ratio of long-term debts to total assets	Compustat
Employee turnover	Percentage of employees that has left the company compared to the previous year (t-1)	Compustat
Gender	Dummy equal to one if the CEO has gender male and zero otherwise	ISS
Voting Power	The percentage of voting power of an executive	ISS
Recent turnover	Dummy equal to one if a CEO turnover took place in the last year and zero otherwise	ISS
Other link	Dummy equal to one if the CEO has other (interlocking) linkages and zero otherwise	ISS
Insiders	The number of insiders on a board	ISS

Note: The Data sources are the sub-databases from which the data is obtained, all these databases are available at WRDS.

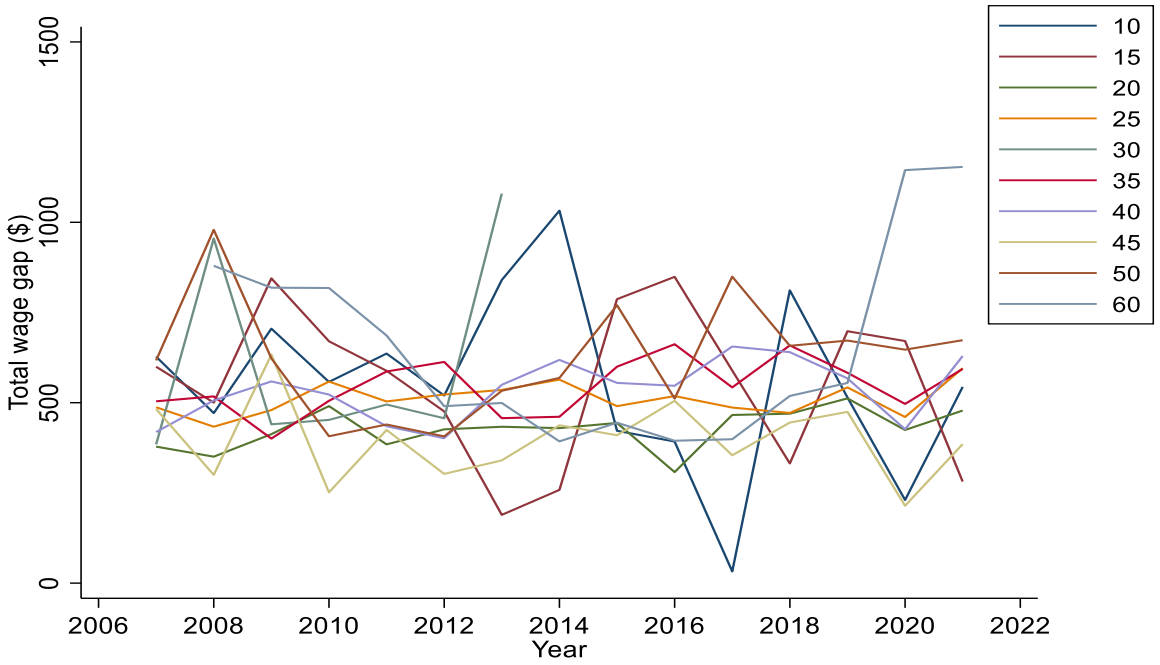

Figure A1: compensation scheme distribution per industry. *With industries defined as*: *(10)-Energy, (15)-Materials, (20)-industrials, (25)-Consumer Discretionary, (30)-consumer Staples, (35)-Health Care, (40)-financials, (45)-Information Technology, (50)-Communication services, (60)-Real Estate.*

Table A2: (Summary) statistics of the instruments

Variable	2018	2019	2020	2021	Total
Disclosure Law	36	55	74	90	255
All	795	791	794	741	3,121
	Observations	Mean	Std. dev.	Min	Max
Company age	5,397	17.87	7.38	1	35
Public float	11,274	14,610.13	27,230.08	16.05	199,658.5
Non-convertible debt	11,240	3,984.49	7,097.57	0	48,643.6

Table A3: First stage results

Variables	Wage Gap	Stock compensation	Proportion stock compensation
	(1)	(2)	(3)
IV – Disclosure law	588.5***	5,421***	9.956***
	(11.89)	(207.0)	(1.111)
Size	61.84***	571.7***	6.880***
	(6.278)	(46.77)	(0.599)
Ln(#employees)	18.36***	-8.671	-0.0908
	(6.166)	(40.48)	(0.624)
Employee turnover	-0.132	-7.965***	-0.138***
	(0.149)	(1.534)	(0.0126)
ROA	-99.74***	-816.9***	18.37***
	(35.15)	(214.8)	(3.701)
Ln(capex)	4.849	153.1***	2.413***
	(4.219)	(19.89)	(0.405)
Ln(leverage)	-12.30***	5.266	-0.324
	(1.722)	(10.60)	(0.226)
Gender	77.82***	370.7***	-0.900
	(5.368)	(34.30)	(0.664)
Voting power	0.992***	-0.643	-0.0298
	(0.294)	(1.735)	(0.0317)
Recent turnover	256.2***	478.0***	5.002**
	(17.36)	(167.2)	(2.307)
Other link	10.97	-363.7***	-7.455***
	(15.30)	(70.98)	(1.585)
Insider	13.93***	94.50***	0.479***
	(0.642)	(6.780)	(0.0680)
Constant	-244.4***	-4,290***	26.49***
	(30.83)	(261.6)	(3.643)
Observations	9,693	9,693	9,685
R-squared	0.531	0.502	0.417
Year & Firm FE	Yes	Yes	Yes

*Note: Robust standard errors are between parentheses, * < 0.10, ** < 0.05, *** < 0.01.*

Table A4.1: First stage IV results.

Variables	Wage Gap	Stock compensation	Proportion stock compensation	Wage gap* Proportion stock compensation
	(1)	(2)	(3)	(4)
Company age	4.145***	-9.535**	-0.766***	6.253
	(0.717)	(4.681)	(0.0708)	(55.60)
Public float	0.000103	0.0363***	0.000130***	0.0965***
	(0.000381)	(0.00422)	(2.24e-05)	(0.0361)
Non-convertible debt	0.0104***	0.113***	-0.000297**	1.105***
	(0.00218)	(0.0192)	(0.000124)	(0.196)
Size	19.15*	452.0***	6.128***	4,104***
	(9.829)	(71.70)	(0.994)	(826.8)
Ln(#employees)	39.96***	-327.6***	1.669*	1,404*
	(9.739)	(66.91)	(0.873)	(727.4)
Employee turnover	-0.225	-7.477***	-0.139***	-94.37***
	(0.162)	(1.200)	(0.0140)	(13.93)
ROA	148.5***	-1,665***	31.11***	3,583
	(46.24)	(344.4)	(4.884)	(3,823)
Ln(capex)	-3.891	89.76***	-0.0855	-683.1**
	(4.597)	(26.84)	(0.445)	(343.0)
Ln(leverage)	-9.524***	-92.26***	-0.302	-1,129***
	(2.130)	(14.52)	(0.270)	(189.4)
Gender	83.68***	497.3***	-1.137	4,254***
	(9.334)	(63.04)	(1.020)	(762.5)
Voting power	0.294	0.907	0.0177	5.369
	(0.300)	(1.953)	(0.0341)	(24.67)
Recent turnover	290.0***	745.4***	13.17***	25,727***
	(18.85)	(112.6)	(1.902)	(1,760)
Other link	-23.31*	-388.6***	-4.969***	-3,728***
	(13.55)	(88.48)	(1.679)	(1,055)
Insider	16.94***	107.0***	0.462***	1,326***
	(1.049)	(10.38)	(0.102)	(95.60)
Constant	-225.3***	-2,083***	21.08***	-34,380***
	(62.74)	(460.3)	(6.309)	(5,155)
Observations	4,598	4,598	4,598	4,598
R-squared	0.421	0.517	0.510	0.471
Firm & Year FE	Yes	Yes	Yes	Yes

*Note: Robust standard errors are between parentheses, * < 0.10, ** < 0.05, *** < 0.01.*

Table A4.2: Second stage IV results.

Variables	Total sales			
	(1)	(2)	(3)	(4)
Wage gap	60.58***			-75.93***
	(12.39)			(14.83)
Stock compensation		6.613***		
		(0.752)		
Proportion stock compensation			532.5***	
			(53.69)	
Wage gap* Proportion Stock compensation				1.733***
				(0.205)
Size	3,152***	-2,459***	735.9	-5,651***
	(669.7)	(718.6)	(744.0)	(1,447)
Ln(#employees)	-732.0	4,016***	2,175***	3,221***
	(990.8)	(503.2)	(563.1)	(1,220)
Employee turnover	-3.026	48.14***	87.57***	150.8***
	(8.644)	(9.328)	(12.69)	(23.38)
ROA	-5,759	7,351***	-13,659***	4,345
	(3,852)	(2,205)	(3,317)	(5,214)
Ln(capex)	434.8	-1,391***	-87.74	-66.38
	(313.2)	(273.4)	(283.2)	(378.5)
Ln(leverage)	1,407***	1,012***	1,058***	1,600***
	(170.9)	(117.8)	(162.7)	(266.2)
Gender	-5,279***	-2,935***	811.3	-739.8
	(1,173)	(500.9)	(570.3)	(1,436)
Voting power	-34.74*	-20.57	-39.74**	-9.338
	(20.47)	(14.12)	(18.62)	(31.77)
Recent turnover	-16,946***	-2,710**	-5,310***	-20,108***
	(3,956)	(1,096)	(1,391)	(6,124)
Other link	2,376**	2,830***	3,083***	4,897***
	(930.1)	(715.9)	(1,017)	(1,676)
Insider	-1,160***	-808.4***	-301.7***	-1,053***
	(231.4)	(104.4)	(61.11)	(341.0)
Constant	-31,132***	4,031	-29,062***	30,118***
	(4,714)	(3,974)	(3,608)	(8,531)
Observations	4,598	4,598	4,598	4,598
R-squared	-	0.165	0.208	-
Firm & Year FE	Yes	Yes	Yes	Yes

*Note: Total sales is the dependent variable and the company age, public float and non-convertible debt are instruments. For all variable definitions see the description in section 3. Robust standard errors are between parentheses, * < 0.10, ** < 0.05, *** < 0.01.*

Appendix B

Table B1: Test of exogeneity of the instruments..

Regression	Chi2	P-value
Wage gap	118.593	0.0000
Stock compensation	16.5227	0.0003
Proportion stock compensation	182.192	0.0000
Wage gap*proportion stock compensation	2.6045	0.1066

Note: This table reports the test statistics of the J-test for overidentifying restrictions with the split instruments, company age, public float and non-convertible debt.

Table B2: Test for relevance.

Regression	F-statistic	P-value
Panel A: IV – Split IV		
Total Sales		
Wage gap	18.3666	0.0000
Stock compensation	87.6048	0.0000
Proportion stock compensation	61.2088	0.0000
	t-statistic	P-value
Panel B: IV – Law 2017		
Total Sales		
Wage gap	49.30	0.0000
Stock compensation	26.10	0.0000
Proportion stock compensation	8.93	0.0000
Panel B: IV - Law 2017		
Net Income		
Wage gap	2,448.23	0.0000
Stock compensation	685.99	0.0000
Proportion stock compensation	80.38	0.0000

Note: This table shows the F-statistics and p-values for the split instrument regressions; with company age, public float and non-convertible debt, and the t-statistics and p-value for the regressions with the Disclosure Law as instrument. The rule of thumb states that an instrument is considered weak if the F-statistics is below 10 or the t-statistic below 3.2 or the p-value above 0.0016.

Table B3: Reduced form test.

Dependent variable	Instrument	F-statistic	P-value
Sale	Disclosure Law	57.32	0.0000
Net income	Disclosure Law	1.66	0.1980
Sale	Split Instrument	373.97	0.0000

Note: This table shows the F-statistic of the standard joint Wald test on the reduced form.

Table B4: Durbin-Wu-Hausman (DWH) test statistics

Regression	DWH statistic	P-value
Panel A: IV - Law 2017		
Total Sales		
Wage gap	14.32	0.0002
Stock compensation	81.02	0.0000
Proportion stock compensation	16.25	0.0001
Net Income		
Wage gap	31.61	0.0000
Stock compensation	19.44	0.0000
Proportion stock compensation	22.29	0.0000
Panel B: IV – Split IV		
Total Sales		
Wage gap	619.22	0.0000
Stock compensation	5,1813.39	0.0000
Proportion stock compensation	677.46	0.0000

Appendix C

Table C1: OLS estimates on randomized sub-sample

Variables	Total Sales				
	(1)	(2)	(3)	(4)	(5)
Wage gap	0.267			0.304	-2.030**
	0.444			(0.450)	(0.967)
Stock compensation		0.348***			
		(0.0719)			
Proportion stock			5.572	5.320	-10.74
compensation			(4.447)	(4.495)	(6.784)
Wage gap* Proportion					0.0367***
					(0.0133)
Size	4,287***	4,139***	4,286***	4,280***	4,309***
	(327.2)	(328.3)	(327.0)	(327.8)	(325.1)
Ln(#employees)	3,571***	3,552***	3,568***	3,549***	3,553***
	(381.6)	(383.0)	(381.2)	(381.9)	(378.7)
Employee turnover	-0.655	0.467	-0.949	-0.880	-0.893
	(7.411)	(7.400)	(7.470)	(7.455)	(7.458)
ROA	20,419***	20,385***	20,220***	20,233***	20,346***
	(2,175)	(2,158)	(2,184)	(2,184)	(2,186)
Ln(capex)	1,165***	1,078***	1,173***	1,171***	1,185***
	(201.3)	(203.2)	(202.9)	(202.9)	(203.6)
Ln(leverage)	725.9***	709.8***	748.5***	750.3***	727.3***
	(94.16)	(94.01)	(95.83)	(95.83)	(95.89)
Gender	-170.3	-305.1	-141.1	-172.9	-187.6
	(357.2)	(345.3)	(348.9)	(357.4)	(357.7)
Voting power	-44.08***	-43.54***	-43.78***	-44.21***	-42.76***
	(10.25)	(10.05)	(10.23)	(10.26)	(10.21)
Recent turnover	1,842***	1,044	1,872***	1,770***	1,629**
	(678.5)	(711.8)	(684.2)	(682.0)	(684.1)
Other link	1,446**	1,561***	1,470**	1,471**	1,492**
	(601.4)	(595.2)	(599.0)	(599.1)	(593.3)
Insider	-199.7***	-225.1***	-206.3***	-210.9***	-205.3***
	(31.12)	(31.28)	(30.90)	(31.85)	(31.54)
Constant	-39,758***	-38,946***	-40,023***	-40,029***	-39,463***
	(2,341)	(2,354)	(2,350)	(2,352)	(2,342)
Observations	4,312	4,312	4,300	4,300	4,300
R-squared	0.828	0.829	0.828	0.828	0.828
Firm & Year FE	Yes	Yes	Yes	Yes	Yes

*Note: Total sales is the dependent variable, for all variable definitions, see the description in section 3. Robust standard errors are between parentheses, * < 0.10, ** < 0.05, *** < 0.01.*

Table C2: First stage IV estimates on randomized sub-sample

Variables	Wage gap	Stock compensation	Proportion stock compensation
	(1)	(2)	(3)
IV – Disclosure Law	514.7***	4,260***	12.33***
	(13.54)	(197.4)	(1.150)
Size	45.00***	495.9***	6.223***
	(10.69)	(71.57)	(0.926)
Ln(#employees)	44.25***	65.73	0.404
	(10.70)	(67.66)	(1.010)
Employee turnover	0.283	0.381	-0.105***
	(0.180)	(1.358)	(0.0193)
ROA	-25.93	-410.0	14.20**
	(54.18)	(364.0)	(5.917)
Ln(capex)	19.02***	288.3***	3.444***
	(6.227)	(36.85)	(0.644)
Ln(leverage)	-12.18***	11.21	-0.188
	(2.990)	(17.03)	(0.355)
Gender	103.1***	376.1***	0.917
	(10.19)	(56.30)	(1.078)
Voting power	1.791***	-0.906	-0.000818
	(0.478)	(2.308)	(0.0479)
Recent turnover	313.1***	2,216***	15.25***
	(21.33)	(356.0)	(1.846)
Other link	13.07	-543.0***	-6.851***
	(21.70)	(94.38)	(2.328)
Insider	10.73***	57.65***	0.399***
	(1.050)	(9.647)	(0.0976)
Constant	-222.0***	-1,011**	16.65**
	(70.37)	(460.0)	(8.302)
Observations	4,309	4,309	4,296
R-squared	0.567	0.500	0.425
Firm & Year FE	Yes	Yes	Yes

*Note: Robust standard errors are between parentheses, * < 0.10, ** < 0.05, *** < 0.01.*

Table C3: Second-stage IV results randomized sub-sample

Variables	Total Sales		
	(1)	(2)	(3)
Wage gap	-0.820		
	(1.358)		
Stock compensation		-0.0991	
		(0.164)	
Proportion stock compensation			-34.82
			(56.72)
Size	3,806***	3,818***	4,012***
	(328.9)	(331.9)	(463.0)
Ln(#employees)	4,121***	4,091***	4,085***
	(389.3)	(380.4)	(382.9)
Employee turnover	6.572	6.377	2.357
	(7.090)	(7.103)	(9.579)
ROA	19,707***	19,688***	20,121***
	(2,002)	(2,003)	(2,187)
Ln(capex)	1,234***	1,247***	1,355***
	(199.9)	(205.7)	(294.5)
Ln(leverage)	716.0***	727.1***	727.7***
	(87.63)	(88.39)	(88.85)
Gender	312.5	265.2	248.8
	(338.3)	(316.4)	(315.7)
Voting power	-43.19***	-44.75***	-45.22***
	(10.09)	(9.697)	(10.18)
Recent turnover	1,851***	1,814***	2,139**
	(687.6)	(656.9)	(971.2)
Other link	2,214***	2,149***	1,970**
	(701.5)	(716.1)	(843.1)
Insider	-223.5***	-226.6***	-226.3***
	(35.41)	(33.19)	(40.32)
Constant	-19,118***	-19,212***	-18,049***
	(2,301)	(2,292)	(3,121)
Observations	4,309	4,309	4,296
R-squared	0.826	0.825	0.823
Firm & Year FE	Yes	Yes	Yes

*Note: Total sales is the dependent variable and the Disclosure Law dummy is used as an instrument. For all variable definitions, see the description in section 3. Robust standard errors are between parentheses, * < 0.10, ** < 0.05, *** < 0.01.*