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MASTER THESIS

Firm value and performance effects of pay disparity in The Netherlands

An empirical analysis of AEX listed companies

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Abstract

This paper examines the relation between the CEO-employee pay ratio and the firm value and firm performance. Therefore, it uses unique hand-collected data from CEO remunerations of listed AEX firms between 2010 and 2017. Using OLS regressions with firm-level and year fixed effects, this paper shows a significant effect between the CEO-employee ratio and the firm performance and value. The first regressions demonstrate a positive effect between the pay ratio and firm performance and value. This corresponds with the tournament theory and managerial talent perspective. The second regressions shows a concave effect of the pay ratio on firm performance and value. This means that the tournament theory and managerial talent perspective are complementary to the relative deprivation theory and the equity theory. This research examines the reaction of employees and stakeholders with the disclosure of remunerations of the CEO and average employee. It shows that pay inequality not only affects employee behaviour, but also influences investors' actions and their assessment of pay inequality.

Keywords: Tournament theory; Managerial talent; Equity theory; Relative deprivation theory; Firm performance; Firm value; Pay ratio; Concave effect; Linear effect

Contents:

List of figures and tables:

Figures:

Tables:

1 Introduction

In the renewed governance code that was published last year, listed companies in The Netherlands were asked to include in their annual report the so called pay ratio: the disparity in remuneration between the CEO and the average employee.

This renewed code reflects the increased scrutiny wage disparities are under. The wage increase of the CEO of the ING bank, Ralph Hamers, was discussed extensively in Dutch media. The wage increase of 40% of ASR Nederland CEO Jos Baeten was also discussed greatly in Dutch media.

There are different theories about the effects of pay disparity. On the one hand there is the economic perspective with the tournament theory and the managerial talent perspective. On the other hand there is the behavioural perspective with the equity theory and the relative deprivation. The tournament theory suggests that employees are more motivated when pay disparity is larger (Lazear & Rosen, 1981). The wider wage gap will increase their effort to promote, it states. The greater the differences in remuneration, the greater the motivation and effort of the employee. The managerial talent perspective suggests that more talented CEOs often work at bigger companies (Gabaix & Landier, 2008; Terviö, 2008). According to them, there is a shortage in managerial talent that is capable to successful running large and complex modern corporations. A wider disparity between the CEO and the average worker pay shows the success of a firm in securing a more talented CEO. When these theories are valid, firms with higher pay ratios perform better and have a higher value.

The equity theory (Adams, 1965) and relative deprivation theory (Crosby, 1984) are based on behavioural perspectives. They concluded that inequity between individuals has negative effects. Workers will be less satisfied, less productive and will leave a firm quicker with higher pay disparity. When the pay ratio is lower and is considered as more equitable, employees work harder and have higher levels of commitment and cooperation, which results in higher firm value and performance.

Given the validity of these theories, it is not surprisingly that there is a lot of empirical evidence supporting both viewpoints. Some prior literature examines that pay dispersion enhances firm performance or firm value, which is in line with the economic perspective (Banker, Bu, & Mehta, 2016; Burns, Minnick, & Starks, 2017; Eriksson, 1999; Faleye et al., 2013; Heyman,

2005; Kale et al., 2009; Lee, Lev, & Yeo, 2008; Main, O'Reilly III, & Wade, 1993). Other literature concludes that inequity between individuals has negative effects on the performance and value (Bebchuk, Cremers, & Peyer, 2011; Bloom, 1999; Cowherd & Levine, 1992; Newton, 2015; Pfeffer & Langton, 1993; Shin, Kang, Hyun, & Kim, 2015; Siegel & Hambrick, 2005; Wade, O'Reilly III, & Pollock, 2006). There are also other studies that suggests there is a concave relationship between the pay ratio and the performance and value of a firm (Bingley & Eriksson, 2001; Braakmann, 2008; Brown, Sturman, & Simmering, 2003; Frick, Prinz, & Winkelmann, 2003; Mahy, Rycx, & Volral, 2011; Winter-Ebmer & Zweimüller, 1999; Yang & Klaas, 2011). This means that the tournament theory is not contradictory, but complementary to the equity theory and relative deprivation theory. The tournament theory dominates the equity theory and deprivation theory to a certain level, but it is reversed beyond that level.

This research examines the effects of the pay ratio on the firm performance and firm value. The objective of this research is therefore to comprehensively answer the following research question:

What is the effect of higher pay disparity on firm performance and firm value?

This research shows that all theories discussed above are valuable, using unique data from listed firms in the Netherlands for the period 2010 to 2017. I analysed the relation between pay ratio and firm value and firm performance using linear and nonlinear regressions. The remunerations of the CEOs for the pay ratios of Dutch listed firms are hand-collected from annual reports. The other data is retrieved from *Datastream*. Return on assets and stock returns are used as dependent variables for the firm performance and the Tobin's q is used for the firm value of a firm. The pay ratio is the pay disparity between the average employee remuneration and the CEO remuneration.

Using OLS regressions, significant effects are found between the pay ratio and the firm value and performance variables. The first regressions show a significant effect between the natural logarithm of the pay ratio and the firm value and performance, which supports the managerial talent perspective and the tournament theory.

Other regressions show a significant hump shaped relationship between the pay ratio and the firm value and performance, implicating that the tournament theory and managerial talent perspective are complementary with the equity theory and relative deprivation.

This research proceeds as follows. Section 2 analyses the relevant literature within the context of the relationship between the pay ratio and the firm value and performance. Section 3 provides the hypothesis development. Section 4 shows the sample selection, data collection and the used research methodology. The empirical results are discussed in section 5. Section 6 combines the results discussed in section 5 and provides the conclusion. Section 7 and 8 describe the limitations and further research of this research respectively.

2 Literature review

The aim of this section is to provide a condense overview of the current knowledge in related areas of the effects of the CEO-to-employee relative pay ratio on firm performance and firm value. Section 2.1 covers the determinants of the pay ratio to get a better understanding why there are big differences in pay disparity between firms. Section 2.2 provides the different theories of the effects of vertical and horizontal disparity on firm value and firm performance. Section 2.3 presents the existing literature of the different effects of pay disparity on firm performance and firm value. Section 2.4 interprets the Dutch corporate governance code.

2.1 Determinants of the pay ratio

The pay ratio is the pay disparity between the CEO and the average employee. The pay disparity between companies can differ greatly. According to the newspaper Financieel Dagblad (Kakebeeke & Couwenbergh, 2018), the CEO of Unilever Paul Polman earns 292 times more than his average employee, while the CEO of Vopak earns 21 times more.

There are two different types of pay disparity (Shin, Kang, Hyung, 2015): vertical pay disparity and horizontal pay disparity. Vertical disparity shows the differences in wages within a company at different levels. Horizontal disparity shows the differences of a certain pay level in a peer group.

The vertical disparity is determined by the relative bargaining power between both parties (Hayes & Schaefer, 1999). When a CEO has more bargaining power, the pay disparity will raise. He has more bargaining power to raise his own wage and keep the wages low of the other employees. When employees have more bargaining power, this is the other way around (Faleye et al., 2013).

To understand the big differences between firms and pay ratio, it is helpful to discuss the determinants of the pay ratio. I will draw on the literature of pay ratio to explore a

comprehensive set of determinants which influence the pay disparity. I will discuss the determinants firm size, capital structure, firm diversification, firm unionization and the CEO entrenchment.

First, the firm size. It is the most important determinant in the United States, according to Bebchuk and Grinstein (2005). Core and Guay (1999) look at firm size to capture CEO talent and conclude that larger firms pay higher CEO compensation due to their demand for higher-quality managerial talent. Faleye et al. (2013) shows that an increase of one standard deviation of firm size is associated with an increase of 106% in CEO-employee ratio. They use the natural log of sales as a proxy for firm size.

Terviö (2008) and Gabaix and Landier (2008) also conclude that more talented managers usually work at larger firms. When a CEO is paid for his added value, which is normally the case, a more talented CEO has a higher wage. So bigger companies have more talented CEOs, which results in higher pay levels.

As discussed later, the tournament theory predicts that the price of a tournament must be large enough to motivate the participants to compete against each other to get a promotion (Lazear and Rosen, 1981). So more employees should result in higher pay ratios to motivate them. To conclude, there is a positive relation between firm size and pay ratio.

Second, the capital structure of the company is related to the pay of employees (Chemmanur, Cheng, & Zhang, 2013; Matsa, 2010; Perotti & Spier, 1993). Higher leverage leads to more bankruptcy costs and this must be compensated by higher employee pay. However, it is unclear if an increase in leverage will increase the pay ratio, because the compensation of a CEO also increases with a higher leverage. So there is not a clear relation between the leverage of a firm and the pay ratio.

Thirdly, diversified firms need highly-skilled managers who have the knowledge of multiple, unrelated businesses. Firms who are more diversified have higher work pay ratios (Bloom & Michel, 2002). So more diversified firms have higher pay ratios. In line with diversified firms is that firms with more complex operations will demand higher-quality managers with higher equilibrium wages (Core, Holthausen, & Larcker, 1999; Faleye et al., 2013). Bloom and Michel (2002) conclude that firms with high investment opportunities need better managers to identify and realize growth opportunities. Thus, firms with more complex business have a positive relation with executive pay.

Fourthly, Cowherd and Levine (1992) and Faleye et al. (2013) conclude that the firm's unionization has a negative relation with the pay ratio. Trade unions often argue for a low pay ratio. A firm's unionization increases the relative bargaining power of the employees. So when the proportion of unionized employees is higher, the pay ratio will be lower.

Lastly, pay higher wages to employees will improve the relation between the CEO and the employee (Cronqvist, Heyman, Nilsson, Svaleryd, & Vlachos, 2009; Jensen & Meckling, 1976). CEOs are able to pay their workers more when they are more entrenched in the company. But when a CEO has more financial stakes in the company, this will mitigate this behaviour (Cronqvist et al., 2009). They will pay their workers more, because it will create benefits for themselves, for example lower effort wage bargaining. Another benefit for the CEO is that higher wages can produce more pleasant relationships with their employees (Jensen & Meckling, 1976). On the other side, an entrenched CEO will also get more compensation. CEOs who also serves as chairman have better bargaining power because they are often more experienced and more talented (Core et al., 1999; Faleye et al., 2013). Cronqvist et al. (2009) and Faleye et al. (2013) also look at the age of a CEO and the pay ratio, but they don't find a relationship. To conclude, it is difficult to say if there is a positive or negative relationship between the CEO entrenchment and pay ratio.

Overall, there are a lot of determinants why there are differences between pay disparities of firms. The pay disparity depends on the relative bargaining power of the CEO and its employees. However, the question is what is the effect of pay gaps on the value and performance of the firm. First, I will discuss the theories of the pay ratio on firm performance and firm value. Subsequently, I will discuss the articles with empirical research on the effects of CEO-to-employee pay on the firm performance and firm value.

2.2 Effects of pay gaps

There are different theories about the effects of vertical and horizontal disparity. On the one side there is the economic perspective with the tournament theory and the managerial talent perspective, on the other hand there is the behavioural perspective with the equity theory and the relative deprivation.

2.2.1 Tournament theory

> *"In the Olympics prizes are awarded, not on the basis of absolute performance, but on the basis of relative performance. Similarly, in most organizations, one of the most important rewards is promotion."* (Green & Stokey, 1983)

The tournament theory describes the principle that the highest placed persons in an organization receives the highest wage as a "price" when they put best work (Lazear & Rosen, 1981). The tournament theory assumes that wages are a great motivation for people and employees will therefore do everything they can to win the highest prize. By working hard and striving for the best, they have a chance of winning a position that is higher than the current one and therefore earn more. This would then be the "price" for hard work. It is comparable with a reward in a sport tournament when you go to the next round.

A good example in the literature of the tournament theory is a research of Ehrenberg and Bognanno (1990), who use data from golf tournaments. They show that performance of golf players is better when the prize money is more skewed toward relatively large prizes for the winner. This supports the basic premise of the tournament theory, namely that performance can be elicited by greater awards for relatively good performers. The simplest tournament in a company is a tournament with two people competing for a position. The greater the difference in remuneration, the greater the motivation and effort.

The tournament theory provides an argument of output-related awards. The theory suggests that lower-level employees make more effort to work hard to earn a promotion to the next rung within the company when the pay ratio is higher. So the theory implies that higher pay ratios results in higher effort in the whole company. This results in better performance and higher firm value.

2.2.2 Managerial talent

Terviö (2008) and Gabaix and Landier (2008) argue that more talented CEOs often work at bigger companies. According to them, there is a shortage in managerial talent that is capable to successful running large and complex modern corporations. In order attract on of the rare talented CEOs, companies pay theme large salaries. Over the years, firms have been growing in size and complexity. The economic impact of a decision by a CEO is multiplicative in talent and firm size. The decision of a CEO in relative terms has a greater impact, because this decision can have consequences for the entire company, while the decision of an employee

only concerns a small part of the organization (Edmans & Gabaix, 2016). So a higher pay ratio can be seen as inevitable in an environment with larger and more complex firms. A wider disparity between salary of the CEO and the average worker shows the success of a firm in securing a more talented CEO. When this argument is valid and a CEO with more talent produces better results, firms with higher pay ratios perform better and have a higher value.

2.2.3 Equity theory and relative deprivation theory

The equity theory and relative deprivation theory (Adams, 1965; Crosby, 1984) are based on behavioural perspectives. The equity theory assumes that an individual is inclined to pursue the same balance between efforts and returns as he seems to observe in others. This can result in three situations.

Firstly, the employee thinks that the ratio between his input and output is in balance. Examples of input for a job are time, effort, loyalty, and flexibility. Examples for output are pay, bonus, recognition, development, enjoyment, and reputation.

Secondly, he believes that he is undervalued compared to other employees. This may result in him negotiating for a higher wage, putting less effort in his job or switching to another company.

Thirdly, an employee may also feel overvalued compared to others. As a result, he puts more effort in his job, asks for a wage reduction, or he tries to increase the wages of his colleagues. Thus, vertical disparity can result in a perception of inequity among lower-level employees.

The relative deprivation theory is closely related to the equity theory. The theory suggests that people feel deprived when they think they are not treated equally. Therefore, they find it unjust and strive to achieve this, perhaps by protesting for a higher wage or by leaving to another company.

To conclude, where the tournament theory and managerial talent suggest that pay disparity results in higher effort by employees, the relative deprivation theory and equity theory also considers whether the employees think it is fair compared to their colleagues, and act accordingly. Based on these theories, the pay inequality of companies will be examined. In the next part, I will discuss the articles who did empirical research on the effects of CEO-to-employee pay on the firm performance and firm value.

2.3 Firm performance and firm value

Prior literature conclude that the pay ratio disparity can have a positive, negative or mixed effect on firm performance and value. Some of that literature suggests that the pay disparity has a positive effect on the firm value and performance. Other studies provides empirical evidence that it has a negative effect, which is in line with the behavioural perspective. There are also empirical studies who show that the tournament theory and behavioural perspectives are complementary. They show that there is a concave relationship between pay disparity and the firm performance and firm value. In this part I will discuss these articles. Table 1 presents an overview of all literature discussed in this section.

2.3.1 Positive effects of pay ratio

Some prior literature suggests that dispersion enhances firm performance or firm value, which is in line with the economic perspective (Banker, Bu, & Mehta, 2016; Burns, Minnick, & Starks, 2017; Eriksson, 1999; Faleye et al., 2013; Heyman, 2005; Kale et al., 2009; Lee, Lev, & Yeo, 2008; Main, O'Reilly III, & Wade, 1993)

Faleye et al. (2013) discuss both consequences of the CEO-employee pay. The measure they use for the pay ratio is the natural log of the ratio of total CEO compensation to average non-executive employee pay. The non-executive employee pay is the total compensation including benefits. They use all *Compustat* firms over 1993-2006 for their sample. They apply the Tobin's q measure for the firm value and the return on assets for the operating performance. An increase of one standard deviation in CEO-employee pay ratio is associated with an increase of 5.3% in firm value, the study concludes.

Overall, the results of Faleye et al. (2013) are inconsistent with the argument that higher pay ratios create perceptions of inequity that distort incentives for rank and file workers. Rather, the results suggest that higher pay ratios incentivize greater productivity, better operating performance, and improved value creation for certain types of companies, which is in line with the tournament theory. Kale et al. (2009) also analyse the effect of the pay ratio on firm value and performance and used the same variables, but with a different sample. The results are in line with Faleye et al. (2013).

Burns et al. (2017) also examine the relation between CEO pay ratio and the firm value and establish a positive effect as well. However, this effect does not hold in all countries. They say

that steeper tournaments can be more effective at improving firm value in countries that value competition, power and fairness in income.

Lee et al. (2008) focuses on the dispersion of compensation across managers and its impact on firm value and firm performance. Their sample is drawn from all firms listed in the *ExecuComp* database during 1992-2003. They conclude that large pay dispersion is associated with enhanced performance in firms with high agency costs related to managerial discretion, and in firms with effective corporate governance.

Main et al. (1993) only discuss the performances of a firm in the U.S between 1980 and 1984 and find results that are also consistent with the operations of tournaments. They use return on assets and the stock market return as a proxy for the performance of a company. There is a positive relation between wage dispersion and return on assets. However, there is no significant relation between stock market returns and wage dispersion.

Eriksson (1999) concludes that there is a weak relationship between firm performance and average pay for Danish firms. This aberrant outcome may be explained by his performance variable: due to a lack of information, he uses the 3-year average of profits divided by sales.

Heyman (2005) uses a data set for Sweden from 1991 to 1995 to test the relationship between the workers' pay and profit per employee. Consistent with the tournament theory, results yield a positive and significant effect of wage dispersion on profits.

Banker et al. (2016) analyse Chinese firms from 2000 to 2009 for their sample to examine the effect of pay gap on performance. They use return on assets, margin and growth as performance measures. Margin is the net income scaled by total sales and growth is the sum of asset growth and sales growth. Their empirical results provide strong evidence that the pay ratio has a positive effect on the firm's performance. The high growth opportunities in China creates a strong demand for scarce executive talent, supporting the assumptions of the managerial talent theory that predicts a positive relation.

To conclude, there is plenty prior literature that find evidence of a positive relation between the pay ratio and the firm performance and firm value (Banker, Bu, & Mehta, 2016; Burns, Minnick, & Starks, 2017; Faleye et al., 2013; Heyman, 2005; Kale et al., 2009; Lee, Lev, & Yeo, 2008; Main, O'Reilly III, & Wade, 1993). Only Eriksson (2008) concludes that there is a weak relationship for Danish firms.

2.3.2 Negative effects of pay ratio

On the other side, there are studies who provide empirical evidence that lower pay ratios are beneficial for the firm performance, supporting the behavioural perspective. Some literature concludes that inequity between individuals has negative effects on the performance and value (Bebchuk et al., 2011; Bloom, 1999; Cowherd & Levine, 1992; Newton, 2015; Pfeffer & Langton, 1993; Shin et al., 2015; Siegel & Hambrick, 2005; Wade et al., 2006).

Cowherd and Levine (1992) establish that a lower pay ratio between the management and worker results in higher product quality. A lower pay ratio is lower is considered more equitable, and therefore workers will have higher levels of commitment, effort and cooperation, resulting in a reduction of total production costs and an increase in market share and profitability. So lower pay ratio will increase the performance and value of a company. The relationship between interclass pay equity and product quality is examined in a sample of 102 business units. The interclass pay equity is determined by comparing the salary and inputs of hourly workers and of lower-level managers to those of the top management.

Wade et al. (2006) conclude that lower-level-managers will leave the firm more likely when they are underpaid compared to their CEO. This results in lower firm performance and firm value.

Bloom (1999) studies the relationship between pay dispersion and performance in a field setting with the Major League Baseball. He uses the pay and performance on 1,644 players on 29 teams for 8 year, and concludes that when the pay dispersion is more compressed, individual and organizational performance will increase.

Pfeffer and Langton (1993) used a survey of 60,000 responses from employees in universities. They concluded that larger pay ratios resulted in lower satisfaction, productivity and collaboration. Siegel and Hambrick (2005) demonstrate that there are differences in pay disparity and performance between high- and low-technology firms. High-tech companies suffer more than low-tech companies if their executives are paid widely disparate amounts. This is because good cooperation is needed at high-tech companies and high pay differences result in poor cooperation.

Newton (2015) studies the relationship between the compensation of a CEO, organizational performance and governance quality in large U.S. non-profit organisations. He says that the non-profit sector is characterized by weaker monitoring mechanisms and potentially more

agency problems relative to the profit sector. He concludes that the workers' pay ratio is significantly negative related to the non-profit performance.

Bebchuk et al. (2011) examine the relationship of the CEO pay slice with the value, performance, and behaviour of public firms using data from the *Compustat ExecuComp* database from 1993 to 2004. The CEO pay slice is defined as the CEO remuneration divided by the total compensation of the top five executives.

They conclude that due to governance failures and CEO rent extraction, an increase in CPS results in lower firm value, lower accounting profitability and lower performance. They use the industry adjusted Tobin's q for firm value and industry adjusted ROA for performance. The negative correlation between CPS and Tobin's q is especially concentrated among firms with higher entrenchment levels.

Shin et al. (2015) use data from all firms listed on the Korean Stock Exchange to examine the effect of the executive pay multiple on performance. They use data from Korea from 2000 to 2009. All publicly listed firms are required to provide detailed information on average employee pay in their annual reports. The results show that the pay ratio has a significant negative effect on return on assets and stock returns.

Overall, there are also studies that suggest that higher differences between wages results in lower firm value and lower firm performance, due to lower satisfaction, productivity, and collaboration. When the pay ratio is lower and is considered as more equitable, workers will work harder and will have higher levels of commitment and cooperation. This results in higher firm value and performance.

2.3.3 Mixed effects of pay ratio

Some literature suggest that there is a concave relationship between the pay ratio and the performance and value of a firm (Bingley & Eriksson, 2001; Braakmann, 2008; Brown et al., 2003; Frick et al., 2003; Mahy et al., 2011; Winter-Ebmer & Zweimüller, 1999; Yang & Klaas, 2011). This means that the tournament theory is not contradictory, but complementary to the equity theory and relative deprivation theory. The tournament theory dominates the equity theory and deprivation theory to a certain level, but it is reversed beyond that level.

Brown et al. (2003) examine the relationship between pay levels and financial performance in 333 short-stay acute care hospitals between 1991 and 1999. They conclude that the relationship

between pay structure and return on assets will be moderated by pay level. When a firm lags the market, it is better to have an egalitarian pay structure. When a firm leads the market, it is better to have a hierarchical structure.

Yang and Klaas (2011) investigate the effect of horizontal pay dispersion on the performance, so they look at pay differences among employees in the same rank. They conclude that the relationship between the pay ratio and performance is curvilinear in nature. They use a survey of Korean firms as data and use the operating profit to assets as firm performance variable. Mahy et al. (2011) find a hump-shaped relationship between pay dispersion and firm productivity. This means that up to a certain level, the tournament theory dominates the behavioural perspectives. This relationship is stronger in stable environments for highly skilled workers, for monitoring costs and production-effort elasticity are higher for skilled workers.

Winter-Ebmer & Zweimüller (1999), Bingley and Eriksson (2001) and Braakmann (2008) also find this hump-shaped relationship between pay dispersion and firm productivity. Winter-Ebmer & Zweimüller (1999) use data from Social Security from 130 firms between 1975 and 1991 in Austria. Bingley and Eriksson (2001) use data of Danish firms that have at least five managers for the years 1992 to 1995. Braakmann (2008) uses data from 1993 to 2005 of German firms.

Frick et al. (2003) investigate the effect of pay dispersion on performance in different sports leagues. Outcomes in some leagues support the equity theory and relative deprivation theory, but results in other leagues support the tournament theory.

To conclude, there is also literature that suggests there is a non-linear relation between the pay ratio and firm performance and value, which supports both economic and behavioural perspectives (Bingley & Eriksson, 2001; Braakmann, 2008; Brown et al., 2003; Frick et al., 2003; Mahy et al., 2011; Winter-Ebmer & Zweimüller, 1999; Yang & Klaas, 2011).

Table 1: Overview literature

Literature (author)	Sample period	Area	Type of pay ratio	Firm value/Firm performance measure
Positive effect				
Faleye et al. (2013)	1993-2006	U.S.	Between CEO and average non-executive employee pay	Tobin's q, ROA, revenue per employee
Kale et al. (2009)	1993-2004	U.S.	Between CEO compensation and next level of executives	Tobin's q and ROA
Burns et al. (2017)	2006-2010	All continents	CEO pay divided by the mean of total top four non-CEO executive pay	Tobin's q
Lee et al. (2008)	1992-2003	U.S.	Dispersion of compensation across managers	Tobin's q and stock returns
Main et al. (1993)	1980-1984	U.S.	CEO and average VP	ROA and stock returns
Eriksson (1999)	1992-1995	Denmark	Between CEO, VP, higher-level manager, lower-level manager	3-year average profit/sales
Heyman (2005)	1991-1995	Sweden	Between CEO, other managers and workers	Profit per employee
Banker et al. (2016)	2000-2009	China	CEO to employee	ROA, net income/sales , asset and sales growth
Negative effect				
Bebchuck et al. (2011)	1993-2004	U.S.	CEO divided by top five executives	Tobin's q and ROA
Bloom (1999)	1992-1997	U.S.	Baseball players with Gini-coefficient	Performance team
Cowherd & Levine (1992)	1991	U.S. and EU	Between management and employee	Index of product quality
Newton (2015)	2008-2010	U.S.	Between CEO and average employee non-profit firms	Spending ratio, expenses to assets, fundraising ratio, log(revenue per employee)
Pfeffer & Langton (1993)	1969	U.S.	Between employees in universities	Satisfaction, productivity and collaboration
Shin et al. (2015)	2000-2009	South Korea	CEO to employee	ROA and stock returns
Siegel & Hambrick (2005)	1991-1993	U.S.	Between CEO, 2nd level and 3th level executives	Market to book ratio
Wade, O'Reilly III & Pollock (2006)	1981-1985	U.S.	CEO and lower level manager	Employee turnover
Mixed effect				
Bingley & Eriksson (2001)	1992-1995	Denmark	Variance of residuals from wage equation	Total factor productivity
Braakmann (2008)	1993-2005	Germany	Firm average pay relative to other firms	Log sales per worker
Brown, Sturman & Stimmering (2003)	1991-1999	U.S.	Hospital average pay relative to other hospitals	ROA
Mahy, Rycx & Volral (2011)	2003	Belgium	Between employees	Annual value added per employee
Winter-Ebmer & Zweimüller (1999)	1975-1991	Austria	Between employees	Standardized wages
Yang & Klaas (2011)	2003-2005	South-Korea	highest paid compared to lowest paid employee in same rank	Profit to assets
Frick et al. (2003)	1985-2001	Sport leagues	Between players	Performance team
No significant effect				
Conyon et al. (2001)	1997-1998	UK	CEO to non-CEO executive directors	Stock returns and ROA

2.4 Institutional background: Governance Code

In my empirical analysis I use a sample of average executive and employee pay data from publicly listed Dutch firms. In 2004 the first Dutch corporate governance code was created with the intention of improving transparency in the annual accounts, enhancing accountability for the supervisory board and strengthening the control and protection of shareholders. This was under the direction of Morris Tabaksblat, therefore it was called Code Tabaksblat.

The most important rule of the Code Tabaksblat was the transparency of the remuneration of the CEO. Over the years, the governance code was changed several times. In 2008, a new version was released under the direction of Jean Frijns, which required more transparency of listed companies about their CEO's long-term remuneration.

In 2016, a revised version was made by Jaap van Maanen (Lokin, 2017), which entailed that listed companies in the Netherlands should include a ratio between the remuneration of directors and a representative reference group determined by the company within the company. They must also report changes in these ratios compared to the previous financial year. As a result, the Netherlands has a pay ratio in their annual reports, following the United States and England.

To conclude, many different empirical studies have examined the effect of the pay ratio on firm performance and firm value. Many different results exist per country for the effect of pay ratios, due to the differences in governance and the differences in the average pay ratio. Peter de Waard (2017) wrote an article in the Dutch newspaper De Volkskrant about the highest CEO pay ratios of the world. The Netherlands has one of the highest pay ratios in the world. However, little research has been done into the effect of pay ratios on firm performance and firm value in the Netherlands. Since 2018, the Dutch listed companies should report their internal remuneration ratios according to the new governance code. However, firms who are listed on the AEX have been publishing the remuneration of the CEO for a long time, due to the Dutch governance code.

3 Hypotheses development

As indicated in the literature review in section 2, there is plentiful research on the relation between the pay ratio and firm performance and firm value. A lot of literature find evidence of a positive relation between the pay ratio and the firm performance and firm value (Banker, Bu, & Mehta, 2016; Burns, Minnick, & Starks, 2017; Eriksson, 2008; Faleye et al., 2013; Heyman, 2005; Kale et al., 2009; Lee, Lev, & Yeo, 2008; Main, O'Reilly III, & Wade, 1993). They are all in line with the tournament theory and the managerial talent perspective. The tournament theory suggests that higher pay disparity motivates employees at lower levels to increase their effort. These high pay ratios result in higher effort throughout the whole company, so the performance and value of the firm will rise. The managerial talent perspective suggests that a more talented CEO needs to be paid more. The high pay ratio shows the success of a firm in securing a more talented CEO, which results in better performance and higher firm value.

On the other side, a lot of literature researches the behavioural perspectives of inequity between individuals and performance. They conclude that inequity between individuals has negative effects on the performance and value (Bebchuk et al., 2011; Cowherd & Levine, 1992; Newton, 2015; Shin et al., 2015; Wade et al., 2006). Higher pay disparity leads to less satisfied, less productive employees that are more willing to leave their firm. When the pay ratio is lower and is considered as more equitable, employees work harder and have higher levels of commitment and cooperation, which results in higher firm value and performance. This is in line with the equity theory and the relative deprivation theory. All theories and literature mentioned above suggest that there is an effect of pay disparity on the firm performance and firm value. I believe that there will be a positive effect between the pay ratio and the firm performance and firm value. This leads to the following hypothesises:

H1a: A higher pay ratio between the CEO and the average employee has a positive effect on the firm performance

H1b: The higher pay ratio between the CEO and the average employee has a positive effect on the firm value

As stated above, the tournament theory, managerial talent, equity theory and relative deprivation theory are all well-developed, consistent theories. As mentioned in section 2.3, there is also literature suggesting that the tournament theory are not contradictory, but complementary to the relative deprivation and equity theory (Bingley & Eriksson, 2001;

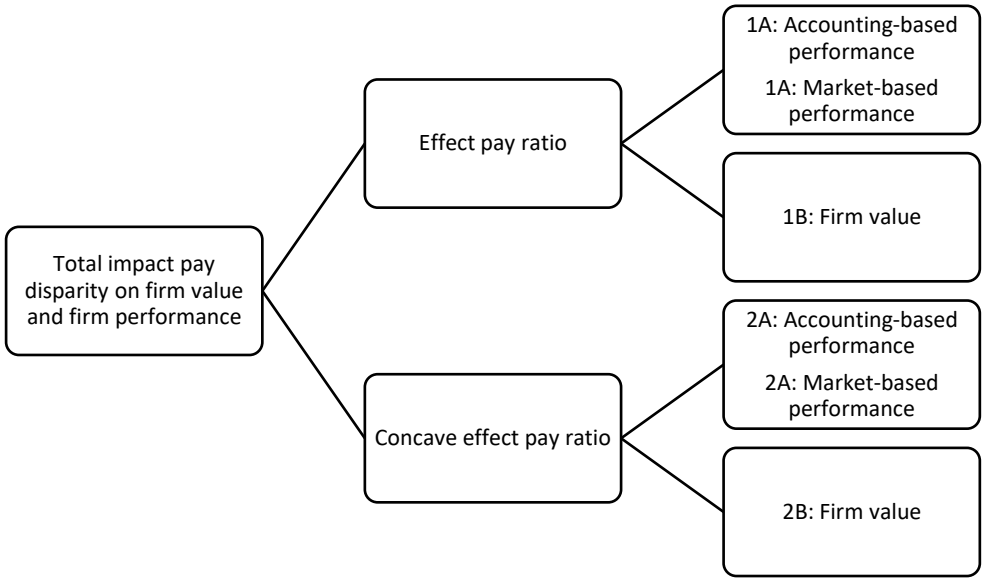
Braakmann, 2008; Mahy et al., 2011; Winter-Ebmer & Zweimüller, 1999; Yang & Klaas, 2011). So instead of a linear effect, there is a concave effect between the pay ratio and the firm performance and value, supporting both theories. I believe that pay disparity in firms is necessary to some level, and predict that the firm performance and firm value will increase with the pay ratio to a certain point, which is consistent with the tournament theory and managerial talent perspective. After this point, I believe, the increase of pay ratio will lead to a decrease of firm value and performance. This is consistent with the equity theory and the relative deprivation. This leads to the following hypothesis:

H2a: A higher pay ratio between the CEO and the average employee has a concave effect on the firm performance

H2b: A higher pay ratio between the CEO and the average employee has a concave effect on the firm value

Most empirical studies look at the linear effect of pay ratios and firm performance and firm value in de United States. There are also some empirical studies who examine the concave effects of pay ratio's on firm performance and firm value. Table 1 shows which countries are used for data. However, no research has been done of the concave effects of pay ratio's on firm performance and firm value in the Netherlands. Figure 1 provides a geographical representation of the research components. In the next section I will explain the figure in more detail. I will also explain the data for my empirical analysis, all variables used in my analysis and the statistical tests.

Figure 1: Hypotheses



4 Data & methodology

This section aims to provide an overview of the panel data set, the construction of the variables and the statistical tests used for the empirical analysis. Section 4.1 presents the construction of the sample and which firms are listed in the AEX between 2010 and 2018. Section 4.2 presents the construction of the pay ratio, section 4.3 of the firm performance and section 4.4 of the firm value. Section 4.5 shows all the constructed control variables and section 4.6 provides statistical tests of the empirical analysis.

4.1 Sample construction

To construct the estimation sample used in this study, I took the following steps. First, I searched all companies listed in the AEX from 2010 till 2018. Since 2012, there are 25 companies in the AEX. Before, there were occasionally more than 25 companies, for example because of the split of shares of TNT in TNT Express and PostNL. The total number of companies in the AEX is 41 from 2010 to 2018. Table A1 shows which years the firm was listed in the AEX. The CEO remunerations are hand-collected for all listed AEX firms. I also hand-collected for how many years the CEO works at the company. The year 2010 is chosen because most listed companies disclosed their CEO's pay since their annual report of that year due to the revised corporate governance code of Jean Frijns. Unfortunately, Aperam and DE Master Blenders 1753 do not report the remuneration of their CEO. Consequently, there is no data available of these companies. This results in 39 financial and non-financial firms.

Table 2 shows all listed AEX firms of the sample period and their average pay ratio. Table 5 presents the descriptive statistics of non-financial firms and Table A2 presents the descriptive statistics of the financial firms. It shows that there are big differences between financial and non-financial firms in total remuneration of CEO, pay ratio and firm characteristics. As in other studies, I have excluded the financial firms due to concerns that government regulations, specific to financial firms, could affect the structure of executive compensation and that accounting performance metrics are likely to be constructed differently for financial firms (Shin et al., 2015). Without financial firms, 32 remain. Subsequently, all other data is obtained from *Datastream* to construct the dependent and control variables. With all these variables, I created my own panel data set. In the following sub sections I will describe the variables that I use in my empirical analysis.

Table 2: Sector, industry group and average pay ratio per firm

This table shows all firms who are listed in the AEX between 2010 and 2018 and in which sector and industry group they belong. The last column shows the average pay ratio between 2010 and 2017 of each firm.

Sector	***Firms AEX***	***Industry Group***	***Average pay ratio***
Energy	Fugro	Energy Equipment & Services	29,60
	SBM Offshore	Energy Equipment & Services	32,28
	Royal Dutch Shell	Oil, Gas & Consumable Fuels	90,95
	Koninklijke Vopak	Oil, Gas & Consumable Fuels	17,6
Materials	Akzo Nobel	Chemicals	63,7
	Koninklijke DSM	Chemicals	38,47
	OCI	Chemicals	57,84
	Aperam	Metals & Mining	N/A
	Arcelormittal	Metals & Mining	91,61
Industrials	Boskalis Westminister	Capital Goods	38,6
	Koninklijke BAM Groep	Capital Goods	19,82
	Royal Imtech	Capital Goods	30,22
	Signify	Capital Goods	49,69
	Aalberts Industries	Capital Goods	25,63
	Randstad	Commercial & Professional Services	56,28
	RELX	Commercial & Professional Services	100,69
	Wolters Kluwer	Commercial & Professional Services	102,9
	PostNL	Transportation	64,20
	TNT Express	Transportation	40,03
	Air France - KLM	Transportation	11,56
Consumer Discretionary	TomTom	Consumer Durables & Apparel	15,82
	Altice Europe	Media	179,33
	Koninklijke Ahold Delhaize	Food & Staples Retailing	129,4
	Heineken	Food, Beverage & Tobacco	174,13
	DE Master Blenders 1753	Food, Beverage & Tobacco	N/A
	Unilever	Food, Beverage & Tobacco	210,96
Health Care	Koninklijke Philips	Health Care Equipment & Services	62,70
	Galapagos	Pharmaceuticals, Biotechnology & Life Sciences	26,79
Financials	ABN-AMRO Group	Banks	9,28
	ING Groep	Banks	20,76
	AEGON	Insurance	41,53
	ASR Nederland	Insurance	8,57
	Delta Lloyd	Insurance	12,71
	NN Group	Insurance	19,06
	Corio	Real Estate	8,84
Information Technology	Gemalto	Software & Services	63,66
	ASML Holding	Semiconductors & Semiconductor Equipment	37,50
Telecommunication Services	Koninklijke KPN	Telecommunication Services	37,90
	ZIGGO	Telecommunication Services	11,43
Real Estate	Unibail-Rodamco	Real Estate	30,01
	Wereldhave	Real Estate	9,61

4.2 Pay ratio

The total compensation of a CEO is divided in the fixed salary, pension allowance, the short-term variable pay, long-term variable pay and other compensation. The base salary and pension allowance are fixed cash compensations of a CEO and not based on the annual performance. The short-term variable pay is mostly a percentage of their base salary, and is based on achievements of annual measures, such as operational measures, financial measures or individual leadership measures. Other compensations are for example social and health care contributions or a severance pay.

RELX, Unilever and Wolters Kluwer use a foreign currency in their reports. I use the exchange rate at the end of the year to convert the data into Euros. Therefore, for the data of 2016, I use the exchange rate at 31-12-2016. Some CEOs in the sample joined or left the management board during the year. These remunerations are then adjusted to make them comparable to annual compensation. I hand collected the base salary, pension allowance, short-term variable pay and other compensation from annual reports of the companies.
The long-term variable award is based on achievements of multiple years, typically 3 to 5 years. Long-term incentives aim to reward the CEO for achievements that maximize shareholder value.

Long-term incentives can be provided in the form of stock-based compensation, such as stock options, restricted stock, performance shares, cash, or stock-settled performance units. The CEO does not receive any pay from the incentive until the end of the performance period.
The data for long term incentives is received from the VEB[1], which gives an overview of the remuneration of executive directors of listed companies at the Euronext Amsterdam since 2002. The VEB is an investment association that protects the interests of investors. The purpose of the website is to create transparency of the remuneration of a CEO, given the increasingly complexity of rewards, which are often granted in the form of options and shares. They use the value at time of issue of the options and shares. Any realized price gain of shares or options is not included in the remuneration. The fair value and the value at issuance are established using the Black and Scholes option model, which provides a reasonable estimate of the actual value of the option based on the current price, the exercise price, the term, dividend yield, interest rate and volatility.

[1] Retrieved from https://www.bestuursvoorzitter.nl.

During the years, a growing number of companies started issuing conditional options and shares. In these cases, a CEO is initially granted a number of options or shares and may, depending on certain performance criteria, lapse or double. In the model of VEB, it is assumed that the director achieves the objectives that give entitlement to the initially acquired package of options and shares.

As mentioned in the literature review, there are multiple ways to examine the vertical disparity between executives and employees. I will use the difference between the CEO and the average remuneration of all employees as suggested by some prior research (Faleye et al., 2013; Shin et al., 2015; Newton, 2015). The average remuneration of employees is obtained from *Datastream* and consists of all employee benefits, such as health insurance and contributions to pension plans, minus costs of external and temporary employees minus the total remuneration of the CEO, divided by the average number of full-time jobs (FTEs). The pay ratio of a company is:

$$Pay\ Ratio_{it} = \frac{(Total\ remuneration\ without\ other\ compensation\ CEO)_{it}}{(Average\ remuneration\ per\ employee)_{it}} \quad (1)$$

i stands for the firm and *t* for the year

For the first hypotheses, I use the natural logarithm of the pay ratio, following Faleye et al. (2013), Newton (2015) and Kale et al. (2009), since the remuneration and the average remuneration per employee are both log normally distributed. Both variables are right skewed, so the pay ratio is also right skewed. The Jarque-Bera test is used to check for normality. The test shows that the p-value of the pay ratio variable is 0.000, which means that the variable is not normal distributed. With the log transformation of both variables, the variables are both normally distributed. The pay ratio for the first hypotheses is:

$$LN(Pay\ Ratio)_{it} = \text{LN}\left(\frac{(Total\ remuneration\ without\ other\ compensation\ CEO)_{it}}{(Average\ remuneration\ per\ employee)_{it}}\right) \quad (2)$$

i stands for the firm and *t* for the year

For the concave hypothesises, I included the squared pay multiple to reflect a potential concave relation between firm performance and pay disparity as suggested by prior research (Bingley & Eriksson, 2001; Braakmann, 2008; Brown et al., 2003; Mahy et al., 2011; Shin et al., 2015; Winter-Ebmer & Zweimüller, 1999; Yang & Klaas, 2011).

4.3 Firm performance

As mentioned in section 2.3 and Table 1, there are a lot of measures for the firm performance. Two of those measures are used in this research: an accounting-based measure and a market-based measure. For the accounting-based measure the return on assets (ROA) is used. This is the most used accounting-based measure in literature (Banker et al., 2016; Bebchuk et al., 2011; Brown et al., 2003; Conyon et al., 2001; Faleye et al., 2013; Kale et al., 2009; Main et al., 1993; Shin et al., 2015). The formula for the return on assets used in this research is:

$$ROA_{it} = \frac{(Operating\ income\ after\ depreciation)_{it}}{(Total\ assets)_{it}} \quad (3)$$

i stands for the firm and *t* for the year

The operating income after depreciation and the total assets are retrieved from *Datastream*.
The market-based measure used in this study is the non-dividend-adjusted stock returns of a firm, as in literature (Conyon et al., 2001; Main et al., 1993; Siegel & Hambrick, 2005). The stock prices retrieved from *Datastream* are the year-end stock prices. The stock returns are defined as:

$$Stock\ Return_{it} = \frac{P_{it} - P_{it-1}}{P_{it-1}} \quad (4)$$

P is the stock price, *i* stands for the firm and *t* for the year

One-year-lagged ROA and shareholder return are used as control variable in the firm performance tests.

4.4 Firm value

The most widely accepted measure is used for the firm value of a company, the Tobin's q, as suggested in literature (Bebchuk et al., 2011; Burns et al., 2017; Faleye et al., 2013; Kale et al., 2009; Lee et al., 2008). The formula of Tobin's q is:

$$Tobins'Q_{it} = \frac{(Market\ value\ of\ equity)_t + (Book\ value\ of\ Liabilities)_{it}}{(Book\ value\ of\ assets)_{it}} \quad (5)$$

Where *i* stands for the firm and *t* for the year

The market value of equity, book value of liabilities and book value of equity are retrieved from *Datastream*. For the market value of equity, the market capitalization of *Datastream* is used. This is the number of shares outstanding at the end of the year multiplied by the share price at the end of the year.

When the Tobin's ratio is lower than 1, the cost to replace a firm's asset is greater than the value of its stock, meaning that the stock is undervalued. When the Tobin's greater than 1, it implies that the firm's stock is more expensive than the replacement cost of its assets, implying that the firm is overvalued. It is a measure to value the stock and a driving factor to invest in a company. One-year-lagged Tobin's q is used as a control variable in the regression of firm value.

4.5 Control variables

Several control variables are used that have an effect on the pay ratio and the performance of a firm. Section 4.5.1 provides the firm specific characteristics: the firm size, leverage and physical capital intensity. Section 4.5.2 specifies the stock volatility. Section 4.5.3 provides the CEO tenure and trade union and section 4.5.4 presents the research and development.

4.5.1 Firm size, leverage and physical capital intensity

The firm size is the control variable that is mostly used in literature. Some studies use the natural logarithm of assets as a proxy for the firm size (Banker et al., 2016; Bebchuk et al., 2011; Newton, 2015). Others use the number of employees as a proxy for firm size (Braakmann, 2008; Conyon et al., 2001; Core et al., 1999; Cowherd & Levine, 1992; Siegel & Hambrick, 2005). However, most literature uses the natural logarithm of sales revenue as control variable for firm size (Burns et al., 2017; Faleye et al., 2013; Kale et al., 2009; Lee et al., 2008; Main et al., 1993). So the natural logarithm of sales revenue is used in this research as a proxy for the firm size.

The data of sales revenue is obtained from *Datastream*. The leverage of a firm is also a control variable that is often used in literature, that suggest two different formulas for leverage: the total debt divided by total assets (Burns et al., 2017; Newton, 2015; Shin et al., 2015) and the long-term debt divided by total assets (Bebchuk et al., 2011; Faleye et al., 2013; Kale et al., 2009).

The long-term debt divided by total assets is used as proxy for the leverage of a company. All data is retrieved from *Datastream*. Capital intensive operations generally require higher employee skills, and higher employee skills will have higher productivity (Bebchuk et al., 2011; Faleye et al., 2013). The net property plant and equipment divided by the total assets is used as proxy in this study.

4.5.2 Stock volatility

The stock volatility is also used as a control variable in prior literature (Core et al., 1999; Faleye et al., 2013; Shin et al., 2015). Faleye et al. (2013) and Shin et al. (2015) use the time-series standard deviation of monthly stock returns over the prior 60 months for the stock return volatility. Core et al. (1999) use the standard deviation of annual percentage stock market returns of the prior five years. The annualized volatility of the daily stock returns over the preceding 5 years is used in this research as a proxy for firm risk.

4.5.3 CEO tenure and trade union

The control for CEO tenure is used to account for potential effects of the CEO experience, following literature (Bebchuk & Grinstein, 2005; Faleye et al., 2013; Newton, 2015). The CEO tenure is the number of years the CEO has held its function excluding the year of appointment. I examined all annual reports when the current CEO has started at the company. Faleye et al. (2013) used the trade union as a control variable. In line with Faleye et al. (2013), trade unionization is used as a control variable. The trade unionization is the ratio of employees who are in a trade union and data is retrieved from *Datastream*.

4.5.4 Research & development

Firms that invest in research and development require highly skilled employees both to do the R&D project and to increase the likelihood of successful innovation, which creates better performance and higher firm values. Some studies use the ratio of R&D expenditures to total assets as a proxy (Faleye et al., 2013; Kale et al., 2009), others use the R&D costs divided by sales as a proxy (Bebchuk et al., 2011; Lee et al., 2008). R&D expenditures to total assets is used in this study as a proxy. The R&D expenditures are retrieved from *Datastream*.

4.6 Statistical tests

To answer the hypotheses, multiple regressions are used. Table 3 gives an overview of all regressions used in my analysis. I use OLS regressions with firm-level fixed effects, α_i, and year fixed effects, α_t, in all regressions. I will analyse the linear relation between the pay ratio and the firm performance and firm value, to answer hypotheses 1a and 1b. For hypotheses 1a, I look at formula 4 and 5 with the dependent variables, ROA_{it}, which is the return on assets for firm *i* and year *t* and $Stock\_return_{it}$, which is the change in stock price for firm *i* in year

t. For hypotheses 1b, I look at formula 6 with the dependent variable $TobinsQ_{it}$, which is the firm value for firm *i* and year *t.*

The explanatory variable in panel A is the $Payratio_{it}$ to examine the linear effect on the firm performance and value. β and Υ are the coefficients of the explanatory and control variables. X_{it} is a vector of control variables in year *t*, which includes all firm, CEO and employee characteristics variables. These control variables used in the regressions are all discussed in section 4.5. X_{it-1} is the first lag of firm value or firm performance as an additional regressor. I use this to reduce the concerns of reverse causality by allowing past realizations of firm performance and firm value to affect its current level (Faleye et al., 2013; Shin et al., 2015).
Panel B of Table 3 shows the regressions used to answer hypotheses 2a and 2b. The regressions used in panel B are the same as panel A, but the $Payratio_{it}^2$ is added to examine the concave effect. Panel C combines all regressions used in panel A and Panel B but with lagged pay ratios to reduce the endogeneity problem (Banker et al., 2016; Bebchuk et al., 2011; Faleye et al., 2013; Shin et al., 2015). Panel D of Table 3 examines all regressions used in panel A and panel B, and analyses the differences of the pay ratios and the dependent variables to reduce the endogeneity problem (Faleye et al., 2013).

In all formulas I check for heteroscedasticity by applying the White standard errors corrected for firm-level clustering throughout the models, which is in line with literature (Bebchuk et al., 2011; Faleye et al., 2013; Shin et al., 2015). Economic theory rarely gives any reason to believe that the errors are homoscedastic. Therefore, it is prudent to assume that the errors are heteroscedastic. ε_{it} is the robust standard error clustered at the firm- level for all regressions. I add the control variable of year fixed effects, α_t, to neutralize the impact of time specific outcomes. To be sure that the results are not affected by the firm specific effects, α_i, I control for firm-level fixed effects. According to Holian and Reza (2011), firm fixed effects are preferred over industry fixed effects. I considered a winsorizing cut off 1%, 5% and 10% to reduce the effect of possibly spurious outliers. I winsorized the variables in my data set at the fifth and 95th percentiles, because it gives the best balance between smoothing extreme values and upholding sufficient variance. To test if there is multicollinearity, I look at the Pearson correlation matrix in Table 6. All correlation coefficients are smaller than |0.6083|, which means that there are no extensive multicollinearity problems. I will discuss the correlation coefficients more in the section 5.2.

Table 3: Regression models

This table shows the estimation equations for the OLS regression analysis on the relationship between the pay ratio and firm performance and value. All the regressions are controlled for firm fixed effects, α_i, and time fixed effects, α_t. The dependent variables, ROA_{it}, is the return on assets for firm *i* and year *t*. $Stock\_return_{it}$ is the change in stock price for firm *i* in year *t*. $TobinsQ_{it}$ is the firm value for firm *i* and year *t*. β and Υ are the coefficients of the explanatory and control variables. In panel A, the $\ln(Payratio)_{it}$ is the explanatory variable for the linear effect on the dependent variables. In panel B, the $\ln(Payratio)_{it}$ is changed for $Payratio_{it}$ $Payratio_{it}^2$. $Payratio_{it}^2$ is the explanatory variable for the concave effect on the dependent variable. X_{it} is a vector of control variables in year *t*, which includes all firm, CEO and employee characteristics variables, for example CEO tenure and leverage. X_{it-1} are the control variables lagged by one year. In Panel C, lagged explanatory variables are used to reduce the endogeneity problem. In Panel D, the differences (Δ) of the explanatory and dependent variables are also used to reduce the endogeneity problem. ε_{it} is the robust standard error clustered at the firm level for all regressions.

Panel A: Linear effect pay ratio	
$ROA_{it} = \alpha_i + \alpha_t + \beta \ln(Payratio)_{it} + \Upsilon_1 X_{it} + \Upsilon_2 X_{it-1} + \varepsilon_{it}$	(6)
$Stock\_return_{it} = \alpha_i + \alpha_t + \beta \ln(Payratio)_{it} + \Upsilon_1 X_{it} + \Upsilon_2 X_{it-1} + \varepsilon_{it}$	(7)
$TobinsQ_{it} = \alpha_i + \alpha_t + \beta \ln(Payratio)_{it} + \Upsilon_1 X_{it} + \Upsilon_2 X_{it-1} + \varepsilon_{it}$	(8)
Panel B: Concave effect pay ratio	
$ROA_{it} = \alpha_i + \alpha_t + \beta_1 Payratio_{it} + \beta_2 Payratio_{it}^2 + \Upsilon_1 X_{it} + \Upsilon_2 X_{it-1} + \varepsilon_{it}$	(9)
$Stock\_return_{it} = \alpha_i + \alpha_t + \beta_1 Payratio_{it} + \beta_2 Payratio_{it}^2 + \Upsilon_1 X_{it} + \Upsilon_2 X_{it-1} + \varepsilon_{it}$	(10)
$TobinsQ_{it} = \alpha_i + \alpha_t + \beta_1 Payratio_{it} + \beta_2 Payratio_{it}^2 + \Upsilon_1 X_{it} + \Upsilon_2 X_{it-1} + \varepsilon_{it}$	(11)
Panel C: Lagged pay ratio	
$ROA_{it} = \alpha_i + \alpha_t + \beta Payratio_{it-1} + \Upsilon_1 X_{it} + \varepsilon_{it}$	(12)
$Stock\_return_{it} = \alpha_i + \alpha_t + \beta Payratio_{it-1} + \Upsilon_1 X_{it} + \varepsilon_{it}$	(13)
$TobinsQ_{it} = \alpha_i + \alpha_t + \beta Payratio_{it-1} + \Upsilon_1 X_{it} + \varepsilon_{it}$	(14)
$ROA_{it} = \alpha_i + \alpha_t + \beta_1 Payratio_{it-1} + \beta_2 Payratio_{it-1}^2 + \Upsilon_1 X_{it} + \varepsilon_{it}$	(15)
$Stock\_return_{it} = \alpha_i + \alpha_t + \beta_1 Payratio_{it-1} + \beta_2 Payratio_{it-1}^2 + \Upsilon_1 X_{it} + \varepsilon_{it}$	(16)
$TobinsQ_{it} = \alpha_i + \alpha_t + \beta_1 Payratio_{it-1} + \beta_2 Payratio_{it-1}^2 + \Upsilon_1 X_{it} + \varepsilon_{it}$	(17)
Panel D: Δ Pay ratios and Δ dependent variables	
$\Delta ROA_{it} = \alpha_i + \alpha_t + \beta \Delta Payratio_{it} + \Upsilon_1 X_{it} + \varepsilon_{it}$	(18)
$\Delta Stock\_return_{it} = \alpha_i + \alpha_t + \beta \Delta Payratio_{it} + \Upsilon_1 X_{it} + \varepsilon_{it}$	(19)
$\Delta TobinsQ_{it} = \alpha_i + \alpha_t + \beta \Delta Payratio_{it} + \Upsilon_1 X_{it} + \varepsilon_{it}$	(20)
$\Delta ROA_{it} = \alpha_i + \alpha_t + \beta_1 \Delta Payratio_{it} + \beta_2 \Delta Payratio_{it}^2 + \Upsilon_1 X_{it} + \varepsilon_{it}$	(21)
$\Delta Stock\_return_{it} = \alpha_i + \alpha_t + \beta_1 \Delta Payratio_{it} + \beta_2 \Delta Payratio_{it}^2 + \Upsilon_1 X_{it} + \varepsilon_{it}$	(22)
$\Delta TobinsQ_{it} = \alpha_i + \alpha_t + \beta_1 \Delta Payratio_{it} + \beta_2 \Delta Payratio_{it}^2 + \Upsilon_1 X_{it} + \varepsilon_{it}$	(23)

5 Empirical results

The following section will explain the empirical results of this research. Section 5.1 details the descriptive statistics. Section 5.2 describes the correlations and interpret the correlation coefficients if there is multicollinearity. Section 5.3 interprets the statistical models to accept or reject the hypothesises discussed in section 3.

5.1 Summary statistics

In this part I will summarize the statistics used for my empirical research. The definitions and measuring levels are reported in Table 4 and Table 5 covers the descriptive statistics of the non-financial firms.

Figure 2 shows an increase of the total remuneration of the CEO and the mean pay per employee of listed firms in the AEX between 2010 and 2017. There is a strong increase in the long term remuneration of the CEO last years. This is due to the increase of options remuneration in companies. For example, the long term remuneration in 2017 of CEO Paul Polman of Unilever and CEO Nancy McKinstry of Wolters Kluwer was three times higher than in 2010. The average long term remuneration of all CEOs increased from €1.1mln to €1.9mln.

Figure 2: Mean total remuneration CEO and mean average remuneration per employee

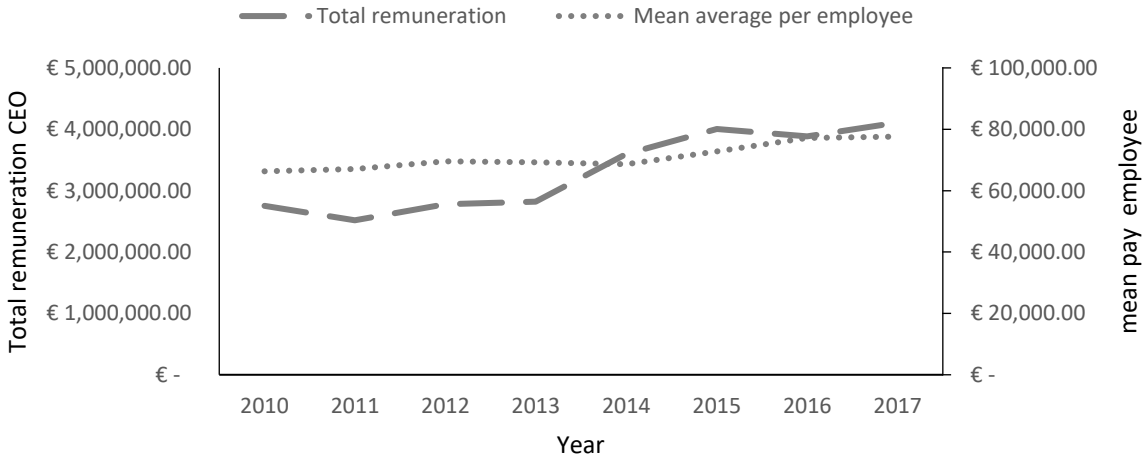
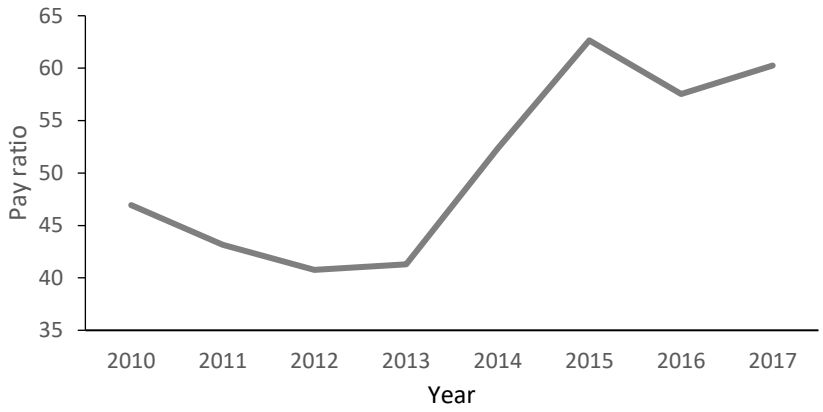


Figure 3 presents the mean pay ratio from 2010 to 2017. The figure shows an increase in pay inequality during the years in the Netherlands. The pay ratio slightly decreased from 2010 to 2012. The mean pay ratio in 2010 was 46.9 and in 2012 40.8. However, from 2012 to 2017, there was a big increase in the pay ratio. The pay ratio peaked in 2015 with 62.7, the average in 2017 is 60.3.

Figure 3: Mean pay ratio per year AEX firms



The increased pay ratios were not caused by a decrease of the average pay of the employees, but by the higher remuneration of the CEO, as presented in Figure 2. The average remuneration of a CEO increased from €2.59 million in 2010 to €3.69 million in 2017. The increase of the average remuneration of an employee was far less impressive: from 65.84 thousand in 2010 to 76.25 thousand in 2017.

Table 4 displays the definitions and measuring levels for the variables used in the analysis and Table 5 presents the descriptive statistics of the non-financial firms. The variables are separated into three groups. The pay characteristics shows the descriptive statistics for the remuneration of a CEO and the employees, the number of employees and the pay ratio's. The firm performance and value show the three dependent variables: the Tobin's q, stock return and return on assets. The firm characteristics and characteristics employee and CEO are the financials for the control variables.

Table 4: Summary variables

This table displays the definitions and the measuring levels for the variables used in the analysis.

Variables	Definition	Measuring level
Pay characteristics		
CEO Fixed salary	Annual fixed compensation of the CEO	x1000 €
CEO variable	Compensation based on achievements of annual measures	x1000 €
CEO Pension	Pension allowance	x1000 €
Long term CEO	Compensation based on achievements of multiple years	x1000 €
Other salary CEO	For example social and health care distributions, severance pay	x1000 €
Remuneration short long CEO	Fixed + Variable + Pension + Long term CEO	x1000 €
Total remuneration CEO	Fixed salary + Variable + Pension + Long term + Other	Number
Employees	Total employees of the firm	x1000 €
Staff expense	Employee benefits - Costs of external and temporary employees - Total remuneration of the CEO	x1000 €
Average expense per employee	Staff expense / Employees	Ratio
Pay ratio	Remuneration short long CEO / Average expense per employee	Ratio
Ln(Pay ratio)	Logarithm of the pay ratio	Log Ratio
Firm performance and value		
Tobin's q	(Market Value of equity + book value of liabilities) / Total assets	Ratio
Stock return	Increase in stock price compared to previous year	Return
ROA	Operating income divided by total assets	Ratio
Characteristics employees and CEO		
CEO tenure	Number of years a CEO is at the company	Years
Trade union	Ratio of employees who are in a trade union	Ratio
Firm characteristics		
Total assets	Total assets	$x10^6$ €
Total debt	Short and long-term debt	$x10^6$ €
Long-term debt	Loans and financial obligations longer lasting over one year	$x10^6$ €
Liabilities	Total liabilities	$x10^6$ €
Leverage	Long-term debt divided by Total assets	$x10^6$ €
Common shareholders' equity	Net book value of the company	$x10^6$ €
Market Value	Total number of listed and unlisted common equivalent shares multiplied by the price of the primary issue at fiscal year-end date	$x10^6$ €
Firm Size	Logarithm of Revenue	Log
Firm risk	Annualized volatility of daily stock returns over the preceding 3 years	Ratio
Operating income	Profit realized from business operations	$x10^6$ €
Property plant and equipment (PPE)	Long-term assets vital to business operations	$x10^6$ €
Physical capital intensity	PPE divided by total assets	Ratio
Research & Development	All direct and indirect costs related to the creation and development of new processes, techniques, applications and products.	$x10^6$ €
R&D to Assets	Research & Development divided to assets	Ratio

Table 5: Descriptive statistics non-financial firms

This table shows the number of observations (N), Mean (μ), Standard deviation (σ), minimum (Min), and maximum (Max) of all the variables. All the variables are from the year 2010 till 2017 for the non-financial firms of the AEX. All variables are winsorised at the fifth and 95th percentiles.

Variables	N	μ	σ	Min	Max
Pay characteristics:					
CEO Fixed salary	230	849.88	313.43	409.00	1,550.00
CEO Variable	229	851.88	751.65	0.00	2,736.00
CEO Pension	200	250.41	226.38	42.50	914.50
Long term CEO	206	1,379.61	1,499.40	0.00	5,253.00
Other salary CEO	157	207.62	354.10	8.00	1,459.00
Total remuneration CEO	229	3,407.65	2,662.87	777.00	10,097.00
Employees	243	42,339.58	50,365.20	796.00	174,000.00
Staff expense	243	2,335,412.02	2,701,578.78	34,550.00	9,257,380.00
Average expense per employee	239	64.73	22.91	26.25	110.39
Pay ratio	224	54.65	43.92	9.48	173.99
Ln(Pay ratio)	224	3.691	0.812	2.25	5.16
Firm performance and value					
Tobin's q	256	1.49	0.58	0.67	2.96
Stock return	238	1.07	0.25	0.52	1.52
ROA	256	0.06	0.04	-0.02	0.15
Characteristics employee and CEO					
CEO tenure	234	5.53	4.78	0.00	18.00
Trade union	71	0.67	0.19	0.38	1.00
Firm characteristics					
Total assets	256	16,264.92	19,858.38	1,646.07	75,436.46
Total debt	256	4,832.49	5,930.14	20.19	20,394.70
Long-term debt	256	4,016.18	5,028.61	3.67	17,755.04
Liabilities	256	9,909.73	11,775.57	629.47	42,708.59
Leverage	256	0.23	0.15	0.00	0.59
Common shareholders' equity	256	9,909.73	11,775.57	629.47	42,708.59
Market Value	240	14,468.77	20,717.87	890.55	83,141.31
Revenue	256	12,488.37	16,599.82	264.56	59,730.94
Firm Size	256	8.61	1.57	4.10	12.80
Firm Risk	250	0.33	0.11	0.18	0.56
Operating income	256	1,063.95	1,594.71	-65.00	6,620.00
Property plant and equipment	256	9,541.37	28,091.27	10.09	223,820.91
Physical capital intensity	256	0.29	0.24	0.02	0.89
Research & Development`	123	375.55	458.06	0.00	1,576.00
R&D to Assets	123	0.05	0.09	0.00	0.51

The mean of fixed salary is €849.88 thousand and the mean of variable salary is €851.88 thousand. The bonuses of non-financial firms are much higher compared to financial firms, due to restrictions in the financial sector. Since 2015, the maximum short-term bonus for financial firms is 20%. The mean of the pension allowance of the CEO is €250.41 thousand and the average long term bonuses of the CEO amount to €1.38 million.

The total average remuneration of the CEO is €3.41 million. The average wage per employee is €64.73 thousand, which results in an average pay ratio of 54.65. This is much higher than in Asian countries: Banker et al. (2016) show a mean pay ratio of 6.2 in China and Shin et al. (2015) a mean pay ratio of 7.2 in South-Korea. Faleye et al. (2013) display a pay ratio of 95.47 in the United States, which is much higher. However, it is difficult to compare these ratio's due to the differences is sample size and time period.

The other important variables are the dependent ones. The mean of the firm value measurement Tobin's q is 1.49, which implies that the average firm's stock is more expensive than the replacement cost of its assets. The market-based performance measure, the average stock return, is also positive. The average stock return is 7%. The average return on assets, which is the accounting-based measure, was 6% between 2010 and 2017. The average firm value and firm performances are high.

The average CEO in this period worked for 5.5 years at a AEX firm and the ratio of employees who are in a trade union is 67%. However, the trade union ratio can be biased due to lack of observations. The firm risk, which is the annualized volatility, is 33%. The statistics of the balance sheet and profit and loss account are all high, which is not surprising since the sample is from listed Dutch companies in the AEX. I omit further discussion of the variables for brevity.

5.2 Correlations

Table 6 shows the bivariate correlation coefficients of all variables used in the regression analysis. The log of the pay ratio and the squared pay ratio are not included in the correlation matrix due to the fact that this is only a transformation of the pay ratio, so the correlations will have the same interpretation. I examine the Pearson correlation matrix to identify the existence of multicollinearity, as mentioned in 4.6, and to understand the relation between the variables.

First of all, the correlation matrix shows that correlation coefficients of the performance and value measurers are all correlated. The Tobin's q, stock return and return on assets are all significantly positive correlated. This is no coincidence given the fact that when a firm operates

well, the return on assets will be higher, the stock price will rise and investors will value the company higher.

Secondly, there are no extreme high pairwise correlations between the control variables and the pay ratio. Only one variable is above 0.5 and that is the correlation between firm size and pay ratio. This was expected based on the literature review, because larger firms often pay higher CEO compensation due to their demand for higher-quality managerial talent. This will result in wider pay disparity (Bebchuk & Grinstein, 2005; Core & Guay, 1999; Faleye et al., 2013; Gabaix & Landier, 2008; Terviö, 2008).

This is also in line with the tournament theory: when there are more employees in a firm, pay ratios must be higher to motivate them. The relationship between the leverage and pay ratio is low and not significantly different from zero. This was expected because higher leverage leads to more bankruptcy costs. This must be compensated by higher employee pay, but also by higher CEO pay. In line with Bebchuck et al. (2011) Core et al. (1999), Faleye et al. (2013), the pay ratio is positive related with the CEO tenure, since a CEO that works longer at the company, has more bargaining power to increase his wage.

Thirdly, when interpreting all correlations between all variables, there is no reason to conclude that there is multicollinearity. The highest significant correlation is |0.6083|. Because the correlation matrix discloses no risky correlations, it is not necessary to show the variance inflation test.

5.3 Statistical models

I conduct my empirical tests using two types of regressions with three dependent variables to answer the hypotheses. First, I will discuss whether the results of the fixed effect regression with the natural logarithm pay ratio have an effect on firm performance and value, presented in table Table 7, Table 8, and Table 9. Second, I will examine if there is a concave effect on firm performance and value with the pay ratio, presented in Table 10, Table 11, and Table 12. The first model in all tables is the regression with only the pay ratio.

Table 6: Pearson correlation matrix

This table shows the Pearson correlation coefficients to examine the strength and direction of the linear relationship between two variables. The data used for the correlation matrix are all the Dutch non-financial firms in the AEX from 2010 to 2017. The variables in this table are used for the regressions. See Table 4 for a detailed overview of the variable definitions. The correlation coefficient can range in value from -1 to 1. *, **, and *** correspond to 10%, 5%, and 1% significance levels.

	Pay ratio	Tobin's q	ROA	Stock return	Firm Size	Leverage	Physical capital intensity	R&D to Assets	CEO Tenure	Firm Risk	Trade union
Pay ratio	1										
Tobin's q	0.3263***	1									
ROA	0.4243***	0.5167***	1								
Stock return	0.0947	0.3733***	0.1983***	1							
Firm Size	0.5659***	-0.0751	0.2679***	-0.0649	1						
Leverage	-0.0320	-0.0920	0.0828	-0.1694***	-0.0516	1					
Physical capital intensity	-0.1893***	-0.3590***	-0.1627***	-0.1094*	-0.0840	0.3644***	1				
R&D to Assets	-0.2284 **	0.3408***	-0.3882***	0.1793**	-0.6083***	-0.4552***	-0.4045***	1			
CEO Tenure	0.2202***	0.1733***	-0.0024	0.1311*	-0.1179*	-0.3151***	-0.2922***	0.4925***	1		
Firm risk	-0.4043***	-0.2971***	-0.4117***	-0.1341**	-0.1861***	-0.0948	-0.1541**	0.1320	-0.0229	1	
Trade Union	0.1264	-0.4384***	-0.1880	0.0458	0.3353***	0.2217*	0.1982*	-0.5438***	-0.0598	0.1808	1

In the second model, the firm characteristics firm size, physical capital intensity and leverage are added as control variables. In the third model, the firm risk and CEO tenure are included. The R&D to assets variable is added in the fourth model and the trade union variable in the fifth model. These were included last because these have less observations due to lack of available data.

5.3.1 Effect of natural logarithm pay ratio

Table 7 shows the relationship between the natural logarithm of the pay ratio and the return on assets. The pay ratio coefficient in specification (2) and (3) is statistically significant at 5% and in specification (4) at 1%. All ln(pay ratio) coefficients are positive, implying that when the pay ratio increases, there in an increase in the return on assets. Only the pay ratio in specification (5) is negative, but this is not significant. This is in line with the tournament theory and prior literature (Banker, Bu, & Mehta, 2016; Burns, Minnick, & Starks, 2017; Eriksson, 2008; Faleye et al., 2013; Heyman, 2005; Kale et al., 2009; Lee, Lev, & Yeo, 2008; Main, O'Reilly III, & Wade, 1993).

In specification (3), which has the highest adjusted r^2 and includes all control variables except the trade union and R&D to assets, the coefficient for ln(Pay Ratio) is 0.0134 (t = 2.432). This means that if the pay ratio increases by 1%, the return on assets increases with 0.000134. The average pay ratio in the sample is 54.65. So if the pay ratio of a company with an average pay ratio of 54.65 rises by 1% (0.5465), the return on assets increases by an average of 0.000134. When the R&D to assets is added, the coefficient of the ln(pay ratio) is 0.0244 (t = 3.524), but this is with less firms in the data sample. Table A3 shows the x-standardized coefficients of the ln(pay ratio) to assess the economic significance of the subsequent performance and value. Specification (3) shows a coefficient of 0.0109, indicating that a standard deviation increase in the pay ratio (81,2%) is associated with an increase in ROA of 1.01%, which is economically not significant.

Table 8 shows the effect of the ln(pay ratio) on stock returns, which is the market-based performance indicator. The coefficients of the ln(pay ratio) in specification (1), (2), (3), and (4) are statistical significant at 1%. Again, all coefficients are positive, as with the return on assets. In specification (3), the coefficient for ln(Pay Ratio) is 0.189 (t = 3.171). This means that if the Pay ratio increases by 1%, the stock returns increases with 0.00189. If the pay of a company, with an average pay ratio of 54.65, rises by 1% (0.5465), the stock returns increases by 0.00189 on average. The x-standardized coefficient of the ln(pay ratio) in specification 3 is 0.1531.

Because the standard deviation of the ln(Pay ratio) is 0.812 (81,2%), this implies that an increase of one standard deviation in the ln(Pay ratio) is associated with an increase of 15.31%, which is economically non-trivial.

Table 9 shows the effect of the ln(pay ratio) on the Tobin's q, the firm value indicator. The coefficients of the ln(pay ratio) in specification (3) and (4) are statistical significant at 1% and in specification (2) at 10%. Again, all coefficients are positive, as with the return on assets and the stock return. In specification (3), the coefficient for ln(Pay Ratio) is 0.161 (t = 3.379). This means that if the pay ratio increases by 1%, the Tobin's q increases with 0.00161. If the pay of a company, with an average pay ratio of 54.65, rises by 1% (0.5465), the Tobin's q increases by 0.00161 on average. The x-standardized coefficient of the ln(pay ratio) in specification 3 is 0.1314. Because the standard deviation of the ln(Pay ratio) is 0.812 (81,2%), an increase of one standard deviation in the ln(Pay ratio) is associated with an increase of 13.14%, which is economically non-trivial.

The control variables in Table 7, Table 8 and Table 9 show that the sign and the significance of many control variables are often susceptible to changes with respect to the test variable. The control variable firm size for example is significantly positive in the model with the return on assets as dependent variable, but significant negative with the stock return and Tobin's q as dependent variable. Another example is the physical capital intensity, which is positive for all three dependent variables, but not always significant. Because all control variables are chosen in the field of previous literature and they are only used as control variables, I omit further discussion.

Overall, all results imply that the pay ratio has a positive effect on the firm value and firm performance, which is in line with the economic perspective. In general, employees do not see it as unfair when the pay disparity increases. All three dependent variables increase significantly, the only question is whether the return on assets dependent variable is economically significant. However, the return on assets is the least important performance indicator for investors. A company's stock performance and firm value are more important to them. It has now only been examined whether there is a linear effect. However, it may also be the effect is not linear, but concave. This means that the relationship is hump-shaped.

Table 7: Pay ratio and accounting-based performance results

This table presents the linear regression fixed effect model for the linear effect of pay ratio on the dependent variable return on assets. All regressions are controlled for firm fixed effects and time fixed effects. *t-1* means that the variable is lagged for one period. I use White (1980) robust standard errors clustered at the firm level. See Table 4 for a detailed overview of the variable definitions. The *t*-statistics are reported below the estimates. ***, ** and * indicate that the value is significantly different from zero at the 1%, 5%, and 10% levels.

Variables	Predicted sign	Return on Assets				
		(1)	(2)	(3)	(4)	(5)
Ln(Pay ratio)	+	0.0140	0.0167**	0.0134**	0.0244***	-0.00324
		(1.391)	(2.354)	(2.432)	(3.524)	(-0.424)
Firm size			0.0349**	0.0243**	0.0327**	0.0713***
			(2.386)	(2.248)	(2.361)	(5.126)
Leverage			-0.0529	-0.0126	-0.0393	0.0173
			(-1.405)	(-0.285)	(-0.431)	(0.119)
Physical capital intensity			0.0972**	0.0826**	0.0956	0.0203
			(2.419)	(2.273)	(1.424)	(0.175)
Firm risk				-0.0180	-0.00649	-0.0203
				(-0.389)	(-0.150)	(-0.238)
CEO tenure				-2.75e-06	0.000836	0.00222*
				(-0.00569)	(0.668)	(2.155)
ROA(*t*-1)				0.292**	0.134	-0.111
				(2.425)	(1.055)	(-0.784)
R&D to Assets					-0.0567	
					(-0.915)	
Trade union ratio						0.0232
						(0.490)
Firm fixed effects		YES	YES	YES	YES	YES
Year fixed effects		YES	YES	YES	YES	YES
Robust std. error		YES	YES	YES	YES	YES
Constant		0.00973	-0.353**	-0.245*	-0.361**	-0.506***
		(0.246)	(-2.255)	(-1.985)	(-2.477)	(-3.494)
Observations		224	224	220	103	66
Firms		32	32	31	18	13
Adjusted R^2		0.772	0.797	0.824	0.802	0.806

Table 8: Pay ratio and market-based performance results

This table presents the linear regression fixed effect model for the linear effect of pay ratio on the dependent variable stock return. All regressions are controlled for firm fixed effects and time fixed effects. *t-1* means that the variable is lagged for one period. I use White (1980) robust standard errors clustered at the firm level. See Table 4 for a detailed overview of the variable definitions. The *t*-statistics are reported below the estimates. ***, ** and * indicate that the value is significantly different from zero at the 1%, 5%, and 10% levels.

Variables	Predicted sign	Stock return				
		(1)	(2)	(3)	(4)	(5)
Ln(Pay ratio)	+	0.168***	0.212***	0.189***	0.230***	0.195
		(3.649)	(4.328)	(3.171)	(3.809)	(1.313)
Firm Size			-0.255***	-0.338***	-0.299**	-0.534***
			(-3.690)	(-3.753)	(-2.624)	(-3.276)
Leverage			-0.372	-0.506	-0.673	0.494
			(-1.110)	(-1.577)	(-0.808)	(0.301)
Physical capital intensity			0.398**	0.0304	0.253	0.426
			(2.141)	(0.130)	(0.815)	(0.387)
Firm risk				0.768	0.678	2.267**
				(1.659)	(0.832)	(2.433)
ROA				2.656***	1.351	7.918**
				(2.802)	(1.365)	(2.936)
CEO tenure				0.00435	0.0152	0.0120
				(0.501)	(1.365)	(0.993)
Stock return (*t*-1*)*				-0.260***	-0.197	-0.600***
				(-3.069)	(-1.732)	(-4.116)
R&D to Assets					-1.461	
					(-1.742)	
Trade union ratio						0.224
						(0.537)
Firm fixed effects		YES	YES	YES	YES	YES
Year fixed effects		YES	YES	YES	YES	YES
Robust std. error		YES	YES	YES	YES	YES
Constant		0.515***	2.892***	3.465***	3.030***	3.095*
		(2.847)	(4.692)	(4.461)	(3.251)	(1.797)
Observations		219	219	189	87	60
Firms		32	32	30	18	13
Adjusted R^2		0.231	0.269	0.380	0.385	0.276

Table 9: Pay ratio and Tobin's q results

This table presents the linear regression fixed effect model for the linear effect of pay ratio on the dependent variable Tobin's q. All regressions are controlled for firm fixed effects and time fixed effects. *t-1* means that the variable is lagged for one period. I use White (1980) robust standard errors clustered at the firm level. See Table 4 for a detailed overview of the variable definitions. The *t*-statistics are reported below the estimates. ***, ** and * indicate that the value is significantly different from zero at the 1%, 5%, and 10% levels.

Variables	Predicted sign	Tobin's q				
		(1)	(2)	(3)	(4)	(5)
Ln(Pay ratio)	+	0.119	0.192*	0.161***	0.255***	0.206**
		(0.955)	(1.715)	(3.379)	(3.364)	(2.818)
Firm size			-0.0242	-0.275***	-0.412***	0.0126
			(-0.276)	(-2.833)	(-3.537)	(0.0805)
Leverage			-0.561*	-0.190	-0.543**	-0.1000
			(-1.751)	(-0.865)	(-2.140)	(-0.147)
Physical capital intensity			1.281**	0.713**	1.181**	0.401
			(2.490)	(2.449)	(2.649)	(0.784)
Firm risk				0.250	-0.123	0.204
				(0.873)	(-0.256)	(0.609)
ROA				2.950***	2.367***	0.277
				(4.259)	(2.994)	(0.212)
CEO tenure				0.00324	-0.00581	-0.00682
				(0.555)	(-0.703)	(-0.562)
Tobin's q (*t*-1)				0.543***	0.524***	0.549**
				(5.473)	(3.713)	(2.688)
R&D to Assets					-3.494***	
					(-4.438)	
Trade union ratio						0.569**
						(2.477)
Firm fixed effects		YES	YES	YES	YES	YES
Year fixed effects		YES	YES	YES	YES	YES
Robust std. error		YES	YES	YES	YES	YES
Constant		1.207***	1.562	3.264***	4.850***	-0.0904
		(11.88)	(1.603)	(3.222)	(3.757)	(-0.0696)
Observations		224	224	220	103	66
Firms		32	32	31	18	13
Adjusted R^2		0.822	0.835	0.909	0.931	0.960

5.3.2 Concave effect pay ratio

Table 10 shows the effect of the pay ratio and squared pay ratio on the return on assets. The pay ratio coefficients are statistically significant at 1% and the sign is positive in specification (2) and (3), while the squared pay ratio is statistically significant at 5% and negative in these specifications. This means that there is a concave relationship between the pay ratio and the return on assets, which is in line with some literature (Bingley & Eriksson, 2001; Braakmann, 2008; Mahy et al., 2011; Winter-Ebmer & Zweimüller, 1999; Yang & Klaas, 2011). This means that the tournament theory is complementary to the equity theory and the relative deprivation theory.

So first, the relation between the pay ratio and return on assets is positive until a certain level. After this "inflection point" of the pay ratio, the effect becomes negative. Table A4 presents the inflection points of the pay ratios, which shows whether the nonlinearity is economically significant. The inflection point is calculated by looking at the derivative of the dependent variable with respect to the pay ratio in all regressions. The inflection points of specification (2) and (3) are 114.24 and 122.96, which is quite high. The 90^{th} percentile of the sample is 112.90, so the question is whether this is economically significant. However, the media are increasingly complaining about the high pay ratios and companies have to disclose more and more about the remuneration in their annual reports.

Table 11 provides the concave effects of the pay ratio on the stock performance. These results are almost the same as the accounting based performance with the return on assets. Specification (1), (2), (3) and (4) are all significant at a minimum significance level of 10%. The inflection points for the pay ratio concave effect on the stock performance are between the 110.41 and 164.98, which is comparable with the return on assets. Consequently, the conclusion is the same as the return on assets.

Table 12 shows the relationship between the pay ratio and squared pay ratio with the Tobin's q. The third and fourth specification are significant at the 5% level. These results are also comparable with the accounting-based performance and the stock performance. The inflection points are between 93.94 and 133.90, which is again almost the same. The coefficients and significance levels of the control variables of table 10, 11 and 12 are almost the same as table 7, 8 and 9. For that reason, I omit further discussion on the control variables.

In summary, table 7, 8 and 9 show that there is a significant positive effect between the pay ratio and the firm performance and value. However, the question is whether the accounting-based method, the return on assets, is economically significant. Tables 10, 11 and 12 show a concave effect, meaning that the tournament theory is complementary to the deprivation theory and equity theory. Up to a certain level, employees will work harder when the pay disparity is higher to get promotion. At some point, they will find the inequality unfair and their performance deteriorate. The same goes for how investors value a company. Higher pay ratios first lead to higher stock returns and higher firm value to some level. These returns and firm value will decrease after the inflection. However, these inflection points are high for AEX companies.

5.3.3 Robustness checks

I did some tests to examine whether all regression models are robust. I used the natural logarithm of the pay ratio in hypotheses one for robustness. With the normal pay ratio, the coefficients are also significant, but to enhance the normality of the variable, I use the logarithm of the pay ratio.

To further test if the models are robust, I changed the pay ratios variables and the dependent variables in the regression analysis. First, I changed the pay ratios with the lagged pay ratios to reduce the endogeneity. Second, I changed the pay ratios and the dependent variables with the delta of the variables, which is the change of the variable from year *t-1* to year *t*. The regression with the delta of the variables removes the effects of time-invariant unobservables. All the results are presented in Table A5, A6 and A7. The lagged variables of all dependent variables are not significant, so it is not possible to reduce the endogeneity problem with the lagged variables. The regressions of changes of the return on assets demonstrate that the ln(pay ratio) is close to 10% significance (t = 1.602). The squared pay ratios are not significant, but one pay ratio is significant at 10%.

The two coefficients of the delta ln(pay ratio) in the regression change model of the stock returns are both significant. Specification (5) and (6) in table A6 table are both significant at 1%. The pay ratio in specification (7) and (8) are significant at 5%. The squared pay ratios are close to the 10% signification in specification (7) and (8) with *t*-statistics of -1.471 and -1.449. The coefficients of the regression of change models of the Tobin's q are also both significant at 1%. The pay ratio coefficients in specification (7) and (8) of table A7 are significant at 10%

and the squared pay ratio are close to the significant level of 10% (t = -1.397 and t = -1.430). All signs of the changed variables are the same as the baseline regressions.

Table 10: Pay ratio and return on assets results with concave effects

This table presents the linear regression fixed effect model for the concave effect of pay ratio on the dependent variable return on assets. All regressions are controlled for firm fixed effects and time fixed effects. *t-1* means that the variable is lagged for one period. I use White (1980) robust standard errors clustered at the firm level. See Table 4 for a detailed overview of the variable definitions. The *t*-statistics are reported below the estimates. ***, ** and * indicate that the value is significantly different from zero at the 1%, 5%, and 10% levels.

Variables	Predicted sign	Return on assets				
		(1)	(2)	(3)	(4)	(5)
Pay ratio	+	0.000824*	0.00101***	0.000802***	0.000703	5.31e-05
		(1.879)	(3.021)	(2.969)	(1.527)	(0.136)
Pay ratio²	−	-3.12e-06	-4.22e-06**	-3.26e-06**	-8.56e-07	-3.11e-07
		(-1.577)	(-2.397)	(-2.293)	(-0.270)	(-0.171)
Firm size			0.0361**	0.0259**	0.0316**	0.0714***
			(2.723)	(2.636)	(2.289)	(3.889)
Leverage			-0.0562	-0.0185	-0.0298	0.0131
			(-1.606)	(-0.436)	(-0.337)	(0.0879)
Physical capital intensity			0.0990**	0.0848**	0.0784	0.0215
			(2.575)	(2.414)	(1.215)	(0.184)
Firm risk				-0.0132	-0.0230	-0.0227
				(-0.282)	(-0.509)	(-0.242)
CEO Tenure				8.43e-05	0.000673	0.00215
				(0.192)	(0.575)	(1.471)
ROA (*t*-1)				0.273**	0.109	-0.111
				(2.320)	(0.874)	(-0.787)
R&D to Assets					-0.00666	
					(-0.0984)	
Trade union ratio						0.0281
						(0.514)
Firm fixed effects		YES	YES	YES	YES	YES
Year fixed effects		YES	YES	YES	YES	YES
Robust std. error		YES	YES	YES	YES	YES
Constant		0.0283	-0.343**	-0.244**	-0.284*	-0.521**
		(1.473)	(-2.547)	(-2.318)	(-1.965)	(-2.800)
Observations		224	224	220	103	66
Firms		32	32	31	18	13
Adjusted R^2		0.780	0.812	0.832	0.799	0.801

Table 11: Pay ratio and stock performance results with concave effects

This table presents the linear regression fixed effect model for the concave effect of pay ratio on the dependent variable stock return. All regressions are controlled for firm fixed effects and time fixed effects. *t-1* means that the variable is lagged for one period. I use White (1980) robust standard errors clustered at the firm level. See Table 4 for a detailed overview of the variable definitions. The *t*-statistics are reported below the estimates. ***, ** and * indicate that the value is significantly different from zero at the 1%, 5%, and 10% levels.

Variables	Predicted sign	Stock return				
		(1)	(2)	(3)	(4)	(5)
Pay ratio	+	0.00829***	0.00943***	0.00704**	0.00903***	0.00778
		(3.099)	(3.812)	(2.754)	(3.287)	(1.277)
Pay ratio²	−	-3.11e-05**	-3.30e-05***	-2.13e-05*	-4.09e-05*	-3.49e-05
		(-2.575)	(-2.829)	(-1.966)	(-2.032)	(-1.509)
Firm Size			-0.261***	-0.345***	-0.299**	-0.345
			(-3.950)	(-3.894)	(-2.722)	(-1.709)
Leverage			-0.378	-0.469	-0.645	0.486
			(-1.122)	(-1.360)	(-0.721)	(0.301)
Physical capital intensity			0.351*	0.00997	0.0919	0.381
			(1.945)	(0.0376)	(0.308)	(0.313)
Firm risk				0.690	0.576	2.341**
				(1.427)	(0.672)	(2.326)
ROA				2.515**	1.490	7.483**
				(2.609)	(1.352)	(2.813)
CEO tenure				0.00425	0.0144	0.0198**
				(0.485)	(1.264)	(2.497)
Stock return (*t*-1)				-0.265***	-0.192	-0.600***
				(-3.197)	(-1.560)	(-4.043)
R&D to Assets					-1.042	
					(-1.300)	
Trade Union ratio						0.446
						(0.846)
Firm fixed effects		YES	YES	YES	YES	YES
Year fixed effects		YES	YES	YES	YES	YES
Robust std. error		YES	YES	YES	YES	YES
Constant		0.810***	3.374***	3.994***	3.577***	1.969
		(6.869)	(5.085)	(4.468)	(3.725)	(0.811)
Observations		219	219	189	87	60
Firms		32	32	30	18	13
Adjusted R²		0.237	0.276	0.378	0.355	0.261

Table 12: Pay ratio and Tobin's q results with concave effects

This table presents the linear regression fixed effect model for the concave effect of pay ratio on the dependent variable Tobin's q. All regressions are controlled for firm fixed effects and time fixed effects. *t-1* means that the variable is lagged for one period. I use White (1980) robust standard errors clustered at the firm level. See Table 4 for a detailed overview of the variable definitions. The *t*-statistics are reported below the estimates. ***, ** and * indicate that the value is significantly different from zero at the 1%, 5%, and 10% levels.

Variables	Predicted sign	Tobin's q				
		(1)	(2)	(3)	(4)	(5)
Pay ratio	+	0.00614	0.00882*	0.00720***	0.0137***	0.00626
		(1.075)	(1.784)	(3.180)	(3.419)	(1.495)
Pay ratio²	−	-2.19e-05	-3.20e-05	-2.69e-05**	-7.31e-05**	-1.96e-05
		(-0.846)	(-1.448)	(-2.244)	(-2.660)	(-0.962)
Firm size			-0.0267	-0.266**	-0.407***	0.0279
			(-0.333)	(-2.644)	(-3.653)	(0.159)
Leverage			-0.571*	-0.211	-0.572**	-0.0680
			(-1.765)	(-0.934)	(-2.123)	(-0.0957)
Physical capital intensity			1.243**	0.676**	1.127***	0.265
			(2.637)	(2.530)	(3.209)	(0.467)
Firm risk				0.237	-0.144	0.189
				(0.820)	(-0.302)	(0.637)
ROA				2.760***	2.582***	0.0508
				(3.756)	(3.229)	(0.0366)
CEO Tenure				0.00392	-0.00544	-0.00600
				(0.667)	(-0.625)	(-0.459)
Tobin's q (*t*-1)				0.541***	0.519***	0.605*
				(5.695)	(3.924)	(2.011)
R&D to Assets					-3.250***	
					(-5.064)	
Trade union ratio						0.573
						(1.574)
Firm fixed effects		YES	YES	YES	YES	YES
Year fixed effects		YES	YES	YES	YES	YES
Robust std. error		YES	YES	YES	YES	YES
Constant		1.032***	1.123	2.637**	4.204***	-0.697
		(4.204)	(1.301)	(2.679)	(4.492)	(-0.427)
Observations		224	224	220	103	66
Firms		32	32	31	18	13
Adjusted R²		0.823	0.837	0.908	0.930	0.955

6 Conclusion

In The Netherlands there is a growing public discussion about the causes and consequences of the wide and growing disparity of pay between the CEOs and the average employee. This study examines the relationship between the pay disparity of the CEO and the employee and the value and performance of its company. High pay ratios can lead to feelings of unfair treatment among employees, resulting in deteriorating work efforts or resignations. On the other hand, people may work harder to earn promotion because of higher pay disparity. It is also possible that the greater scalability of CEO talent to the average employee suggests that the CEO receives disproportionately more remuneration for his productivity compared to an employee. If this is the case, more talented CEOs will be paid more and therefore do better work. As a result, there is a positive effect of higher pay ratios on firm value and performance.

A new data set was created by hand-collecting remuneration data from year reports. The firm characteristics are retrieved from *Datastream.* With the data set of Dutch listed firms in the AEX between 2010 and 2017, I analysed the effect of pay disparity on the firm performance and value. The first hypothesis considers the linear effect with regards to the natural logarithm of the pay ratio.

The second hypothesis studies the concave effect with respect to the pay ratio and squared pay ratio. The return on assets is used for the accounting-based performance and the stock performance for the market-based performance. Tobin's q is used to establish the firm value. Using OLS regressions with firm-level and year fixed effects, significant effects are obtained between the pay ratio and the firm performance and value variables.

The first regressions show a significant effect between the natural logarithm of the pay ratio and the firm value and performance, which is in line with the managerial talent perspective and the tournament theory. The effect on effect of the pay ratio on Tobin's q and Stock return is economical significant. The question, however, is whether the pay ratio has an economically significant effect, since these coefficient values are very small. The results for the second hypothesis demonstrate a significant concave effect of the pay ratio on the firm value and performance. With all three variables, positive effects of pay ratio change in negative effects. Accordingly, the discussed theories are not contradictory, but complementary. However, these inflection points are for all three variables at high pay ratios. A summary of the results of the hypotheses are reported in Table 13**.**

This research showed how pay disparities recently affected companies in the AEX. Furthermore, I examined how internals (employees and executives) and externals (investors and stakeholders) responded to the disclosures of remunerations of the CEO and its average employee. This study shows a stronger effect of pay ratio on the market-based performance and the firm value than the accounting-based performance. This means that pay inequality not only affects employee behaviour, but actually influences investors' actions and how they judge pay inequality.

Table 13: Summary hypotheses results

	Expected sign	Findings	Result
H1a: Effect on firm performance:			
Return on assets	+	+	Accept
Stock performance	+	+	Accept
H1b: Effect on firm value			
Tobin's q	+	+	Accept
	Expected nonlinearity	Findings nonlinearity	Result
H2a: Concave effect on firm performance:			
Return on assets	Yes	Yes	Accept
Stock performance	Yes	Yes	Accept
H2b: Concave effect on firm value:			
Tobin's q	Yes	Yes	Accept

7 Limitations

Before I show the recommendations for further research, I discuss the limitations of this study. The methodology of this study is determined on prior literature and is strengthened by different robustness tests. However, some limitations in this research are unavoidable.

Until recently, there was scarce information about stock options plans in annual reports. The renewed governance code has enacted regulation that changed this. Due to the company VEB, reliable data could be collected about stock options and shares. As mentioned in the section (data), pay ratios have been included in the annual reports for two years to give a better view of the pay disparity in a firm for investors and employees. However, there are no strict rules on the definition of the pay ratio, so it is impossible to compare the ratio between firms. Another issue is that not every firm chooses to disclose the remunerations of the CEO. The sample only contains remunerations of CEOs which are available in annual reports, creating a selection bias.

Even though many control variables from previous studies are used in the regression models of this research, it is still susceptible to the omitted variable bias. This results in endogeneity. There is also not much data available for some control variables used in the regressions, again resulting is biased variables. These control variables are the research and development and the trade union. The sample is much smaller when these control variables are added, due to the lack of data. Another limitation is the insignificance of the lagged pay ratios. Due to the insignificance of the lagged pay ratios, it is not possible to reduce the endogeneity problem with these regressions. However, the change variables regressions are almost all significant.

8 Future research

To get a better view of the effects of pay disparity on the performance and value of a company, here are some recommendations for further research.

First of all, it is helpful to increase the sample with more Dutch listed firms, to increase regression possibilities. At this moment, it is not possible to split the sample in different type of firms in the Netherlands. The sample may be widened by including the listed firms of the AMX. Faleye et al. (2013) have done different regressions with different type of firms.

For example, they looked at firms with high research and development costs, and companies that are relatively more unionized. Unfortunately, this is not possible because of the lack of data of the research and development costs and trade union. A bigger sample is also useful for examining whether the inflection point depends on the type of company.

The literature review mentioned that the effect of pay disparity on firm performance and value differs per country. For further research it is recommendable to research other countries to conclude whether there are differences in pay ratio effects.

As mentioned in the limitations, there are still omitted control variables. Considering which variables will add value as a control variable in the regressions and reduce the endogeneity problem. It is also useful to do further research on the lagged variables, which are not significant in this research.

In this research, the pay ratio is calculated with the disparity between the CEO and the average employee. Further research that uses other pay ratios for robustness checks would be valuable.

In prior literature, the pay disparity between executives is used as pay ratio (Burns et al., 2017; Eriksson, 1999; Kale et al., 2009; Main et al., 1993). However, too little data is available of other executives in a company to use this pay ratio. Examining different levels of pay within a company, and comparing these results, would enhance understanding of the pay structure within a firm.

The results in this research show a significant effect of the pay ratio on firm value and stock returns. The question remains whether investors can outperform the market by going long and short in stocks of companies with high and low pay inequalities. For further research, a hedge portfolio can be created to check whether abnormal returns arise.

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Appendix

Table A1: Firms per year listed AEX

This table presents when a firm is listed in the AEX. The last row presents the number of firms per year in the AEX and the last column presents the total years the firm was in the AEX between 2009 and 2018.

Firms AEX	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	***Total years***
Aalberts Industries							●	●	●	●	4
ABN-AMRO Group								●	●	●	3
AEGON	●	●	●	●	●	●	●	●	●	●	10
Air France - KLM	●	●	●	●	●	●					6
Akzo Nobel	●	●	●	●	●	●	●	●	●	●	10
Altice Europe					●	●	●	●	●	●	6
Aperam			●	●							2
Arcelormittal	●	●	●	●	●	●	●	●	●	●	10
ASML Holding	●	●	●	●	●	●	●	●	●	●	10
ASR Nederland										●	1
Boskalis Westminister	●	●	●	●		●	●	●	●		8
Corio	●	●	●	●	●	●					6
DE Master Blenders 1753				●							1
Delta Lloyd						●	●				2
Fugro	●	●	●	●	●	●					6
Galapagos										●	1
Gemalto						●	●	●	●	●	5
Heineken	●	●	●	●	●	●	●	●	●	●	10
ING Groep	●	●	●	●	●	●	●	●	●	●	10
Koninklijke Ahold Delhaize	●	●	●	●	●	●	●	●	●	●	10
Koninklijke BAM Groep	●	●									2
Koninklijke DSM	●	●	●	●	●	●	●	●	●	●	10
Koninklijke KPN	●	●	●	●	●	●	●	●	●	●	10
Koninklijke Philips	●	●	●	●	●	●	●	●	●	●	10
Koninklijke Vopak							●	●	●	●	4
NN Group							●	●	●	●	4
OCI						●	●				2
PostNL			●	●	●						3
Randstad	●	●	●	●	●	●	●	●	●	●	10
RELX	●	●	●	●	●	●	●	●	●	●	10
Royal Dutch Shell	●	●	●	●	●	●	●	●	●	●	10
Royal Imtech					●						1
SBM Offshore	●	●	●	●	●			●	●		7
Signify										●	1
TNT Express	●	●	●	●	●	●	●	●	●		9
TomTom	●	●	●	●							4
Unibail-Rodamco	●	●	●	●	●	●	●	●	●	●	10
Unilever	●	●	●	●	●	●	●	●	●	●	10
Wereldhave	●	●	●								3
Wolters Kluwer	●	●	●	●	●	●	●	●	●	●	10
ZIGGO					●						1
Total firms per year	25	25	26	26	25	25	25	25	25	25	

Table A2: Descriptive statistics financial firms

This table shows the number of observations (N), Mean (μ), Standard deviation (σ), minimum (Min), and maximum (Max) of all the variables. All the variables are from the year 2010 till 2017 for the financial firms of the AEX. All variables are winsorised at the fifth and 95th percentiles.

Variables	N	μ	σ	Min	Max
Pay characteristics:					
CEO Fixed salary	48	881.77	374.36	359.00	1,713.00
CEO variable	33	211.94	210.34	0.00	850.00
CEO Pension	48	359.15	423.97	0.00	1,728.00
Long term CEO	19	405.84	153.67	0.00	633.00
Other salary CEO	19	204.21	228.55	29.00	800.00
Total remuneration CEO	48	1,628.11	953.81	685.00	4,252.00
Employees	48	22,488.23	25,275.58	451.00	100,000.00
Staff expense	49	1,992,960.77	2,079,146.69	0.00	7,769,647.00
Average expense per employee	48	98.27	18.84	72.13	145.60
Pay ratio	45	17.39	12.50	4.91	52.63
Ln(Pay ratio)	45	2.66	0.60	1.59	3.96
Firm performance and value					
Tobin's q	48	0.97	0.04	0.86	1.08
Stock return	36	1.09	0.27	0.32	1.63
ROA	48	0.01	0.01	-0.02	0.03
Characteristics employee and CEO					
CEO tenure	48	5.33	5.88	0.00	23.00
Trade union	22	0.61	0.28	0.17	1.00
Firm characteristics					
Total assets	48	333,573.34	354,216.58	7,374.30	1,270,557.00
Total debt	48	52,796.53	72,561.08	1,223.00	241,392.00
Long-term debt	48	32,765.00	41,727.11	38.00	111,757.00
Liabilities	48	315,495.97	338,467.73	3,478.00	1,223,329.00
Leverage	48	0.11	0.11	0.00	0.36
Common shareholders' equity	48	17,631.95	16,115.37	1,668.40	56,607.00
Market Value	48	14,839.64	15,360.22	1,239.10	59,535.26
Revenue	48	23,033.56	20,856.47	414.40	94,232.00
Firm size	48	9.46	1.38	6.03	11.45
Firm Risk	40	0.35	0.16	0.09	0.79
Operating income	48	1,901.71	1,855.53	-1,273.60	7,129.00
Property plant and equipment	48	1,530.25	2,155.17	53.10	7,088.10
Physical capital intensity	48	0.09	0.27	0.00	0.90
Research & Development`	0				
R&D to Assets	0				

Table A3: Economic significance effect pay ratio

This shows the x-standardized coefficients of the ln(pay ratio) of all models in table 8, 9 and 10. (1) means the first model in results table, (2) is the second model in the table etc. the x-standardized coefficient is the standard error of the variable ln(pay ratio) times the coefficient of the ln(pay ratio) in the model.

***, ** and * indicate that the coefficient of the model is significantly different from zero at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)
Return on assets					
Ln(Pay ratio)	0.0114	0.0135**	0.0109**	0.0173***	-0.0022
Stock return					
Ln(Pay ratio)	0.1360***	0.1717***	0.1531***	0.1640***	0.1393
Tobin's q					
Ln(Pay ratio)	0.0967	0.1556*	0.1314***	0.1815***	0.1429**

Table A4: Economic significance concave effect pay ratio

This shows the inflection points of the pay ratio of all models in table 8, 9 and 10. The number between the parentheses is the model number of the regression in table 11, 12 and 13.

***, ** and * indicate that the coefficient of the model is significantly different from zero at the 1%, 5%, and 10% levels.

	(1)	(2)	(3)	(4)	(5)
Return on assets	132.12	114.24**	122.96**	408.57	85.61
Stock return	133.20**	142.80***	164.98*	110.41*	111.36
Tobin's q	140.21	137.89	133.90**	93.94**	159.62

Table A5: Endogeneity return on assets

This table presents the linear regression fixed effect model to examine the endogeneity problem. All regressions are controlled for firm fixed effects and time fixed effects. *t-1* means that the variable is lagged for one period. The first 4 models are with the lagged pay ratio's. Model 5 to 8 are with ΔROA and Δpay ratios. I use White (1980) robust standard errors clustered at the firm level. See Table 4 for a detailed overview of the variable definitions. The *t*-statistics are reported below the estimates. ***, ** and * indicate that the value is significantly different from zero at the 1%, 5%, and 10% levels.

Variables	(1) ROA(*t*)	(2) ROA(*t*)	(3) ROA(*t*)	(4) ROA(*t*)	(5) ΔROA	(6) ΔROA	(7) ΔROA	(8) ΔROA
Ln(Pay ratio) (*t*-1)	0.00545	0.00214						
	(0.665)	(0.304)						
Pay ratio (*t*-1)			0.000505	0.000354				
			(1.286)	(0.992)				
Pay ratio² (*t*-1)			-2.71e-06	-2.00e-06				
			(-1.395)	(-1.131)				
ΔLog(Pay ratio)					0.00784	0.00835		
					(1.409)	(1.602)		
ΔPay ratio							0.000364	0.000359*
							(1.636)	(1.728)
ΔPay ratio²							-9.33e-07	-8.67e-07
							(-0.864)	(-0.858)
Firm Size	0.0283*	0.0260*	0.0311**	0.0287**	0.0112	0.0143	0.0112	0.0140
	(1.980)	(1.968)	(2.276)	(2.238)	(1.172)	(1.389)	(1.144)	(1.353)
Leverage	-0.0609	-0.0398	-0.0657	-0.0464	0.0903*	0.0702	0.0908*	0.0712
	(-1.230)	(-0.726)	(-1.301)	(-0.838)	(1.888)	(1.638)	(1.906)	(1.662)
Physical capital intensity	0.0686	0.0581	0.0689	0.0620	0.0751	0.0762	0.0742	0.0753
	(1.157)	(1.020)	(1.249)	(1.149)	(1.510)	(1.373)	(1.466)	(1.340)
Firm risk		-0.0804*		-0.0681		0.0773**		0.0752**
		(-1.869)		(-1.637)		(2.383)		(2.279)
CEO tenure		0.000260		0.000383		-0.000800		-0.000823
		(0.261)		(0.392)		(-1.094)		(-1.089)
Lagged Pay ratio	YES	YES	YES	YES	NO	NO	NO	NO
ΔROA	NO	NO	NO	NO	YES	YES	YES	YES
Firm fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Robust std. error	YES	YES	YES	YES	YES	YES	YES	YES
Constant	-0.240	-0.179	-0.266*	-0.215*	-0.135	-0.187*	-0.134	-0.183
	(-1.663)	(-1.363)	(-1.962)	(-1.704)	(-1.379)	(-1.726)	(-1.340)	(-1.675)
Observations	194	193	194	193	191	190	191	190
Firms	32	31	32	31	32	31	32	31
Adjusted R²	0.791	0.797	0.795	0.799	-0.0399	-0.0116	-0.0301	-0.00284

Table A6: Endogeneity stock returns

This table presents the linear regression fixed effect model to examine the endogeneity problem. All regressions are controlled for firm fixed effects and time fixed effects. *t-1* means that the variable is lagged for one period. The first 4 models are with the lagged pay ratio's. Model 5 to 8 are with ΔStock returns and Δpay ratios. I use White (1980) robust standard errors clustered at the firm level. See Table 4 for a detailed overview of the variable definitions. The *t*-statistics are reported below the estimates. ***, ** and * indicate that the value is significantly different from zero at the 1%, 5%, and 10% levels.

Variables	(1) Stock return (*t*)	(2) Stock return (*t*)	(3) Stock return (*t*)	(4) Stock return (*t*)	(5) ΔStock return	(6) ΔStock return	(7) ΔStock return	(8) ΔStock return
Ln(Pay ratio) (*t*-1)	-0.00480	-0.00235						
	(-0.0695)	(-0.0325)						
Pay ratio (*t*-1)			-0.000616	-0.000976				
			(-0.207)	(-0.300)				
Pay ratio² (*t*-1)			7.00e-06	8.69e-06				
			(0.475)	(0.540)				
ΔLog(Pay ratio)					0.254***	0.259***		
					(3.059)	(3.188)		
ΔPay ratio							0.0118**	0.0119**
							(2.288)	(2.305)
ΔPay ratio²							-5.09e-05	-5.03e-05
							(-1.471)	(-1.449)
Firm Size	-0.290***	-0.338***	-0.309***	-0.363***	-0.391***	-0.375***	-0.382***	-0.353***
	(-4.524)	(-5.589)	(-3.991)	(-4.720)	(-3.587)	(-3.627)	(-3.656)	(-3.030)
Leverage	-0.440	-0.417	-0.417	-0.377	-0.210	-0.357	-0.212	-0.356
	(-1.117)	(-1.301)	(-1.068)	(-1.187)	(-0.497)	(-0.826)	(-0.499)	(-0.823)
Physical capital intensity	-0.531*	-0.630**	-0.487*	-0.613**	-0.878	-0.879	-0.835	-0.809
	(-1.948)	(-2.139)	(-1.913)	(-2.314)	(-1.526)	(-1.634)	(-1.386)	(-1.434)
Firm risk		0.554		0.503		0.542		0.443
		(1.174)		(1.063)		(1.667)		(1.139)
ROA		2.502***		2.580***				-0.529
		(3.254)		(3.258)				(-0.437)
CEO tenure		0.00333		0.00225		-0.0120		-0.0113
		(0.427)		(0.282)		(-1.049)		(-0.978)
Lagged Pay ratio	YES	YES	YES	YES	NO	NO	NO	NO
ΔROA	NO	NO	NO	NO	YES	YES	YES	YES
Firm fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Robust std. error	YES	YES	YES	YES	YES	YES	YES	YES
Constant	3.944***	4.063***	4.131***	4.342***	3.770***	3.475***	3.666***	3.305***
	(6.131)	(6.680)	(5.259)	(5.671)	(3.383)	(3.294)	(3.443)	(2.971)
Observations	192	191	192	191	186	186	186	186
Firms	32	30	32	30	32	30	32	30
Adjusted R²	0.235	0.269	0.233	0.267	0.181	0.181	0.176	0.169

Table A7: Endogeneity Tobin's q

This table presents the linear regression fixed effect model to examine the endogeneity problem. All regressions are controlled for firm fixed effects and time fixed effects. *t-1* means that the variable is lagged for one period. The first 4 models are with the lagged pay ratio's. Model 5 to 8 are with ΔTobin's q and Δpay ratios. I use White (1980) robust standard errors clustered at the firm level. See Table 4 for a detailed overview of the variable definitions. The *t*-statistics are reported below the estimates. ***, ** and * indicate that the value is significantly different from zero at the 1%, 5%, and 10% levels.

Variables	(1) Tobin's q(*t*)	(2) Tobin's q(*t*)	(3) Tobin's q(*t*)	(4) Tobin's q(*t*)	(5) ΔTobin's q	(6) ΔTobin's q	(7) ΔTobin's q	(8) ΔTobin's q
Ln(Pay ratio) (*t*-1)	0.0463	0.000119						
	(0.464)	(0.00164)						
Pay ratio (*t*-1)			0.00340	9.83e-05				
			(0.757)	(0.0280)				
Pay ratio² (*t*-1)			-1.47e-05	1.89e-06				
			(-0.675)	(0.109)				
ΔLog(Pay ratio)					0.154***	0.155***		
					(2.756)	(2.764)		
ΔPay ratio							0.00548*	0.00514*
							(1.927)	(1.864)
ΔPay ratio²							-1.70e-05	-1.67e-05
							(-1.379)	(-1.430)
Firm Size	-0.0194	-0.158	-0.0147	-0.170	-0.364***	-0.356***	-0.367***	-0.398***
	(-0.197)	(-1.666)	(-0.152)	(-1.567)	(-3.411)	(-3.328)	(-3.227)	(-3.135)
Leverage	-0.482	-0.0686	-0.497	-0.0562	-0.00111	-0.0427	0.00517	0.00417
	(-1.078)	(-0.222)	(-1.089)	(-0.172)	(-0.00261)	(-0.104)	(0.0123)	(0.0106)
Physical capital intensity	1.006*	0.634	1.032*	0.667	0.0112	0.0186	0.0186	-0.0420
	(1.832)	(1.382)	(1.955)	(1.536)	(0.0512)	(0.0842)	(0.0814)	(-0.190)
Firm risk		-0.414		-0.422		0.172		0.231
		(-0.852)		(-0.813)		(0.537)		(0.657)
ROA		4.716***		4.737***				1.278*
		(4.509)		(4.470)				(1.826)
CEO tenure		0.00733		0.00678		0.000826		0.00123
		(0.846)		(0.753)		(0.120)		(0.164)
Lagged Pay ratio	YES	YES	YES	YES	NO	NO	NO	NO
ΔROA	NO	NO	NO	NO	YES	YES	YES	YES
Firm fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Year fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Robust std. error	YES	YES	YES	YES	YES	YES	YES	YES
Constant	1.189	2.562**	1.177	2.672**	3.576***	3.435***	3.600***	3.756***
	(1.194)	(2.535)	(1.216)	(2.246)	(3.249)	(3.084)	(3.073)	(2.955)
Observations	194	193	194	193	191	190	191	190
Firms	32	31	32	31	32	31	32	31
Adjusted R^2	0.852	0.884	0.852	0.883	0.288	0.282	0.279	0.279