ERASMUS UNIVERSITY ROTTERDAM

MASTER THESIS

DIFFERENT TYPES OF COMPENSATION AND OBSERVABLE LUCK FOR DUTCH CEOS

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Declaration of Authorship

I, Justin VINK BSc, declare that this thesis titled, "DIFFERENT TYPES OF COMPENSATION AND OBSERVABLE LUCK FOR DUTCH CEOS" and the work presented in it are my own. I confirm that:

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“The desire to write grows with writing.”

Desiderius Erasmus

Erasmus University Rotterdam

Abstract

Faculty Name
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Master of Economics and Business

DIFFERENT TYPES OF COMPENSATION AND OBSERVABLE LUCK FOR DUTCH CEOS

by Justin VINK BSc

The Principal-agent theory states that, under the assumption of a risk-averse agent and a risk-neutral principal, the risk should be allocated optimally between the principal and the agent. The literature on management control states that under certain circumstances the agent should bear some risk in the form of incentive pay. These incentives deliver risk and can influence the performance both in a good, as well as in a bad way. In order to test for this relationship, we gathered information regarding the compensation of the CEOs, and the performance of Dutch firms. This data was assembled from the Wharton Research Data Services. This was supplemented by information on the investment performance for the Nasdaq and Dow Jones. Finally the relationship between compensation and luck is tested by using a TSLS model with the return on investments for both the Nasdaq, as well as the Dow Jones as instrumental variables. We find that this risk is a driving force behind the compensation for Dutch CEOs. This leads to the conclusion that CEOs of Dutch companies are paid for observable luck. We analysed this by using three types of compensation namely total compensation, base wage, and bonus. All types of compensation show to have a positive relation with observable luck.

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List of Abbreviations

CEO	**C**hief **E**xecutive **O**fficer
CRSP	**C**enter for **R**esearch in **S**ecurity **P**rices
EBIT	**E**arnings **B**efore **I**nterest and **T**axes
EBITDA	**E**arnings **B**efore **I**nterest **T**axes **D**epreciation and **A**ccumulation
IV	**I**nstrumental **V**ariable
OLS	**O**rdinary **L**east **S**quares
ROA	**R**eturn **O**n **A**ssets
ROI	**R**eturn **O**n **I**nvestments
SIC	**S**tandard **I**ndustrial **C**lassification
TSLS	**T**wo **S**tage **L**east **S**quares
WRDS	**W**harton **R**esearch **D**ata **S**ervices

Chapter 1

Introduction

Modern large corporations have created a culture of high compensations and bonuses for high-end employees. One of the most important reasons for the existence of this culture can be found in the ongoing competition between firms to outperform each other. This can be explained by the belief of firms that specific high-level employees of executives are worth the high levels of compensation. Considering the specific case of the compensation of CEOs, there exists a broad academic discussion on the question whether these high compensations are justified. In the literature this question is approached from multiple points of view. In the first place, there exists literature which discussed the fairness of high CEO compensation from a philosophical point of view (e.g. Harris (2009) and Andersson (1996)). The general conclusion from this is that high levels of executive compensation (in comparison to the compensation of lower level employees) tend to be seen as unfair by the lower level employees. This creates 'Employee cynicism' as Andersson (1996) describes it. This is especially the case when there is no (or barely a) correlation between the executive compensation and firm performance.
The economic theory gives an answer to the question why specific levels of executive compensation have emerged. However, it does not directly address the questions as to how and why the compensations could have risen to tremendous levels. Crystal (1991) gives multiple explanations for the existence of the increasing compensations. In the first place, he argues that, as seen from a theoretical point of view, the CEO is the seller of his services and the board of directors is the buyer. He finds that many boards of directors mainly consist of outside directors. This is essential since the CEO is assumed to have at least a couple of years of experience within the firm considering the compensation at multiple levels of the firm. This gives him a negotiation advantage over the board of directors, since he is simply better informed. Secondly, it is common in modern day corporate life for the CEO to hire a compensation consultant to defend his personal levels of compensation in front of the board.
Referring back the economic approach, a popular way of thinking about executive compensation is by using the theoretical framework of the agency theory. According to this theory, an agent should be rewarded and/or punished for his actions. By linking the wage of the agent to his actions, the principal is able to enforce an alignment of interests. This alignment eventually results in an efficient allocation of resources in the production process. Even though it is optimal to contract on the actions of the agent, in practice this is very difficult, if not impossible. To overcome this issue, the contract will focus on the performance of the agent. Contracting on performance, however, delivers a major concern: the agent is only able to influence a limited part of the total performance. There are external factors, which are not controlled by the executive, which have an impact on performance. The fact that external factors can influence the performance gives rise to the possibility of luck playing a role in determining the bonus. Since there are both observable, as well

unobservable external influential factors, we can speak here about observable luck and unobservable luck. It might be possible for the firms to filter out the observable external factors out of the compensation scheme, which would eliminate the effect of observable luck. Following from the principal agent theory, the firms need to filter out the observable luck component to create an optimal situation. This can be explained by the fact that in the model, the assumption is made that risk results in mental costs for a risk-averse player. Thus, the players can reduce the mental costs associated with the observable risk by explicitly excluding this component from the contract.

Bertrand and Mullainathan (2001) investigated whether firms are able to filter this observable luck out of the compensation contract of their CEOs.[1] They found that observable luck tends to have the same impact on compensation as general performance. Stating it differently, firms are unable to filter out the observable luck out of the compensation scheme of the CEOs. They arrived at this conclusion by developing a TSLS model. Bertrand and Mullainathan (2001) use an observable external factor as an instrument for firm performance. Doing this allows them to interpret the coefficient of firm performance as the relationship between observable luck and compensation. As an example, they try to investigate whether observable luck influences the compensation of CEOs of American oil companies. They use the price of rude oil as an instrument for the performance of the American oil companies. This external observable factor allows for the interpretation of the coefficient as the effect of an increase in performance due to luck on compensation. Next to this individual analysis, they shed similar light on other cases with other instruments as well to ensure the validity of their results.

As an addition to the existing literature, we follow the general methodology of Bertrand and Mullainathan (2001) to investigate whether the CEOs of Dutch firms are compensated for observable luck as well. This results in the following research question:

Are CEOs of Dutch companies rewarded for observable luck?

The model we use to investigate the effect of observable luck is similar to the one used by Bertrand and Mullainathan (2001). We will use the same TSLS approach. However, Bertrand and Mullainathan (2001) use only one instrument at a time, which only allows for either variance over time or cross-sectional variance in one model. To allow for both cross-sectional variance as well as variation over time simultaneously, we use two different instruments in the same model. The allowance for cross-sectional variance is possible since the two values of the instruments varies between companies. As robustness check, we grab back to the model of Bertrand and Mullainathan (2001) and estimate the relationship with only one instrument. Finally, we will use different measures of compensation in our analysis. Where Bertrand and Mullainathan (2001) mainly focus on the effect of observable luck on total compensation, we split the total compensation up in two other variables. This results in the situation where we have three distinct compensation measures: total compensation, bonus, and base wage. Compared to Bertrand and Mullainathan (2001), this is a more precise method of estimating where the effect of observable luck is the strongest. As we are interested in the effect of observable luck on these compensation measures, three different analyses are performed. As an addition to the general analyses we will expand the investigation by performing multiple robustness checks. These robustness checks should give an indication whether the

[1] They used two different datasets for the periods 1977-1994 and 1984-1991.

conclusions drawn from the general analyses are valid.
Considering the previous research of Bertrand and Mullainathan (2001), two main reasons for comparable investigation emerge. In the first place, the paper could be outdated due both environmental changes, as well as academic changes, since the publication of Bertrand and Mullainathan (2001). The environmental changes can refer to changes of different natures. One can think here about legal changes, but a change in the general corporate culture, with respect to executive compensation, is also one of the possibilities. The progress in academic knowledge, regarding the field of management control and management compensation, is significant as well. Over the past sixteen years, the amount of papers published on this topic is tremendous. This might lead to an improvement in the compensation contracts.
The second reason for this research relates to the national environment of interest in this paper, as compared to the one used by Bertrand and Mullainathan (2001). We want to investigate whether the conclusions from Bertrand and Mullainathan (2001) hold in the setting of Dutch corporations as well.
The remainder of this report looks as follows: in the second chapter, the theoretical framework, literature are elaborated upon. The specification of the hypotheses follows; in the third chapter, the data are explained extensively; the fourth chapter rolls out the methodology which is used to examine the research question; the fifth chapter gives the results of our analyses for the three compensation measures; the sixth and final chapter gives a discussion on the executed investigation.

Chapter 2

Background

The empirical analysis will be based on the widely known agency framework. Ross (1973) and Mitnick (1973) are one of the first to come up with this abstract theory which helps thinking about interactions between multiple interested parties with differing objectives. This framework suggests that there are two players in the game with different objectives. The two players are called the principal and the agent (hence, the name of the agency framework or the principal-agency framework). The game is characterised by the assumptions that the principal and the agent have different information on what happens, and both players have different objectives. Both players want to maximise their individual pay-off in terms of utility, irrespective of the pay-off of the other player. The information-asymmetry in combination with the fact that both players have an incentive to behave in line with their own objectives, gives room for moral hazard problems. These specific problems can have detrimental effects on the performance of the agent (Arrow, 1970; Hölmstrom, 1979). Hölmstrom (1979) shows with a theoretical method that contracts can be improved by using all the information regarding the behaviour of the agent. In the literature, this method is also known under the subject of management control. In fact, the agency framework is widely used in the latter field. Most of the applications of this model have in common that one person acts on behalf of the other person. As a matter of terminology, the agent acts on behalf of the principal.

To prevent the issue of moral hazard, the principal and the agent can choose to contract upon the actions of both players. This contract should have the goal to align the interests, which should take away the incentive to undertake actions that can increase one's pay-off, at the expense of others. The alignment of interests can be achieved in multiple ways. The principal has the possibility to invest in a loyal relationship with the agent (Akerlof & Kranton, 2005). A loyal relationship should result in a change in the utility function of the agent, and the agent should allocate value to the pay-off of the principal as well. A second potential solution for the principal is to impose intensive monitoring. This solution has the disadvantage that it can be very costly to intensively monitor the actions of an agent. It seems natural that a principal should determine the level of monitoring intensity based on the costs associated with it (Doherty & Smetters, 2005). One other aspect the principal should consider is his personal value created by monitoring the agent. Empirical evidence of Cornelli, Kominek, and Ljungqvist (2013) let us conclude that active monitoring is especially prevalent among companies which have large shareholders. The principal can also agree upon a steep wage-tenure profile. This means that the wage of an agent grows significantly with tenure. This motivates the agent to behave in line with the objectives of the principal since the agent does not want to be fired before getting the high wage. The fourth solution for the principal is to get rid of the agent, and to take the production process into his own hands. This can be seen as integration of the production process. The final and most interesting solution for our analysis is the pay-for-performance contract. By linking the wage of the agent to his performance, he gets an incentive to increase his productivity (or at least behave in line with the objectives of the principal, dependent of the performance measures). Research regarding the effect of performance pay is evident. Empirical evidence supports the hypothesis that an incentive scheme, which relates the performance to the compensation, can lead to a tremendous increase in performance (Bailey, Brown, & Cocco, 1998; Lazear, 2000). Lazear (2000) shows with an extensive field experiment that the shift from a fixed wage scheme towards an incentive scheme can result in an increase in output of a staggering 44% per employee. The author used data on the compensation schemes and performance of a windshield repair company in the United States. Bailey et al. (1998) take a more in-depth look regarding the exact effect of a piece-rate scheme. They analysed this topic in the setting of repetitive tasks. Their analysis shows that a transition towards a piece-rate scheme results in a higher initial output. Secondly, they show that the implementation of this scheme does not result in an increase in performance which can be attributed to higher levels of skill. These two publications have in common that they focused their analysis on the effect on the performance of lower level employees. However, the findings of these papers are tested for higher levels within the firm as well. Papers on this topic with respect to higher level employees find that it is beneficent to use an incentive scheme for CEOs as well (Hayes & Schaefer, 2000). Furthermore, Bebchuk and Fried (2003) give multiple reasons for why the executive should be subject to an incentive scheme. The amount of evidence for a positive effect of incentives on performance at multiple levels of the firm is mounting.[2]

From a theoretical point of view, it would be ideal for the principal to contract upon the actions of the agent. However, it is difficult, if not impossible, to do this. To overcome this issue, they can choose to contract upon performance instead. This gives the potential problem that performance measures are not perfect. This means that a performance measure is not a perfect proxy for the actions of the agent. This can be because the measure is simply mis-aligned, or because the measure is noisy. These two issues have the implication that the principal needs to think about a couple of things before setting the incentive scheme. Firstly, the principal needs to come up with a proper performance measure, which should be as accurate as possible. If this measure is not accurate, the pay-for-performance relationship may be distorted because it might deliver random factors which are relevant for neither the principal nor the agent. Secondly, it is important to think about the strength of the incentives. The incentives should not be too weak, since then they might not have the foreseen effect. But they should not be too strong either, because the agent might choke under the high pressure of the incentives (Ariely, Gneezy, Loewenstein, & Mazar, 2009; Baumeister, 1984; Baumeister & Showers, 1986; Dohmen, 2008). Thirdly, the principal should think about how he plans to measure the performance.[3] This relates to the earlier mentioned significant monitoring costs. Furthermore, the principal should also consider problems like gaming the system, multi-tasking, and incentives over time.

In our analysis, we make the assumption of a risk-neutral principal, and a risk-averse agent. This risk-aversion, from the perspective of the agent, implies that

[2]Banker, Potter, and Srinivasan (2000), Campbell (2008), Stivers, Covin, Hall, and Smalt (1998), Lau and Sholihin (2005), and Frigo (2002) are just a few examples of the literature on this topic.

[3]Note the difference between the earlier mentioned choice of what kind of measure to use, and this new mentioned how to measure the performance.

he is willing to pay for a reduction in risk[4], and the principal should pay a risk premium in order to make the agent accept the offer. Thus, the agent wants to be compensated for accepting the risk imposed on him due to the pay-for-performance contract. This results in a trade-off for the principal. The principal can choose to provide stronger incentives, which presumably lead to higher effort, but this also demands for a higher risk premium. Hence, the noisier the performance measure, the lower the optimal incentive strength. This reduces efficiency.

The interest in this paper can be found in the performance measure. In theory, a performance measure consists of three components: the actions of the agent, observable external factors, and unobservable external factors. A strong performance measure should filter out all external factors. However, we already concluded that it is nearly impossible to set the performance measure such that only the actions are included. In theory, the unobservable external factor cannot be excluded from the performance measure since it cannot be observed either. The observable external factor, however, can be observed by the employer. The fact that it can be observed gives rise to the possibility of filtering out these observable factors out of the compensation contract. This leads to the conclusion that the CEO should not be paid for observable luck.

In practice it there exists a possibility for firms to exterminate a large part of the external factors. A firm can implement a performance measure which is not directly interested in the absolute performance of the CEO, but rather in the relative performance. Relative performance measures allow for a reduction in the systematic risk for the CEO, without reducing the incentive for the CEO. In our setting, the relative performance measure compares the absolute performance of the CEO, with the absolute performance of CEOs of other firms in comparable industries. The effect of relative performance measures on the performance of executives has been investigated by Antle and Smith (1986). Putting this theory into the context of the CEO, it is likely that the shareholders will contract upon the firm's performance to determine the pay-off of the CEO. Firm performance (denoted by p), for its part, depends on a couple of factors. The first factor comprises of the actions of the CEO (denoted by a). The second factor comprises of observable random factors (denoted by o), which are not controlled by the CEO. The final factor comprises of the unobservable random factors (denoted by u), which are not controlled by the CEO either. Under assumption, we can combine these factors and write performance as $p = a + \delta o + u$. As mentioned, this is all just in line with a simple agency framework.

Given this production function of the agent, Holmstrom and Milgrom (1987) came up with the optimal incentive scheme for the agent. This incentive scheme is denoted by s. There are only two factors in the agent's production function which can be observed by the principal, these are p and o. Given this information, the principal will only contract upon these two factors.[5]

$$s = \alpha + \beta(p - \delta o) = \alpha + \beta(a + u) \tag{1}$$

Equation (1) shows that the optimal contract depends on the actual performance and the observable random factor. The observable external factor is subtracted from the total performance. This means that the CEO is not paid for this observable random factor. Taking a closer look at the essence of (1), we see that the contract exists out of two compensation components. These two components are denoted by α and β. Here α gives the fixed base wage of the CEO. The base wage should not be directly

[4]since risk is the equivalent of negative luck, from now on we will use luck to denote either risk or positive luck

[5]Please note the difference between α, and a.

influenced by the performance of the CEO during that same period, it is an independent component within the optimal contract. The bonus of the CEO is determined by the expression: $\beta(p - \delta o)$. In this expression, β gives the bonus-rate, and $(p - \delta o)$ is the performance measure.
The bonus-rate β can be interpreted as the incentive for the CEO to exert a specific amount of effort. The production function (as is also shown in equation 1) shows that the optimal performance measure is equal to the sum of the actions and the unobserved external factors: $p - \delta o = a + u$. In this model, the CEO has only one option to increase his bonus since all other factors cannot be directly controlled by himself. The only way to actually enforce a direct increase in the bonus is by exerting more effort. The CEO now will set his amount at such a level that his marginal benefit of exerting that amount of effort (β) equals his marginal costs of doing that. Stated differently, the CEO will choose to maximize his utility, considering his own utility function and the compensation contract.
Comparing the conclusion of this theoretical framework with the empirical findings of Bertrand and Mullainathan (2001), we arrive at the conclusion that they contradict each other. The agency theory states that all observable external factors can, and should, be filtered out of the optimal contract. However, the empirical findings suggest that this is not the case, and that CEOs in fact are rewarded for observable luck. Applying the idea behind the model and the findings of Bertrand and Mullainathan (2001), we arrive at our first hypothesis.

Hypothesis 1. *Observable luck has a positive effect on the total CEO compensation during that period.*

Hypothesis 1 follows directly from the analysis conducted by Bertrand and Mullainathan (2001). They investigated the relationship between observable luck and total compensation as well. Since the empirical findings and the theoretical model contradict each other, we chose to state the hypothesis in line with the conclusions of Bertrand and Mullainathan (2001).
The analysis regarding the total compensation is complemented by a more in-depth analysis regarding the distinct components of the total compensation. The distinction of the two different components is executed in the same way as done in the theoretical model. Hypothesis 2 tests the relationship between the base wage and observable luck.

Hypothesis 2. *Observable luck has a positive effect on the base wage of a CEO in subsequent periods.*

We argue that an increase in performance due to luck results in more negotiation power for the CEO. The fact that the CEO gains negotiation power, might result in an increase in the base wage in subsequent years. This analysis will be conducted in two stages. First, the relationship between luck and base wage one year later is investigated. After this analysis, we will shed light on the same relationship for a two year gap.
The final hypothesis which will be tested relates to the relationship of luck and the bonus during the same year. As we have shown, the bonus depends on the bonus-rate, and the performance measure used.

Hypothesis 3. *Observable luck has a positive effect on the bonus received by a CEO in that specific period.*

Hypothesis 3 is the most interesting hypothesis since we expect the relationship between bonus and observable luck to be the strongest compared to the relationship tested under hypotheses 1 and 2.

Chapter 3

Data

The hypotheses are tested using an empirical approach. Data from multiple sources are gathered, and merged into one final dataset. Three of these datasets originate from the Wharton Research Data Services (WRDS). In order to investigate this research topic, different kinds of information are needed. In the first place, to cover the necessary data relating to the compensation of the CEOs of Dutch companies, the Compustat - Capital IQ People Intelligence is needed. The second relevant dataset belongs to the Compustat - Capital IQ (Compustat Global) as well. The latter provides information on annual fundamental firm performance. These two sources are filtered in such a way to only include data of firms which are settled in the Netherlands. The third belongs to the Center for Research in Security Prices (CRSP). This dataset provides information on the Nasdaq index. These three datasets were gathered from the website of the Wharton Research Data Services. Fourthly, we found information about the Dow Jones Indices. This was gathered from Yahoo Finance. Finally, information for the major Dutch stock market (AEX) is gathered.[6] The final collection of data consists of information on 127 distinct Dutch firms, and 130 different CEOs over the period from the year 2001 up to 2016 which accounts for a total of 637 observations.

TABLE 1: Summary Statistics

	Mean	Sd	Min	Max	*N*
Base Wage (Thousand Euros)	433.93	286.40	0	2,016	600
Bonus (Thousand Euros)	297.96	469.49	0	4,166	543
Total Compensation (Thousand Euros)	1,260.9	1,607.4	0	11,301	482
ROA (%)	4.94	46.78	-434.95	367.33	540
EBIT (Million Euros)	349.55	923.94	-1,263.96	7,886	637
EBITDA (Million Euros)	501.75	1,213.6	-185.67	9,171	635
Employees	16.13	54.18	0	658.58	541
ROI Dow Jones (%)	7.50	13.04	-33.85	26.46	637
ROI Nasdaq (%)	11.72	19.08	-40.54	50.00	637
ROI AEX (%)	4.99	17.49	-51.63	35.34	637
Age (Years)	51.90	6.02	34	72	616

Descriptive statistics for the important variables for the analysis are shown in table 1. The first three rows give the statistics for the three compensation variables. As mentioned, we use three different measures for compensation. The first one is the base wage. Table 1 shows that the CEOs face an average base wage of approximately

[6] For more information see www.aex.nl

FIGURE 1: Total Compensation density histogram

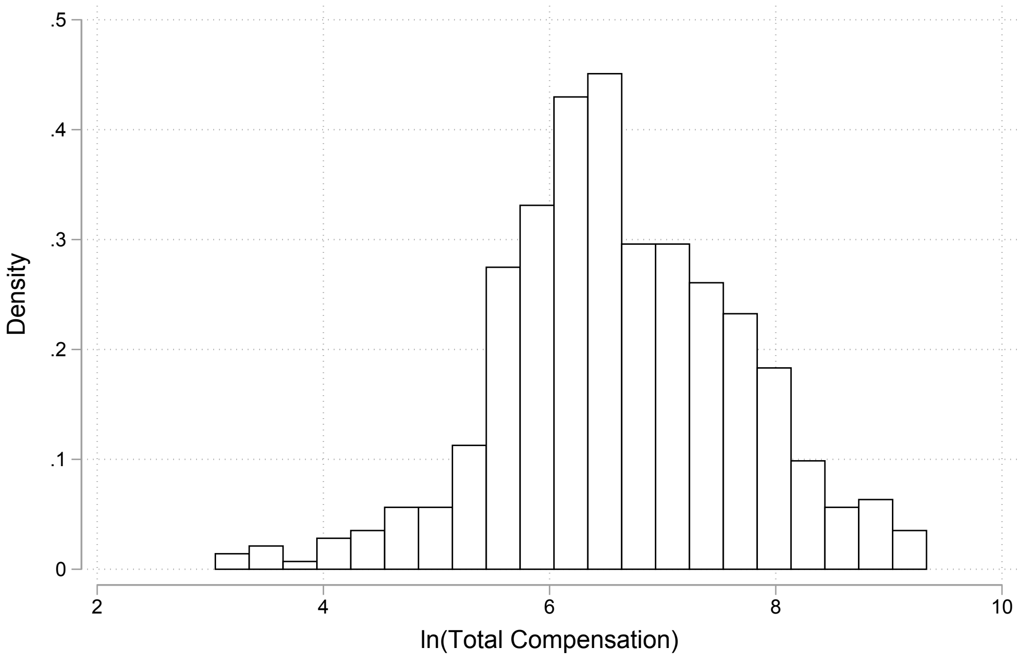
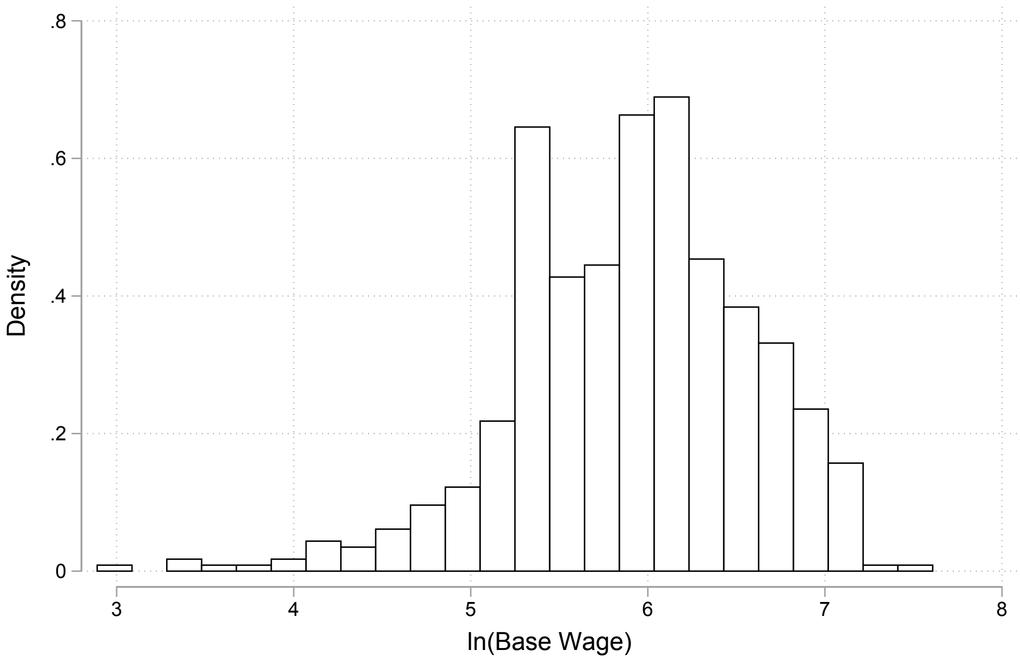


FIGURE 2: Base Wage density histogram



€433,930 per year, with a maximum of €2,016,000. The bonus has a mean of approximately €298,000 with a maximum of €4,166,000. The third, and final, compensation variable denotes the total yearly compensation. Over the period from 2001 up to 2016, a CEO of a Dutch firm had an average total compensation of €1,260,917, with a maximum of €11,301,000. Base wage, bonus and total compensation have 600, 543 and 482 observations respectively. Following from these numbers of observations, in combination with the earlier mentioned total number of observations of 637, it is evident that the the three compensation variables have missing values. The fact that these three variables have missing observations, will inevitably lead into a reduction of the number of used observations in the regression analysis.
The composition of the three compensation variables differs from the exact theoretical definition. The theoretical model claims that the total compensation consists of two components, the bonus and the base wage. This has the implication that the bonus and base wage would add up to the total compensation. However, in real life this is not necessarily the case. The total compensation variable in our data has more components than just the earlier mentioned bonus and base wage (this can also be concluded from figure 4). We assume that the main gap can be found at the side of the bonus. In our case, the bonus is defined as the cash bonus, however there exist other types of bonuses as well, which are quite common for CEOs. One example of another type of a bonus could be stocks, or stock options. Even though we have information on these types of compensation, we do not consider them since we do not have the necessary data considering the valuation of the specific stocks and bonds.
The observant reader might ask the question why there are 637 instead of $16 * 127 = 2,032$ distinct observations. The reason for this is that the companies in our dataset, generally are not present for the whole period between 2001 and 2016. Over the whole sample period, there are on average 5.02 observations per company. This means that the average firm gives information for slightly more than 5 years.

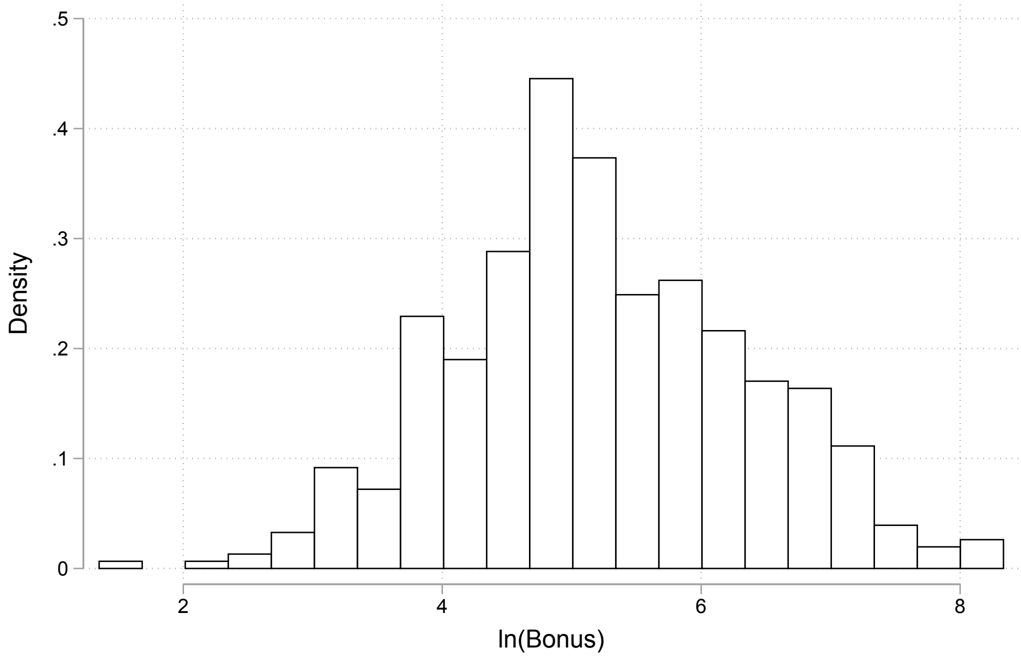
Figure 1 gives a density histogram of the natural logarithm of the total compensation. From now on, we choose to transform our three compensation variables into the logarithmic scale in order to reduce the skewness in the distribution. Testing for normality of the logarithm of total compensation with a skewness test, and the Kurtosis test gives a joint P-value of 0.1183. This does not allow us to reject a normal distribution for this variable.
The density histogram of the base wage can be found in figure 2. This histogram shows a slightly different distribution compared to the one shown in figure 1. Similar tests for a normal distribution show that the logarithm of the base wage is significantly not normally distributed at the 1% level. The Skewness test shows that it is highly skewed. Combining these results with the histogram in figure 2, we conclude that this histogram shows a left-skewed distribution.
Figure 3 shows the distribution of the logarithm of the bonus. At the first glance, this figure hints at a normal distribution for this variable. Testing for normality by using a skewness test, and the Kurtosis test (overall P-value of 0.8157), let us conclude that the logarithm of bonus follows a normal distribution.
The returns on assets of the Dutch firms range from minus 435% up to a positive of 367% on a yearly basis, with a mean of 4.9%. Associated with the returns on the indices of the Dow Jones and the Nasdaq, the data shows that they range from minus 34% up to a positive of 26%, and from minus 41% up to a positive of 50% respectively. This results in a mean return on investment for the Dow Jones index of 7.5%, and a mean return on investment for the Nasdaq index of 11.7%. The return on investment for the AEX has a mean of 4.99%, with the minimum and maximum of -51.63% and 35.34% respectively.

TABLE 2: Correlation matrix

	Base Wage	Bonus	Total Compensation	ROA	EBIT	EBITDA	Employees	ROI Dow Jones	ROI Dow Jones$_{t-1}$	ROI Nasdaq	ROI Nasdaq$_{t-1}$	ROI AEX	ROI AEX$_{t-1}$	Age
Base Wage	1.00													
Bonus	0.69***	1.00												
Total Compensation	0.79***	0.85***	1.00											
ROA	0.09*	0.15***	0.15***	1.00										
EBIT	0.56***	0.67***	0.67***	0.17***	1.00									
EBITDA	0.57***	0.69***	0.70***	0.14***	0.96***	1.00								
Employees	0.40***	0.38***	0.39***	0.07	0.43***	0.43***	1.00							
ROI Dow Jones	0.08*	0.03	0.07	0.10**	0.05	0.04	0.02	1.00						
ROI Dow Jones$_{t-1}$	0.05	0.04	0.05	0.10**	0.05	0.03	0.01	-0.23***	1.00					
ROI Nasdaq	0.04	0.00	0.04	0.09**	0.04	0.03	0.01	0.89***	-0.30***	1.00				
ROI Nasdaq$_{t-1}$	0.06	0.05	0.05	0.11**	0.05	0.04	0.02	-0.14***	0.93***	-0.24***	1.00			
ROI AEX	0.04	0.02	0.05	0.10**	0.04	0.03	0.03	0.80***	-0.36***	0.83***	-0.28***	1.00		
ROI AEX$_{t-1}$	0.04	0.06	0.04	0.13***	0.05	0.04	0.02	-0.07	0.80***	-0.28***	0.86***	-0.28***	1.00	
Age	0.21***	0.09**	0.22***	-0.03	0.09**	0.08**	0.07*	0.07*	0.06	0.03	0.06	0.03	0.04	1.00

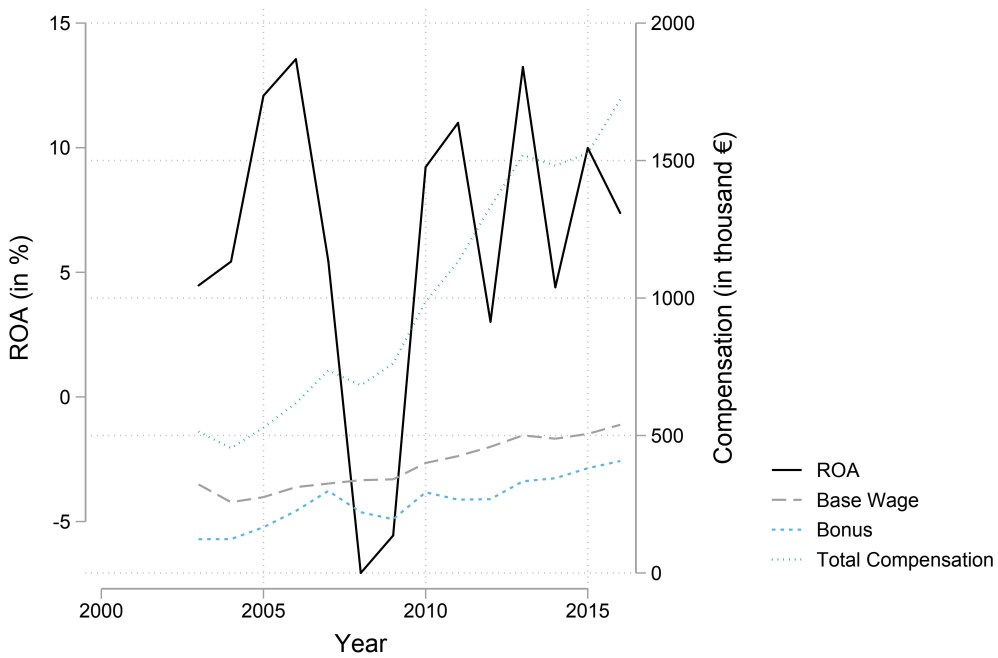
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

FIGURE 3: Bonus density histogram



The age of the CEOs ranged from 34 up to 72 years old (with a mean of slightly less than 52). This confirms the idea that CEOs in general are experienced employees. Table 2 gives the correlation coefficients of the same variables as mentioned in table 1. This correlation matrix shows that there is a positive significant correlation between the return on assets of the firms with all three compensation variables. This is an indication that there is a positive relationship between the performance and the compensation. This is supported by the fact that there is a strong positive correlation between the other performance measures (being EBIT and EBITDA) and the compensations. The correlation of the return on investment for the Dow Jones and the Nasdaq with the return on assets have a value of around 0.10 (for both the initial, as well as the one year-lagged value of the instruments). These coefficients are all significant at the 5% level, indicating that these are relevant instruments for our performance measure. However, since the return on investments for the Nasdaq and Dow Jones do not show high correlation coefficients, we need to conclude that these are not very strong instruments. Taking this together, we are still convinced of the value of these indices as instruments. The correlation between the instruments and the compensation are notably small. This indicates that there is a small, or no relationship, between the wages and bonuses paid to the CEOs and the return on investment for the Dow Jones and the Nasdaq. As an addition, the return on investment for the AEX could potentially be useful as an instrument as well. We see that both the current return as well as the lagged return of the AEX is significantly correlated with the return on assets of the Dutch firms. In addition to this, the only other variables with which it is significantly correlated belong to the return on investment for the other two indices. Taking this all together suggests that both the current value of the return for the AEX, as well as the lagged value, are relevant and valid instruments. Taking all this together, we are determined to find evidence for

FIGURE 4: Performance-compensation time-series

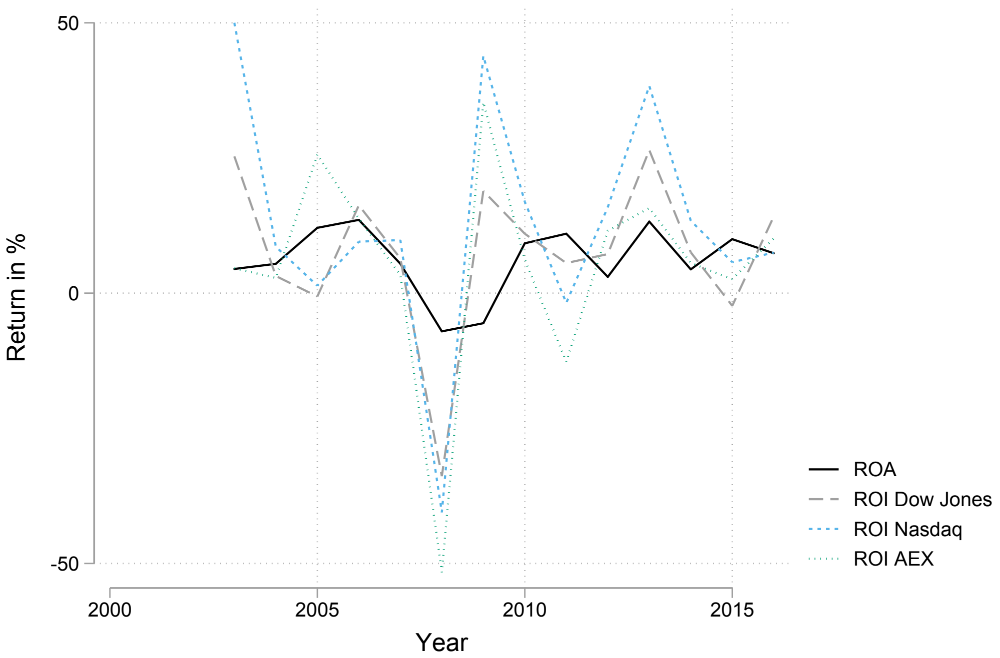


our hypotheses using this dataset.[7]
In order to differentiate between the relevance for either the Dow Jones or the Nasdaq index for specific firms, we generate an extra (dummy)variable which indicates whether a firm is relatively technology focused. Since the Nasdaq index consists of mainly of the technological sector, we argue that this index is more closely related to the performance of technology firms in the Netherlands, as compared to the Dow Jones index. The same reasoning holds for the non-technology firms. We argue that these firms are more closely linked with the Dow Jones index, rather than the Nasdaq index.
After this distinction between technology, and non-technology firms the data show that out of the 127 firms in the dataset, there are 68 firms focused on the technology sector. This is only slightly more than half the total amount of firms. We made this distinction based on the Standard Industrial Classification (SIC).
Figure 4 shows a time-series graph for the three compensation variables we focus on, and for the return on assets. This figure shows the changes in the averages of the variables over the period 2003-2016.[8] It is evident that the return on assets fluctuates greatly over the time-period, with it's absolute low during the economic crisis starting in 2008. Apart from the two years 2008 and 2009, all other years showed a positive average return on assets. What is interesting in this figure however, is the small resemblance between the return on assets on the one hand, and the bonus and total compensation on the other hand. Without stepping too much into detail, one can see that, on average, a good year as denoted by the return on assets is associated

[7]Apart from the most interesting variables, there is one more notable correlation, which is the correlation between age and return on assets. This suggests a negative relationship between age and this specific performance measure.
[8]We chose to exclude the first two years since it had only a small number of observations, which made it easily influenced by outliers.

with a growth in the bonus and total compensation. When comparing these good years with the years with worse performance, we can also see that during those bad years employers are more hesitant to assign high bonuses and high levels of total compensation.
Figure 5 compares the return on investments of the Nasdaq index, the return on investment of the Dow Jones index, the return on investment of the AEX and the average return on assets of the firms over the period from 2003 to 2016. This makes clear, when the three indices are compared separately with the average return on assets, that they show a comparable pattern. This is an indication for a potential relationship between the return on assets and the two indices. Secondly, the three indices themselves show a nearly identical pattern in the sense that they face growths and declines at the same periods.

FIGURE 5: Return time-series



Chapter 4

Methodology

Regarding the theoretical background, the same agency model is used in this research as was used by Bertrand and Mullainathan (2001). In the field of research of this present paper, the principal is the risk-neutral shareholder while the agent is the risk-averse CEO. Equation (1) shows that the optimal incentive scheme depends on two elements, namely the performance and the observable random factors. Since the latter cannot be influenced by the agent, this raises the question why it would be optimal to contract upon this factor. From the proposed model follows that putting an incentive on o does not have the desired effect. Secondly, including the observable random factor in the contract results in extra variance in wage paid to the agent. Since we made the assumption that the agent is risk-averse (and the principal is risk neutral), the principal needs to pay extra to compensate for the risk that is now put on the shoulders of the agent.

This observable random factor is exactly the component we are interested in. This variable can be interpreted as the 'observable luck' variable.[9]

Regarding the empirical methodology, the following equation will be used to estimate the relationship between the wage of the CEO and firm's performance:

$$y_{it} = \beta_0 + \beta_1 * perf_{it} + \gamma_i + \chi_t + \beta_x * \mathbf{X}_{it} + \epsilon_{it} \tag{2}$$

In equation (2), y_{it} stands for the compensation for the CEO, $perf_{it}$ stands for firm performance, γ_i stands for firm-fixed effects, χ_t stands for time-fixed effects, and $\mathbf{X}_{it}$ is a collection of control variables. β_1 indicates the relationship between the firm's performance and CEO compensation.

The main analysis focuses on the use of return on assets as a performance measure of the firms. Using this measure partly takes care of the variance across firms, namely the size of the firms. The return on assets takes care of the differences in size because it is a measure of performance which compares the net profit with the total assets of the firm. One could argue that large firms, with a lot of assets, tend to have higher profits. By comparing these assets to the profit, the size of the firm would be less of a problem. As a matter of robustness check, two other performance measures are used as well. These performance measures are the EBIT and the EBITDA.[10]

With respect to the dependent variable, i.e. CEO compensation, we focus on three different measures. These measures are: the salary, the bonus, and the reported total executive compensation. By using these different outcome measures, we can test whether a higher (or lower) compensation originates from the base wage or from the bonus. The total compensation measure simply gives an indication whether the CEO's performance has a relation with his total compensation. Regarding the implementation of these performance measures, we use the logarithmic scale for the

[9] To prevent later confusion, we iterate that this can be either good or bad luck.

[10] The results of these robustness checks can be found in the appendix.

compensation variables.
y_{it} is estimated using (2) to give the general relationship between the CEO's wage and the firm's performance with the OLS method. However, this paper is not focused on this relationship. To estimate the relationship between luck and the CEO's wage, an observable luck variable needs to be isolated. This relationship is estimated using a TSLS model. In the first stage of this model, firm's performance is used as the dependent variable, and the observable luck variable is the independent variable.[11]
In theory, the TSLS model looks as follows:

$$\widehat{perf}_{it} = b * o_t + g_i + c_t + a_x * \mathbf{X}_{it} + e_{it} \tag{3}$$

$$y_{it} = \beta_{Luck} * \widehat{perf}_{it} + \gamma_i + \chi_t + \alpha_x * \mathbf{X}_{it} + \epsilon_{it} \tag{4}$$

In equation (4), β_{Luck} denotes the effect of luck on CEO compensation. Theory and prior empirical findings contradict each other regarding the expected result. Theory predicts β_{Luck} to be equal to zero, and prior findings predict it to be positive. Since we already stated that we expect the prior findings to be closer to reality, we have hypothesised β_{Luck} to be positive.
The specified TSLS model presents only one instrument, which gives variation over time, but it does not include cross-sectional variation. In order to include cross-sectional variation, we build a TSLS model which uses two distinct instruments. The two relevant instruments in this analyses are return for the Nasdaq index and the return on the Dow Jones index. The returns on the indices are used instead of the actual indices themselves to allow for some comparability between instruments and the performance measure. Since the performance measure is a flow variable over a period of one year, we choose to make flow variables over the same period out of the indices (which translates into the return on investment of these indices). Since the Nasdaq index is especially related to technology focused firms, we argue that the return on the Nasdaq index should be more relevant for the technology firms in the Netherlands, compared to the return on the Dow Jones index. This means that we differentiate between two types of firms: we focus on technology-focused firms, and on non-technology focused firms. This results in a final, and conclusive TSLS model of the analysis.

$$\widehat{perf}_{its} = b_1 * o_{Nasdaq,t-1} * d_{Tech.} + b_2 * o_{Dow,t-1} * (1 - d_{Tech.}) + g_i + c_t + a_x * \mathbf{X}_{it} + e_{it} \tag{Stage 1}$$

$$y_{its} = \beta_{Luck} * \widehat{perf}_{its} + \gamma_i + \chi_t + \alpha_x * \mathbf{X}_{it} + \epsilon_{it} \tag{Stage 2}$$

In (Stage 1), the predicted value of firm performance is estimated. This variable is accompanied by three indicators. Subscript i is an indicator for the specific firm, subscript t is a time indicator for the specific fiscal year, and subscript s indicates whether the firm is closely related to the technology sector. In (Stage 1), we included a dummy which indicates whether a firm is related to the technology sector. This results in two different coefficients of interest in the first stage: one for the technology-focused firms and one for the non technology-focused firms.[12]
This first stage translates into the predicted firm performance according to the observable random factors. This predicted performance will be used in (Stage 2) to

[11]Thus, observable luck is an instrument for firm's performance.
[12]b_1 gives the relationship for technology focused firms between the return on investment for the Nasdaq and the firm's performance, and b_2 gives the relationship for the non-technology focused firms between the return on investment for the Dow Jones and the firm's performance.

estimate the CEO compensation. In (Stage 2), the variable of interest is β_{Luck}. This coefficient denotes the relationship between observable luck and the CEO compensation. As mentioned earlier, relating this to our hypotheses, we expect: $\beta_{Luck} > 0$. The TSLS model gives the effect of performance due to luck and CEO compensation. This is the case since the value of performance used in (Stage 2), is predicted by observable external factors.
To relate said TSLS model with the theoretical model presented in chapter 2, it is important to take equation (1) in mind. The second component of the optimal contract denotes the bonus structure. As a recap, this was $\beta(p - \delta o)$. As the theory predicted, the firm should be able to filter out the observable noise factor. This would mean that $\delta = 1$. This specific case indicates that all observable external factors are irrelevant for the compensation of the CEO. Translating this to our TSLS model, the coefficient of interest, β_{Luck}, which gives the relation between observable luck and compensation should be equal to zero. The empirical side of the explanation, as supported by Bertrand and Mullainathan (2001), states that the companies fail to filter out all the observable luck. This has the implication that $0 > \delta > 1$. Given this range of values for δ, it is evident that part of the observable external factors should be relevant for the compensation. Linking this with the TSLS model, $\beta_{Luck} > 0$. These numbers suggest that there should be a positive relationship between performance caused by observable luck and compensation.

Chapter 5

Results

The empirical analysis is subdivided in three parts, following the earlier stated hypotheses. The results considering hypothesis 1, which predicts a positive relationship between total compensation and observable luck, are presented in table 3. This table shows the results for the regressions in which the logarithm of total compensation is the dependent variable, and the rate of return on assets is the variable of interest. Both the lagged values of the Dow Jones, as well as the Nasdaq rate of return, are used as instruments in line with Stage 1 in Chapter 4. Throughout the Results section of this paper, Stage 1 and Stage 2 are used as the backbone for analysis unless stated otherwise. This means that we use interaction terms between the Nasdaq, and the dummy for being a technology focused firm; and the Dow Jones, and not being a technology focused firm respectively rather than using the simple Nasdaq and Dow Jones variables. By doing this, we allow for both cross-sectional, as well as variation over time to be present in our model.
Table 3 gives the results of two types of regressions. The results in table 3 are built up from simple models in the first two columns, with only the performance measure as a predictor, to more complex models in later columns with more controls such as firm and time-fixed effects and age. By presenting the results in such a manner, we are able to compare the results of the OLS regression with the next TSLS results. Doing this results in the conclusion that all the coefficients estimated with the IV approach are larger compared to the OLS coefficients. This suggests that mere observable luck has a larger effect on total compensation than general performance.
In the first, third, fifth, and seventh column, the coefficient of general OLS regressions are shown. These columns give the general relationship between performance, as measured by the rate of return on assets and total compensation. The coefficients of interest in these columns are all positive indicating a positive relationship. Which is in line with findings in prior empirical literature. These coefficients range from 0.0015 up to 0.0023. This suggests an increase in performance of one percentage point results in an increase of total compensation between approximately 0.15% and 0.23%. Taking this together with the fact that all these coefficients are significant at the 1% level results in the conclusion that performance and compensation are positively related.
With respect to hypothesis 1, the coefficients of the TSLS models are more interesting. These coefficients can be found in columns 2, 4, 6, and 8 op table 3. Taking a look at Stage 1 unravels that coefficients of the instruments are all positive. However, only the return on investment for the Nasdaq index shows two significant coefficients (at the 10% level). Going further, all four TSLS models give a positive coefficient in Stage 2 for the performance measure and the logarithm of total compensation. Two of these coefficients are significant as well at the 5% level. All the IV estimated coefficients of interest have a value of around 0.015, which suggests that an increase of the return on assets of one percentage point due to observable luck, is associated

TABLE 3: Total compensation for observable luck

	Dependent variable: ln (Total Compensation)								
		General	Luck	General	Luck	General	Luck	General	Luck
	Constant	6.62***	6.50***	6.70***	6.54***	7.01***	6.51***	-0.14	1.97
		(0.11)	(0.13)	(0.005)	(0.09)	(0.063)	(0.22)	(3.60)	(3.97)
	ROA	0.0023***	0.018**	0.0023***	0.018**	0.0016***	0.015	0.0015***	0.014
		(0.00044)	(0.0088)	(0.00045)	(0.009)	(0.00049)	(0.012)	(0.00049)	(0.011)
Stage 2	Age							0.27**	0.19
								(0.13)	(0.14)
	Age^2							-0.0025*	-0.0019
								(0.0013)	(0.0013)
	Constant		5.30		7.66***		12.74***		-165.38
			(8.34)		(1.16)		(3.40)		(171.59)
	ROI Dow Jones		0.156		0.154		0.297		0.295
			(0.101)		(0.121)		(0.629)		(0.666)
Stage 1	ROI Nasdaq		0.258*		0.259*		0.353		0.362
			(0.152)		(0.145)		(0.383)		(0.403)
	Age								5.80
									(6.12)
	Age^2								-0.047
									(0.055)
	Time FE					Yes	Yes	Yes	Yes
	Firm FE			Yes	Yes	Yes	Yes	Yes	Yes
	N	333	333	333	333	333	333	320	320
	adj. R^2			-0.255		0.288		0.315	
	R^2 Within	0.0473	0.0473	0.0473		0.4873		0.5148	
	R^2 Between	0.0105	0.0105	0.0105	0.0105	0.1253	0.0709	0.1938	0.1051
	R^2 Overall	0.0148	0.0148	0.0148	0.0148	0.1089	0.0533	0.1585	0.0681
	F	27.14	4.20	25.73	5,227.66	19.94	121,809.90		16,584.44

Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

with an increase in total compensation of approximately 1.51%.
As a matter of robustness checks, similar regressions are constructed with the logarithm of EBIT and EBITDA as performance measures. The results of these regressions are summarized in Appendix A in tables 7 and 8 respectively. To begin with the results for the EBIT regressions in table 7, they seem to somewhat contradict the previous conclusion. The two models with both time-fixed effects, as well as firm-fixed effects, show negative coefficients for performance due to observable luck. Nevertheless, these negative coefficients are contradicted by positive coefficients for the remaining models and a high level of insignificance. From all the TSLS models presented in table 7, three coefficients jump out (of which two are the negative coefficients) in the sense that the standard errors are at least twice as large as the actual coefficient. Even though the goodness of fit of these three models is quite adequate according to the overall R^2, the fact that the coefficients are highly insignificant casts some doubt on the validity of these results. Secondly, the TSLS model with crisis as a control variable has a remarkably low F-statistic. This weakens the indication of the acceptable level of the overall R^2 that this model fits the data well. Therefore, we consider the other two TSLS models, with a fairly high value of the overall R^2 as well, as leading.[13]
The regressions with the logarithm of EBITDA as the performance measure in table

[13] We are aware of the low value of the F-statistic of these models

8 provide similar results. Just like the EBIT regressions, the table shows two negative coefficients for performance caused by observable luck. The standard error of these two negative coefficients again is at least twice as large as the coefficients themselves, which results in insignificance of these results. The remaining models all have a positive sign. As an addition to that, two of the coefficients are even significant at the 10% and the 5% level. These significant results have values of 0.91 and 0.88.[14] This suggests that an increase of 1% in the EBITDA due to observable luck, results in an increase between 0.88% and 0.91% in total compensation.
The results of the final robustness check with the Dutch AEX index as the instrument (table 9 are in line with the previous results. All the coefficients of interest in the TSLS models are positive, and two of them are significant at the 5% level.
Taking all the evidence together, we gathered some significant results for the relationship between observable luck and compensation. These significant results allow us to accept our hypothesis that observable luck has a positive impact on total compensation. This result is completely in line with the findings of Bertrand and Mullainathan (2001).

TABLE 4: Base wage for observable luck after one year

Dependent variable: ln (Base Wage)

		General	Luck	General	Luck	General	Luck	General	Luck	General	Luck
Stage 2	Constant	5.99***	5.91***	5.98***	5.90***	5.57***	5.48***	4.04***	5.81**	6.00***	5.90***
		(0.068)	(0.091)	(0.009)	(0.062)	(0.020)	(0.128)	(1.49)	(2.79)	(0.068)	(0.096)
	ROA_{t-1}	0.001*	0.011	0.001	0.011	0.001	0.009	0.001	0.010	0.001*	0.013*
		(0.0008)	(0.007)	(0.0009)	(0.007)	(0.0009)	(0.010)	(0.0009)	(0.010)	(0.0008)	(0.007)
	Age							0	-0.040		
								(.)	(0.104)		
	Age^2							0.0008	0.0008		
								(0.0008)	(0.001)		
	Crisis									-0.174***	-0.161***
										(0.034)	(0.048)
Stage 1	Constant		7.04		7.72***		16.43***		1.10		7.08
			(11.00)		(0.517)		(3.14)		(83.32)		(4.82)
	ROI Dow Jones		0.137		0.137		0.688		0.714		0.144
			(0.088)		(0.104)		(0.466)		(0.471)		(0.148)
	ROI Nasdaq		0.111*		0.110**		0.451		0.473		0.111
			(0.065)		(0.051)		(0.303)		(0.308)		(0.075)
	Age								0		
									(.)		
	Age^2								0.008		
									(0.045)		
	Crisis										-1.82
											(4.19)
	Time FE					Yes	Yes	Yes	Yes		
	Firm FE			Yes	Yes	Yes	Yes	Yes	Yes		
	N	324	324	324	324	324	324	313	313	324	324
	adj. R^2			-0.240		0.207		0.210			
	R^2 Within	0.0212	0.0212	0.0212		0.4058		0.4129		0.0762	0.0338
	R^2 Between	0.0029	0.0029	0.0029	0.0029	0.1121	0.0459	0.0107	0.0256	0.0308	0.0048
	R^2 Overall	0.0129	0.0129	0.0129	0.0129	0.1350	0.0720	0.0306	0.0628	0.0316	0.0167
	F	2.93	2.48	2.73	9,147.27	$4.31*10^{11}$	2,496.61		37.83	19.87	30.64

Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

As an addition to these findings, hypothesis 2 predicts a positive relationship between performance and the base wage in later periods due to observable luck. To give a conclusive answer regarding this hypothesis, the analysis is executed in two

[14] We are aware of the low value of the F-statistic, but this is at least an indication of a positive relation

stages. The results of the first stage are found in table 4. For this table, we made the assumption that a superior performance due to observable luck in this period results in a higher base wage one period ahead. Good performance due to observable luck in the current year results in a higher base wage in the subsequent year. This is in fact a prediction that the variable of interest in table 4 is positive. Not considering the timing of the performance measure as just described, the models in general are comparable to the ones found in table 3. As an addition, we include a model with an indicator for the two years 2008 and 2009. We chose to include such a variable, because figures 4 and 5 show that those two years are very specific regarding the return on assets, the return on investment for the two indices, and the compensation variables. These anomalies can be explained by the start of the economic crisis, therefore the name 'crisis'. Using this crisis variable restricts the use of time-fixed effects. Just like the analysis of hypothesis 1, we use the logarithm of the compensation variable in this analysis. Table 4 shows negative and significant re-

TABLE 5: Base wage for observable luck after two year

Dependent variable: ln (Base Wage)

		General	Luck	General	Luck	General	Luck	General	Luck	General	Luck
	Constant	5.97***	5.90***	6.00***	5.93***	5.60***	5.54***	3.99**	5.79**	6.02***	5.93***
		(0.076)	(0.085)	(0.004)	(0.046)	(0.015)	(0.064)	(1.57)	(2.38)	(0.066)	(0.118)
	ROA_{t-2}	0.0005	0.010*	0.0004	0.009*	0.0003	0.005	0.0003	0.005	0.001*	0.017
		(0.0004)	(0.005)	(0.0004)	(0.005)	(0.0004)	(0.005)	(0.0004)	(0.005)	(0.0006)	(0.018)
	Age							0	-0.041		
Stage 2								(.)	(0.089)		
	Age^2							0.0008	0.0008		
								(0.0008)	(0.0008)		
	Crisis									-0.189***	-0.295***
										(0.046)	(0.090)
	Constant		5.47		7.36***		18.23***		9.87		4.70
			(10.61)		(0.572)		(3.60)		(88.09)		(4.63)
	ROI Dow Jones		0.168*		0.166		0.934*		0.972*		-0.011
			(0.097)		(0.125)		(0.532)		(0.540)		(0.154)
	ROI Nasdaq		0.123*		0.121**		0.616*		0.646*		0.090
Stage 1			(0.070)		(0.055)		(0.339)		(0.347)		(0.077)
	Age								0		
									(.)		
	Age^2								0.004		
									(0.045)		
	Crisis										6.23
											(4.32)
	Time FE					Yes	Yes	Yes	Yes		
	Firm FE			Yes	Yes	Yes	Yes	Yes	Yes		
	N	257	257	257	257	257	257	248	248	317	317
	adj. R^2			-0.259		0.347		0.355			
	R^2 Within	0.0018	0.0018	0.0018		0.5127	0.2562	0.5223	0.2199	0.0709	0.0190
	R^2 Between	0.0260	0.0260	0.0260	0.0260	0.1096	0.1300	0.0417	0.1055	0.0955	0.0298
	R^2 Overall	0.0110	0.0110	0.0110	0.0110	0.1220	0.1075	0.0331	0.0858	0.0364	0.0206
	F	1.20	3.33	0.69	16,843.81		3,115.54		50.43	20.73	14.31

Robust standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

sults for the two crisis years, as expected. Just like the previous table, table 4 shows the results of the general OLS regressions in the odd columns. These columns all show a positive sign for the performance measure. This indicates a positive relationship between performance in one year, and base wage during the subsequent year. This is strengthened by the fact that two of these coefficients are significant at the 10% level. The coefficients of interest in the general models have a value of

approximately 0.001. This means that an improvement in performance of one percentage point in this year results in an increase in the base wage during next year of approximately 0.1%. Comparing this with the IV estimates, results in the conclusion that these coefficients are positive as well. Furthermore, the IV-coefficients are larger than the OLS-coefficients. This indicates that observable luck has a larger effect on base wage than general performance. The observable luck coefficients have a value of around 0.01. This means that a performance increase of one percentage point during this year due to observable luck results in an increase of base wage next year of around 1%. However, we need to be careful to conclude that this relationship is causal. Only one of the observable luck coefficients is significant at the 10% level. This means that we only have a weak indication of a positive relationship.
The first stage in the model shown in table 4 shows that the returns on investment for the two indices have a positive coefficient. This hints at a positive relationship between the returns on these indices and performance. This is completely in line with the expectation. Nevertheless, out of all the coefficients for the return on investment for the Dow Jones and the Nasdaq, only the Nasdaq shows two significant coefficients at the 10% and 5% level
The analysis regarding the one-year lagged performance is continued by using the logarithms of EBIT and EBITDA as the performance measure. The results for these regressions can be found in tables 10 and 11 respectively of Appendix B. Table 10 shows positive coefficients for the general relationship between performance as measured as the logarithm of EBIT one year earlier, and the logarithm of the base wage. Two of these coefficients are significant (at the 1% level). This, combined with the acceptable levels of goodness of fit of the models as concluded based on the overall R^2 and the F-statistic, leads to the conclusion that the positive relationship really exists. The table shows as well that crisis has a negative significant effect on the base wage. In Stage 1 of the model, crisis shows a negative coefficient as well, indicating a negative effect of the crisis on performance. Furthermore, the table suggests that there is a positive relationship between the return on investments of the Dow Jones and the Nasdaq and firm performance. Taking a closer look teaches that the size of the coefficients is larger for the return on investment of the Dow Jones compared to the Nasdaq. This indicates that there is a stronger relationship between the performance of Dutch firms and the Dow Jones, compared to the Dutch firms and the Nasdaq. On the other hand, the return on investment for the Nasdaq shows more significant results than the return on investment for the Dow Jones. The robustness checks for the conclusion based on table 4 deliver positive coefficients. Two of the coefficients are significant at the 10% level. The two significant results are delivered by the simple TSLS model (thus without controls) and the TSLS model with the indicator for the crisis years as a control variable. These models show a coefficient of approximately 0.25. This indicates that a performance improvement of 1% during the previous year due to observable luck results in an increase in the base wage of 0.25%. The comparable columns with the general estimates show coefficients of around 0.11, thus an improvement of general performance last year results in an increase in the base wage of 0.11%. It is evident that this model shows that observable luck has a larger impact on next year's base wage than general performance has. The robustness check in table 11 with the logarithm of EBITDA shows comparable results. Again, the simple TSLS and the TSLS model with crisis as a control, deliver significant results, and again the magnitude of these results is higher than the magnitude of the coefficients of the associated OLS models. Taking all this together, we confirm our hypothesis that last year's performance due to observable luck has a positive impact on this year's base wage of the CEOs of Dutch firms.

To continue the investigation of the relationship between base wage and observable luck, the one-year lagged variable of return on assets is replaced by the two-year lagged variable of this performance measure. The results of this new model are shown in table 5. In line with the findings in table 4, table 5 shows positive coefficients for the performance measure (being the two-year lagged return on assets) in the general OLS models. However, only one of those coefficients is significant at the 10% level. So, we only have weak evidence for a positive relationship between general performance now, and the base wage two years later. The one significant result has a value of 0.001, which suggests that a general performance increase of one percentage point this year would result in a base wage increase of approximately 0.1% two years ahead. Looking further into the columns with the IV-estimates, we see that all the estimates are positive. The simple TSLS model and the model with firm fixed-effects are the only models with significant coefficients (at the 10% level). This results in a similar conclusion as given for the one-year lagged models delivered by table 4. The tables give some evidence for a positive relationship, but we need to be careful to consider it being causal. In the first stage in table 5, there is one interesting coefficient since it's value deviates from what can be expected. The return on investment for the Dow Jones in the model with the crisis variable shows a negative (but insignificant) coefficient. This is strange in the sense that a positive relationship between this index and firm performance is more likely to occur. But since it is heavily insignificant, this point will no longer be elaborated upon.
The last robustness check regarding the relation between observable luck and base wage relates to the usage of the return on the AEX index. These results are shown in table 14 and 15. These table do not show any positive significant results. However, table 15 shows one negative significant result (at the 10% level). This makes that we need to be careful with thinking about a positive relationship between the two year lagged performance due to observable luck and base wage. The secondary analysis for the two-year lagged performance is executed with the lagged terms of the logarithms of EBIT and EBITDA in the tables 12 and 13. Table 12 shows two insignificant negative results for the general relationship between the two year lagged logarithm of EBIT and the logarithm of base wage. These negative coefficients are contradicted by three positive coefficients, of which two are significant at the 1% level. The two significant results originate from the simple OLS model without controls, and the model with the crisis variable. The two coefficients have a comparable magnitude of approximately 0.125 which indicates that an increase of EBIT of 1% two years ago, results in an increase of base wage of approximately 0.125%. Stage 1 in table 12 shows that all the coefficients of the return on investments of the two indices are positive, with some of them being significant at either the 10% or the 5% level. The return on investment of the Dow Jones index, shows a higher coefficient as compared to the return on investment of the Nasdaq index. Crisis gives significant negative results in Stage 2. Regarding the coefficients of interest in the TSLS models, all the coefficients are positive which is in line with our prior finding for the one-year lagged performance measure, and our hypothesis. Just like the one-year lagged models, the simple model as well as the model with crisis as a control delivers coefficients which are significant at the 1% level. The TSLS model with firm fixed-effects shows a significant coefficient this time as well (at the 10% level). The three significant results range from 0.240 up to 0.284. This indicates, that an improvement of the EBIT of 1% due to observable luck, is associated with an increase in the base wage between 0.24%, and 0.284%, which is considerably more than the 0.125% increase due to a general improvement of the EBIT. The conclusions drawn from table 13 are comparable. All the TSLS models have a positive sign regarding the relationship between

the two-year lagged logarithm of the EBITDA and the base wage. Three of those coefficients are significant at either the 1% or the 5% level. The coefficients of the TSLS models in this table relate in a similar manner to the coefficients of the OLS models as compared to those in table 12. Table 13 suggests that the relationship between performance due to observable luck and base wage two years later is considerably larger than the general relationship between performance and base wage two years later.

Looking back, table 4 and 5 together delivered only two significant results (at the 10% level) for the IV-estimates. However, all the robustness checks with the logarithms of the EBIT and EBITDA did deliver multiple significant results, for both the one-year lagged performance as well as the two-year lagged performance. These results allow for the rejection of the null-hypothesis that there is no relationship between performance due to observable luck and base wage in later periods.[15]

The empirical analysis is finalized by tests for hypothesis 3. If hypothesis 3 is true, there should be a positive relationship between current firm performance due to observable luck, and the bonus received by the CEO during that same year. The regressions presented in table 6 use the logarithm of the bonus received as the dependent variable. This table again shows negative coefficients for the crisis variable (with the OLS estimate being significant at the 1% significance level). Looking further, the OLS models give positive and significant results for the coefficients for the performance measure. This is in line with the findings in prior literature that performance has a positive effect on bonus. The coefficients all have a value of around 0.003, which means that a performance improvement of one percentage point results in an increase in the bonus of around 0.3%. The IV-estimates, however, give three positive coefficients (of which two are significant at the 5% and 10% level), and two negative (insignificant) results. Strictly taken, the significant coefficients allow for the rejection of the null-hypothesis that there is no positive relationship between observable luck and the bonus. According to the two significant result, a one percentage point increase in performance due to observable luck results in an increase in the bonus between 2.63% and 3.36%.[16] Due to the two insignificant results, we are, however, hesitant to reject the null-hypothesis.

To test whether the positive results are in fact valid, robustness checks are executed similar to the previous robustness checks. Tables 16 and 17 give the results for the regressions with the logarithms of the EBIT and EBITDA as performance measures. Table 16 delivers solely positive coefficients for the performance measure in the TSLS models. However, some strange results have been found. The two models with time fixed-effects show coefficients of considerable magnitude (though highly insignificant). These two coefficients suggest that a performance increase of 1% due to observable luck, as measured by the EBIT, results in an increase of the bonus of approximately 16%. Since the standard errors associated with these coefficients are at least eight times larger than the coefficientes themselves, we assume that these results are invalid. The models without time-fixed effects show positive coefficients as well, but here the coefficients are of a more reasonable magnitude. Two of these TSLS models show significant results of 0.674 and 0.607. These results indicate that an increase of 1% in the EBIT due to observable luck results in an increase in the bonus of 0.674% and 0.607% respectively. The OLS estimates of the same models show significant positive results as well (at the 1% level), of which the magnitude is slightly more than half the magnitude of the TSLS coefficients. This can be seen as

[15]The results remain similar after controlling for current period's performance

[16]The other positive coefficient predicts an increase of bonus of 1.61%

TABLE 6: Bonus for observable luck

Dependent variable: ln (Bonus)

		General	Luck	General	Luck	General	Luck	General	Luck	General	Luck
	Constant	5.21***	5.11***	5.23***	4.94***	4.52***	4.65***	-0.13	-4.64	5.23***	5.18***
		(0.114)	(0.193)	(0.015)	(0.156)	(0.299)	(0.406)	(5.39)	(6.54)	(0.113)	(0.163)
	ROA	0.003***	0.026*	0.004**	0.033**	0.003*	-0.029	0.003*	-0.029	0.003***	0.016
		(0.001)	(0.014)	(0.001)	(0.016)	(0.002)	(0.025)	(0.002)	(0.025)	(0.001)	(0.017)
	Age							0.170	0.331		
Stage 2								(0.205)	(0.244)		
	Age^2							-0.001	-0.003		
								(0.002)	(0.002)		
	Crisis									-0.323***	-0.216
										(0.125)	(0.182)
	Constant		2.46		8.43***		13.68**		-118.3		2.48
			(5.67)		(0.502)		(5.42)		(135.3)		(6.51)
	ROI Dow Jones		0.221**		0.192		0.846*		0.844*		0.170
			(0.106)		(0.126)		(0.489)		(0.505)		(0.116)
	ROI Nasdaq		0.162		0.110**		0.537		0.540		0.113
Stage 1			(0.100)		(0.044)		(0.323)		(0.336)		(0.113)
	Age								4.45		
									(4.89)		
	Age^2								-0.034		
									(0.043)		
	Crisis										-4.56
											(5.76)
	Time FE					Yes	Yes	Yes	Yes		
	Firm FE			Yes	Yes	Yes	Yes	Yes	Yes		
	N	346	346	346	346	346	346	337	337	346	346
	adj. R^2			-0.264		-0.099		-0.104			
	R^2 Within	0.0291	0.0291	0.0291		0.2001		0.2052		0.0633	0.0399
	R^2 Between	0.0092	0.0092	0.0092	0.0092	0.0440	0.0036	0.0633	0.0030	0.0154	0.0099
	R^2 Overall	0.0241	0.0241	0.0241	0.0241	0.0947	0.0054	0.1137	0.0037	0.0361	0.0273
	F	8.95	3.31	6.49	1,007.73	$2.18{*}10^8$	3,466.82		475.85	18.14	11.44

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

evidence that performance due to observable luck has a larger impact on the bonus than general performance itself. The same analysis with the logarithm of EBITDA instead in table 17, gives strange results for the TSLS models with time-fixed effects as well. These models give negative coefficients, though they are highly insignificant since their standard error is at least twice as large as the coefficients themselves. The TSLS estimates deliver two significant results at the 10% level. These coefficients are 0.792 and 2.01. This suggests that an increase of 1% in EBITDA due to observable luck results in an increase in the bonus of 0.792% or 2.01% respectively. These findings are supported by the analysis with the AEX returns as instrument in table 18. This table shows positive (and some) significant results for the effect of observable luck on the bonus.

Taking all these results together, we reject the null-hypothesis that there is no relationship between performance due to observable luck and bonus. Given the initial analysis and the robustness checks, we are confident that the positive relationship between observable luck and bonus is present for CEOs of Dutch firms.

Chapter 6

Conclusion

Taking the entire empirical analysis together, we found considerable evidence for the existence of a positive relationship between performance due to observable luck and the compensation of the CEOs of Dutch firms. After subdividing the CEO's compensation in three components, the analysis was executed for these three components one by one. Consecutively, all three hypotheses were tested with three distinct performance measures to ensure the validity of the results.

The analysis for hypothesis 1 shows that an improved performance due to observable luck results in an increase in the total compensation between 0.88% and 1.6% (depending on the performance measure used). Even though the significant results aim at a positive relationship, some negative coefficients cast doubt on the actual existence of the relationship. Still, we are allowed to confirm hypothesis 1 that performance due to observable luck has a positive effect on total compensation.

Secondly, the analysis shed some light on the relation between the base wage and the performance during earlier periods. In this analysis, we assumed one year to be equal to one period. The analysis was executed in two stages, first we took a look at the relation between performance caused by observable luck and the base wage one year later. After that, the same relation for the performance due to observable luck and the base wage two years later was examined. The results showed that a positive relationship exists for both of these stages. After one year, an increase in performance of 1% caused by observable luck results in an approximate increase the base wage of 0.25%. After two years, this is around 0.21%. These results allow for the confirmation of hypothesis 2.

Finally, the existence of a relation between observable luck and bonus was investigated. The initial analysis, with the return on assets as the performance measure, does not give a conclusive result. The robustness checks, however, give fairly convincing evidence for the existence of a positive relation between performance due to observable luck and the bonuses of CEOs of Dutch firms.

In the end we are allowed to confirm all our stated hypotheses. These results are in line with the findings of Bertrand and Mullainathan (2001).

Chapter 7

Discussion

The results in this paper, in addition with the prior findings of Bertrand and Mullainathan (2001), form fairly convincing evidence for the existence of a positive relationship between observable luck and CEO compensation. As Bertrand and Mullainathan (2001) state: "CEOs are rewarded for observable luck". Comparing the results of Bertrand and Mullainathan (2001) with the results of this paper teaches that both papers found a positive relationship between performance due to observable luck and compensation. This paper, however, found that performance due to observable luck has a larger impact on compensation than general performance. There might be a couple of reasons for the difference between these results. In the first place, the geographical setting of the two researches differs significantly. This paper made use of data that solely related to CEOs of Dutch companies. Bertrand and Mullainathan (2001), however, used data on primarily American CEOs. There may be some legal or cultural differences between Dutch and American firms which result in different types of contracts for the CEOs. Secondly, the analysis of Bertrand and Mullainathan (2001) was conducted for the periods 1977-1994 and 1984-1991, whereas the analysis for this paper was executed with the assistance of data from the period 2001-2016. This may have had a serious impact on the results due to the ongoing process of globalization. Over the past couple of decades, many trade barriers over the world have vanished, which has ultimately resulted in a more international state of mind, both from the CEO's as wel as the firm's perspective. This shift towards a more international state of mind might potentially result in a shift of risk towards the CEOs, and thus more pay for observable luck.

As a matter of differentiation from the method implemented by Bertrand and Mullainathan (2001), this paper allows for cross-sectional variance across different types of firms by using two instruments in the analysis. Bertrand and Mullainathan (2001) only use one instrument. This means that they only take into account the variance over time and the variation across firms in distinct models.

Our results have the implication for corporate policy to aim for a more efficient contract with their CEOs. Even though we did not analyse the total loss of utility caused by the pay for observable luck, the finding that CEOs are paid for observable luck in combination with the agency theory suggests that this cannot be an efficient contract. Being more concrete, firms should get rid of the observable luck component in the contracts of their CEOs, and potentially of other employees as well.

Irrespective of the significant results, this paper has a couple of serious drawbacks which need to be considered for future research. In the first place, due to a lack of available information, this research might suffer from omitted variable bias. An attentive reader might suggest to use more control variables regarding the individual characteristics of the CEOs. One could think here of education, ethnicity, tenure, and gender for example. A second thing to consider is the lack of CEO replacements over the period of interest. Over the period 2003-2016, there were no more than three CEO replacements. As a matter of fact, it might be interesting to take a closer look at the observable luck relationship in case there are more of these replacement available in the dataset. Another potential issue is the valuation of other types of compensation. As was mentioned throughout the paper, the total compensation variable consists of the bonus, the base wage, and other types of compensation. This last part, in general consists of undefined types of compensation. We only have information about the fact that the total compensation consists, among other components, of the base wage, the bonus, stocks, and stock options. Unfortunately, the data does not deliver any information on the valuation of these stocks and options. This leads to the idea that the stock and options valuation in fact can have a detrimental effect on the conclusion drawn regarding the total compensation. Our final concern regarding the analysis drawn in this papers refers to the numbers of observations in the distinct models. The summary statistics in table 1 shows a great variance in the number of observations across different variables. This indicates that some of these variables suffer from missing values. Since these missing values across all these different variables do not necessarily overlap, this results in a serious reduction in the number of observations in de models. This is the reason why most models have around 300 observations, whereas the return on the indices in table 1 shows 637 observations. Finally, comparing the variation of the variables of interest in the TSLS models with the variations of those variables in the general models, results in the conclusion that the variations in the TSLS models are larger every time without an exception. An explanation for the growth in the variation can be that the instruments used in our models are not very strong. An increase in the variation from a general OLS model to a TSLS model can indicate that the instruments used for the variable of interest are rather weak.

Taking all this together, there is still room for improvement on the topic of compensation for observable luck. This is not surprising since there has been only one paper published in the past which investigates this relationship (as far as we are aware of the literature). Therefore, we recommend to continue investigating the relationship between observable luck and compensation. For example, one can investigate the same relationship for lower level employees (as compared to the CEO).

Appendix A

Robustness Check for Total Compensation

TABLE 7: Total compensation for observable for luck

		Dependent variable: ln (Total Compensation)									
		General	Luck	General	Luck	General	Luck	General	Luck	General	Luck
	Constant	6.02***	3.59	6.42***	3.73*	6.99***	9.71	1.83	8.17	6.09***	-1.78
		(0.16)	(2.42)	(0.24)	(2.19)	(0.12)	(9.68)	(3.22)	(18.06)	(0.16)	(38.69)
	ln (EBIT)	0.18***	0.812	0.089	0.743	0.021	-1.32	0.021	-1.07	0.167***	2.20
		(0.044)	(0.62)	(0.059)	(0.53)	(0.030)	(3.38)	(0.027)	(2.24)	(0.044)	(10.01)
	Age							0.222*	0.118		
Stage 2								(0.123)	(0.396)		
	Age^2							-0.0023*	-0.0012		
								(0.0012)	(0.0038)		
	Crisis									-0.27***	0.575
										(0.088)	(4.01)
	Constant		3.82***		4.08***		4.19***		6.53		3.86***
			(0.177)		(0.032)		(0.148)		(7.03)		(0.189)
	ROI Dow Jones		0.003		0.005		0.004		0.006		-0.0003
			(0.006)		(0.004)		(0.014)		(0.014)		(0.005)
	ROI Nasdaq		0.005		0.004		0.0008		0.002		0.0008
Stage 1			(0.005)		(0.004)		(0.011)		(0.011)		(0.005)
	Age								-0.097		
									(0.244)		
	Age^2								0.001		
									(0.002)		
	Crisis										-0.404**
											(0.184)
	Time FE					Yes	Yes	Yes	Yes		
	Firm FE			Yes	Yes	Yes	Yes	Yes	Yes		
	N	349	349	349	349	349	349	338	338	349	349
	adj. R^2			-0.290		0.239		0.268			
	R^2 Within	0.0285	0.0285	0.0285		0.4558		0.4829		0.0722	0.0200
	R^2 Between	0.4512	0.4512	0.4512	0.4512	0.2130	0.4075	0.1368	0.3715	0.4574	0.4497
	R^2 Overall	0.5089	0.5089	0.5089	0.5089	0.1886	0.4541	0.1517	0.4089	0.5137	0.5047
	F	16.85	1.70	2.24	2.89	13.99	$1.20*10^6$		10,456.32	46.07	0.60

Robust standard errors in parentheses

$^* p < 0.10$, $^{**} p < 0.05$, $^{***} p < 0.01$

TABLE 8: Total compensation for observable luck

Dependent variable: ln (Total Compensation)

		General	Luck	General	Luck	General	Luck	General	Luck	General	Luck
	Constant	5.47***	2.78	5.57***	2.79	6.97***	8.43	1.67	11.52	5.55***	1.64
		(0.17)	(2.33)	(0.499)	(2.03)	(0.375)	(5.76)	(3.20)	(73.75)	(0.18)	(6.52)
	ln (EBITDA)	0.29***	0.91*	0.27**	0.88**	0.022	-0.48	0.035	-1.06	0.271***	1.18
		(0.043)	(0.538)	(0.108)	(0.449)	(0.082)	(1.34)	(0.078)	(8.23)	(0.045)	(1.52)
	Age							0.226*	0.023		
Stage 2								(0.122)	(1.53)		
	Age^2							-0.0023**	-0.0001		
								(0.0012)	(0.016)		
	Crisis									-0.238***	0.082
										(0.085)	(0.559)
	Constant		4.26***		4.49***		4.71***		8.98**		4.30***
			(0.157)		(0.019)		(0.0739)		(4.171)		(0.163)
	ROI Dow Jones		0.0006		0.004		-0.005		-0.002		-0.002
			(0.006)		(0.003)		(0.011)		(0.011)		(0.005)
	ROI Nasdaq		0.004		0.003		-0.004		-0.001		0.0008
Stage 1			(0.004)		(0.002)		(0.008)		(0.008)		(0.004)
	Age								-0.184		
									(0.156)		
	Age^2								0.002		
									(0.001)		
	Crisis										-0.368**
											(0.156)
	Time FE					Yes	Yes	Yes	Yes		
	Firm FE			Yes	Yes	Yes	Yes	Yes	Yes		
	N	349	359	349	359	349	359	338	346	349	359
	adj. R^2			-0.223		0.238		0.267			
	R^2 Within	0.0792	0.0613	0.0792		0.4548	0.1596	0.4826		0.1174	0.0562
	R^2 Between	0.4762	0.4828	0.4762	0.4828	0.2157	0.3783	0.1724	0.4032	0.4785	0.4825
	R^2 Overall	0.5373	0.5422	0.5373	0.5422	0.1896	0.3918	0.1886	0.4278	0.5429	0.5412
	F	44.82	2.88	6.00	1.88	13.87	53.46		556.90	53.58	3.88

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 9: Total compensation for observable luck

Dependent variable: ln (Total Compensation)

		General	Luck	General	Luck	General	Luck	General	Luck
	Constant	6.62***	6.56***	6.70***	6.62***	7.01***	6.48***	-0.137	-0.464
		(0.110)	(0.117)	(0.004)	(0.043)	(0.063)	(0.095)	(3.60)	(3.51)
	ROA	0.0023***	0.010**	0.0023***	0.010**	0.0016***	0.0125	0.0015***	0.0029
		(0.000440)	(0.00427)	(0.000445)	(0.00427)	(0.0005)	(0.0097)	(0.0005)	(0.0064)
Stage 2	Age							0.268**	0.260*
								(0.135)	(0.132)
	Age^2							-0.0025*	-0.0024*
								(0.0013)	(0.0012)
	Constant		6.24		8.85***		13.62***		-174.2
			(61.21)		(0.504)		(3.75)		(172.7)
	ROI AEX		0.246**		0.246***		0		0
			(0.109)		(0.099)		(.)		(.)
Stage 1	Age								
									()
	Age^2								
									()
	Time FE					Yes	Yes	Yes	Yes
	Firm FE			Yes	Yes	Yes	Yes	Yes	Yes
	N	333	333	333	333	333	333	320	320
	adj. R^2			0.044		0.465		0.489	
	R^2 Within	0.0473	0.0473	0.0473		0.4873		0.5148	0.4981
	R^2 Between	0.0105	0.0105	0.0105	0.0105	0.1253	0.0822	0.1938	0.1820
	R^2 Overall	0.0148	0.0148	0.0148	0.0148	0.1089	0.0623	0.1585	0.1565
	F	27.14	5.52	25.73	2,3545.29	19.94	131,067.62		28795.62

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix B

Robustness Check for Base Wage

TABLE 10: Base wage for observable luck after one year

Dependent variable: ln (Base Wage)

		General	Luck	General	Luck	General	Luck	General	Luck	General	Luck
	Constant	5.61***	5.14***	5.89***	5.14***	5.63***	4.72***	6.74***	5.12	5.63***	5.09***
		(0.112)	(0.544)	(0.192)	(0.654)	(0.136)	(1.14)	(1.60)	(3.40)	(0.113)	(0.551)
	ln ($EBIT_{t-1}$)	0.116***	0.241*	0.043	0.231	0.001	0.217	0.001	0.226	0.114***	0.255*
		(0.029)	(0.141)	(0.048)	(0.164)	(0.032)	(0.269)	(0.032)	(0.280)	(0.029)	(0.143)
	Age							-0.039	-0.023		
Stage 2								(0.063)	(0.096)		
	Age^2							0.0003	0.0003		
								(0.0006)	(0.0008)		
	Crisis									-0.164***	-0.154***
										(0.048)	(0.059)
	Constant		3.73***		3.93***		4.36***		7.13		3.73***
			(0.207)		(0.029)		(0.131)		(7.99)		(0.203)
	ROI Dow Jones		0.008		0.007*		0.018		0.018		0.008
			(0.006)		(0.004)		(0.013)		(0.013)		(0.006)
	ROI Nasdaq		0.006*		0.005		0.011		0.011		0.007*
Stage 1			(0.004)		(0.003)		(0.010)		(0.010)		(0.004)
	Age								-0.068		
									(0.287)		
	Age^2								0.0002		
									(0.003)		
	Crisis										-0.088
											(0.163)
	Time FE					Yes	Yes	Yes	Yes		
	Firm FE			Yes	Yes	Yes	Yes	Yes	Yes		
	N	335	335	335	335	335	335	326	326	335	335
	adj. R^2			-0.280		0.159		0.153			
	R^2 Within	0.0190	0.0190	0.0190		0.3879		0.3903		0.0583	0.0378
	R^2 Between	0.5547	0.5547	0.5547	0.5547	0.1256	0.5776	0.1098	0.5533	0.5659	0.5601
	R^2 Overall	0.5008	0.5008	0.5008	0.5008	0.1578	0.5488	0.1581	0.5206	0.5166	0.5118
	F	15.97	2.91	0.81	61.76		956,086.09		422.99	41.76	7.18

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 11: Base wage for observable luck after one year

	Dependent variable: ln (Base Wage)										
		General	Luck	General	Luck	General	Luck	General	Luck	General	Luck
	Constant	5.31***	5.18***	5.42***	5.25***	5.42***	5.31***	7.34***	5.96*	5.34***	5.12***
		(0.096)	(0.450)	(0.261)	(0.504)	(0.183)	(0.932)	(1.59)	(3.14)	(0.098)	(0.460)
	ln ($EBITDA_{t-1}$)	0.174***	0.207*	0.144**	0.185	0.056	0.086	0.052	0.208	0.170***	0.224**
		(0.023)	(0.107)	(0.061)	(0.118)	(0.048)	(0.250)	(0.048)	(0.263)	(0.023)	(0.109)
	Age							-0.071	-0.041		
Stage 2								(0.063)	(0.091)		
	Age^2							0.0007	0.0004		
								(0.0006)	(0.0008)		
	Crisis									-0.160***	-0.149***
										(0.041)	(0.039)
	Constant		4.08***		4.23***		3.81***		8.93**		4.09***
			(0.189)		(0.020)		(0.073)		(4.46)		(0.187)
	ROI Dow Jones		0.010		0.009**		0.010		0.013		0.010
			(0.006)		(0.004)		(0.009)		(0.009)		(0.006)
	ROI Nasdaq		0.005*		0.004**		0.003		0.006		0.005*
Stage 1			(0.003)		(0.002)		(0.006)		(0.006)		(0.003)
	Age								-0.193		
									(0.172)		
	Age^2								0.002		
									(0.002)		
	Crisis										-0.181
											(0.120)
	Time FE					Yes	Yes	Yes	Yes		
	Firm FE			Yes	Yes	Yes	Yes	Yes	Yes		
	N	349	349	349	349	349	349	338	338	349	349
	adj. R^2			-0.156		0.187		0.183			
	R^2 Within	0.1063	0.1063	0.1063	0.0979	0.4018	0.3982	0.4058	0.3099	0.1563	0.1501
	R^2 Between	0.6093	0.6093	0.6093	0.6093	0.5074	0.5786	0.4801	0.6041	0.6154	0.6139
	R^2 Overall	0.5552	0.5552	0.5552	0.5552	0.4711	0.5480	0.4434	0.5685	0.5665	0.5650
	F	57.40	3.75	5.62	108.30		231,284.97		1,453.94	121.31	20.36

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 12: Base wage for observable luck after two year

Dependent variable: ln (Base Wage)

		General	Luck	General	Luck	General	Luck	General	Luck	General	Luck
	Constant	5.58***	5.06***	5.95***	4.95***	5.66***	4.36***	4.87***	3.54	5.62***	5.19***
		(0.090)	(0.354)	(0.165)	(0.603)	(0.102)	(1.38)	(1.27)	(3.50)	(0.094)	(0.301)
	ln ($EBIT_{t-2}$)	0.126***	0.267***	0.029	0.284*	-0.003	0.304	-0.004	0.295	0.122***	0.240***
		(0.025)	(0.093)	(0.042)	(0.153)	(0.034)	(0.325)	(0.024)	(0.306)	(0.025)	(0.080)
	Age							0	-0.005		
Stage 2								(.)	(0.106)		
	Age^2							0.0004	0.0005		
								(0.0006)	(0.0009)		
	Crisis									-0.237***	-0.239***
										(0.055)	(0.068)
	Constant		3.58***		3.89***		4.36***		5.27		3.57***
			(0.245)		(0.029)		(0.125)		(6.20)		(0.252)
	ROI Dow Jones		0.011		0.007*		0.016		0.017		0.010
			(0.007)		(0.004)		(0.013)		(0.013)		(0.007)
	ROI Nasdaq		0.008**		0.005		0.011		0.012		0.008**
Stage 1			(0.004)		(0.003)		(0.009)		(0.009)		(0.004)
	Age								0		
									(.)		
	Age^2								-0.0004		
									(0.003)		
	Crisis										0.040
											(0.185)
	Time FE					Yes	Yes	Yes	Yes		
	Firm FE			Yes	Yes	Yes	Yes	Yes	Yes		
	N	261	261	261	261	261	261	253	253	261	261
	adj. R^2			-0.279		0.305		0.306			
	R^2 Within	0.0113	0.0113	0.0113		0.4945		0.4987		0.1133	0.0668
	R^2 Between	0.7240	0.7240	0.7240	0.7240	0.1065	0.7401	0.0436	0.6733	0.7387	0.7355
	R^2 Overall	0.5512	0.5512	0.5512	0.5512	0.1240	0.5895	0.0470	0.5007	0.5748	0.5729
	F	26.63	8.31	0.49	67.15		130,923.08		38.12	55.58	15.66

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 13: Base wage for observable luck after two year

Dependent variable: ln(Base Wage)

		General	Luck	General	Luck	General	Luck	General	Luck	General	Luck
	Constant	5.37***	5.08***	5.60***	5.09***	5.53***	4.31**	4.03***	3.54	5.41***	5.16***
		(0.079)	(0.326)	(0.213)	(0.463)	(0.118)	(1.91)	(1.28)	(4.27)	(0.082)	(0.306)
	ln (EBITDA$_{t-2}$)	0.165***	0.237***	0.105**	0.227**	0.029	0.355	0.022	0.378	0.161***	0.224***
		(0.020)	(0.079)	(0.050)	(0.109)	(0.031)	(0.512)	(0.030)	(0.427)	(0.020)	(0.075)
	Age							0	0.007		
Stage 2								(.)	(0.127)		
	Age^2							0.0008	0.0002		
								(0.0006)	(0.001)		
	Crisis									-0.231***	-0.227***
										(0.050)	(0.051)
	Constant		3.89***		4.17***		3.80***		0.472		3.89***
			(0.235)		(0.020)		(0.072)		(4.41)		(0.239)
	ROI Dow Jones		0.012*		0.009**		0.009		0.012		0.012*
			(0.007)		(0.004)		(0.009)		(0.008)		(0.007)
	ROI Nasdaq		0.006*		0.004**		0.004		0.006		0.006*
Stage 1			(0.003)		(0.002)		(0.006)		(0.005)		(0.003)
	Age								0		
									(.)		
	Age^2								0.002		
									(0.002)		
	Crisis										-0.032
											(0.111)
	Time FE					Yes	Yes	Yes	Yes		
	Firm FE			Yes	Yes	Yes	Yes	Yes	Yes		
	N	273	273	273	273	273	273	264	264	273	273
	adj. R^2			-0.190		0.329		0.335			
	R^2 Within	0.0765	0.0765	0.0765		0.5089		0.5174		0.2073	0.1880
	R^2 Between	0.7203	0.7203	0.7203	0.7203	0.4558	0.7342	0.0822	0.7124	0.7330	0.7311
	R^2 Overall	0.5857	0.5857	0.5857	0.5857	0.3510	0.6146	0.0644	0.5773	0.6063	0.6048
	F	71.44	9.00	4.33	120.95		31,963.26		32.72	147.16	28.86

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 14: Base wage for observable luck after one year

Dependent variable: ln (Base Wage)

		General	Luck	General	Luck	General	Luck	General	Luck	General	Luck
	Constant	5.99***	5.98***	5.98***	5.97***	5.57***	5.79***	4.04***	5.94**	6.00***	5.98***
		(0.068)	(0.073)	(0.008)	(0.039)	(0.020)	(0.140)	(1.49)	(2.42)	(0.0678)	(0.0740)
	ROA_{t-1}	0.0014*	0.0022	0.0014	0.0021	0.0013	-0.017	0.0013	0.0048	0.00140*	0.0041
		(0.0008)	(0.0042)	(0.0009)	(0.004)	(0.0009)	(0.011)	(0.0009)	(0.004)	(0.0008)	(0.004)
	Age							0	-0.043		
Stage 2								(.)	(0.091)		
	Age^2							0.0008	0.0008		
								(0.0008)	(0.0009)		
	Crisis									-0.174***	-0.170***
										(0.040)	(0.038)
	Constant		7.66		8.45***		11.93***		0.388		7.83
			(5.53)		(0.202)		(0.739)		(80.8)		(5.39)
	ROI AEX		0.128**		0.126***		0		0		0.132***
			(0.051)		(0.044)		(.)		(.)		()
	Age								0		
Stage 1									(.)		
	Age^2								0.006		
									(0.043)		
	Crisis										-2.51
											(4.02)
	Time FE					Yes	Yes	Yes	Yes		
	Firm FE			Yes	Yes	Yes	Yes	Yes	Yes		
	N	324	324	324	324	324	324	313	313	324	324
	adj. R^2			0.018		0.379		0.383			
	R^2 Within	0.0212	0.0212	0.0212	0.0172	0.4058		0.4129	0.2858	0.0762	0.0586
	R^2 Between	0.0029	0.0029	0.0029	0.0029	0.1121	0.0054	0.0107	0.0413	0.0308	0.0104
	R^2 Overall	0.0129	0.0129	0.0129	0.0129	0.1350	0.0002	0.0306	0.0904	0.0316	0.0244
	F	2.93	0.27	2.73	23,661.95	$4.30770 * 10^{11}$	500		33.50	19.87	25.38

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 15: Base wage for observable luck after two year

	Dependent variable: ln (Base Wage)										
		General	Luck	General	Luck	General	Luck	General	Luck	General	Luck
	Constant	5.97***	5.96***	6.00***	5.99***	5.60***	5.95***	3.99**	5.89**	6.02***	5.98***
		(0.076)	(0.077)	(0.004)	(0.026)	(0.015)	(0.195)	(1.57)	(2.29)	(0.066)	(0.081)
	ROA_{t-2}	0.0005	0.002	0.0004	0.001	0.0003	-0.029*	0.0003	-0.006	0.001*	0.007
		(0.0004)	(0.003)	(0.0004)	(0.003)	(0.0004)	(0.016)	(0.0004)	(0.006)	(0.0006)	(0.011)
	Age							0	-0.0410		
Stage 2								(.)	(0.087)		
	Age^2							0.0008	0.0008		
								(0.0008)	(0.0008)		
	Crisis									-0.189***	-0.227***
										(0.046)	(0.065)
	Constant		6.49		8.28***		12.18***		8.46		4.90
			(9.05)		(0.180)		(0.578)		(85.91)		(5.75)
	ROI AEX		0.140***		0.138***		0		0		0.071
			(0.053)		(0.047)		(.)		(.)		(0.068)
	Age								0		
Stage 1									(.)		
	Age^2								0.002		
									(0.043)		
	Crisis										5.59**
											(2.46)
	Time FE					Yes	Yes	Yes	Yes		
	Firm FE			Yes	Yes	Yes	Yes	Yes	Yes		
	N	257	257	257	257	257	257	248	248	317	317
	adj. R^2			-0.002		0.487		0.494			
	R^2 Within	0.0018	0.0018	0.0018		0.5127		0.5223	0.0367	0.0709	0.0305
	R^2 Between	0.0260	0.0260	0.0260	0.0260	0.1096	0.0060	0.0417	0.0220	0.0955	0.0371
	R^2 Overall	0.0110	0.0110	0.0110	0.0110	0.1220	0.0013	0.0331	0.0214	0.0364	0.0253
	F	1.20	0.36	0.69	54,634.07		219.98		28.83	20.73	16.00

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix C

Robustness Check for Bonus

TABLE 16: Bonus for observable luck

Dependent variable: ln (Bonus)

		General	Luck	General	Luck	General	Luck	General	Luck	General	Luck
Stage 2	Constant	3.98***	2.59**	3.91***	-2.01	3.77***	-41.17	-1.32	-32.78	4.02***	2.88**
		(0.141)	(1.23)	(0.361)	(6.68)	(0.295)	(363.9)	(3.42)	(337.0)	(0.143)	(1.25)
	ln (EBIT)	0.330***	0.674**	0.346***	1.79	0.313***	15.56	0.307***	16.21	0.324***	0.607**
		(0.037)	(0.304)	(0.088)	(1.63)	(0.073)	(123.7)	(0.071)	(145.9)	(0.038)	(0.31)
	Age							0.190	-0.087		
								(0.127)	(3.52)		
	Age^2							-0.002	-0.005		
								(0.001)	(0.045)		
	Crisis									-0.258**	-0.155
										(0.120)	(0.155)
Stage 1	Constant		3.97***		4.07***		2.93***		1.95		4.004***
			(0.145)		(0.026)		(0.602)		(6.26)		(0.154)
	ROI Dow Jones		-0.008		0.003		-0.001		-0.001		-0.010
			(0.010)		(0.003)		(0.010)		(0.011)		(0.010)
	ROI Nasdaq		0.009		0.002		-0.0007		-0.0008		0.005
			(0.007)		(0.003)		(0.008)		(0.009)		(0.007)
	Age								0.018		
									(0.226)		
	Age^2								0.0002		
									(0.002)		
	Crisis										-0.342
											(0.304)
	Time FE					Yes	Yes	Yes	Yes		
	Firm FE			Yes	Yes	Yes	Yes	Yes	Yes		
	N	359	359	359	359	359	359	350	350	359	359
	adj. R^2			-0.104		-0.003		-0.005			
	R^2 Within	0.1552	0.1552	0.1552		0.2712		0.2774		0.1798	0.1694
	R^2 Between	0.4964	0.4964	0.4964	0.4964	0.4831	0.4958	0.4641	0.4562	0.4983	0.4972
	R^2 Overall	0.6151	0.6151	0.6151	0.6151	0.6066	0.6083	0.5939	0.5814	0.6175	0.6173
	F	77.97	4.90	15.37	0.09		0.16		0.44	98.30	9.44

Robust Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 17: Bonus for observable luck

Dependent variable: ln (Bonus)

		General	Luck	General	Luck	General	Luck	General	Luck	General	Luck
Stage 2	Constant	3.56***	1.80	2.70***	-3.72	2.99***	20.10	-2.02	19.21	3.59***	2.84
		(0.147)	(2.01)	(0.457)	(5.89)	(0.433)	(32.43)	(3.85)	(36.04)	(0.151)	(1.96)
	ln (EBITDA)	0.388***	0.792*	0.581***	2.01*	0.501***	-4.61	0.50***	-3.73	0.383***	0.556
		(0.036)	(0.459)	(0.102)	(1.31)	(0.112)	(9.40)	(0.113)	(6.69)	(0.037)	(0.448)
	Age							0.192	-0.166		
								(0.143)	(0.735)		
	Age^2							-0.002	0.003		
								(0.001)	(0.009)		
	Crisis									-0.244**	-0.195
										(0.116)	(0.146)
Stage 1	Constant		4.35***		4.46***		3.39***		5.15*		4.37***
			(0.139)		(0.016)		(0.401)		(3.03)		(0.145)
	ROI Dow Jones		-0.006		0.003		0.004		0.005		-0.006
			(0.008)		(0.002)		(0.007)		(0.007)		(0.007)
	ROI Nasdaq		0.005		0.002		0.002		0.003		0.002
			(0.005)		(0.002)		(0.004)		(0.005)		(0.005)
	Age								-0.088		
									(0.111)		
	Age^2								0.001		
									(0.001)		
	Crisis										-0.269
											(0.198)
	Time FE					Yes	Yes	Yes	Yes		
	Firm FE			Yes	Yes	Yes	Yes	Yes	Yes		
	N	366	366	366	366	366	366	357	357	366	366
	adj. R^2			-0.030		0.023		0.022			
	R^2 Within	0.2097	0.2097	0.2097		0.2877		0.2942		0.2219	0.2269
	R^2 Between	0.5058	0.5058	0.5058	0.5058	0.5045	0.4936	0.4780	0.4609	0.5062	0.5061
	R^2 Overall	0.6278	0.6278	0.6278	0.6278	0.6329	0.6085	0.6164	0.5823	0.6300	0.6301
	F	114.10	2.98	32.51	0.40		2.45		16.17	122.85	8.99

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 18: Bonus for observable luck

Dependent variable: ln (Bonus)

		General	Luck	General	Luck	General	Luck	General	Luck	General	Luck
	Constant	5.21***	5.05***	5.23***	4.83***	4.52***	4.32***	-0.128	-8.81	5.23***	5.12***
		(0.114)	(0.230)	(0.015)	(0.168)	(0.299)	(0.326)	(5.39)	(14.69)	(0.113)	(0.212)
	ROA	0.0033***	0.0324**	0.0038**	0.0445***	0.0027*	0.0522	0.0027*	-0.0584	0.0029***	0.0209
		(0.0011)	(0.0153)	(0.0015)	(0.0170)	(0.0015)	(0.0318)	(0.0015)	(0.0802)	(0.0010)	(0.0174)
	Age							0.170	0.479		
Stage 2								(0.205)	(0.512)		
	Age^2							-0.0015	-0.0040		
								(0.0019)	(0.0042)		
	Crisis									-0.323***	-0.245
										(0.125)	(0.195)
	Constant		4.31		9.13***		4.18*		-142.2		5.01
			(4.64)		(0.229)		(2.31)		(127.5)		(4.70)
	ROI AEX		0.191**		0.141***		0		0		0.200
			(0.0947)		(0.046)		(.)		(.)		(0.150)
	Age								5.07		
Stage 1									(4.62)		
	Age^2								-0.0404		
									(0.0406)		
	Crisis										0.104
											(7.55)
	Time FE					Yes	Yes	Yes	Yes		
	Firm FE			Yes	Yes	Yes	Yes	Yes	Yes		
	N	346	346	346	346	346	346	337	337	346	346
	adj. R^2			0.026		0.164		0.163			
	R^2 Within	0.0291	0.0291	0.0291		0.2001		0.2052		0.0633	0.0388
	R^2 Between	0.0092	0.0092	0.0092	0.0092	0.0440	0.0114	0.0633	0.0053	0.0154	0.0099
	R^2 Overall	0.0241	0.0241	0.0241	0.0241	0.0947	0.0302	0.1137	0.0094	0.0361	0.0270
	F	8.95	4.48	6.49	828.75	$2.18*10^8$	3,496.21		204.68	18.14	14.14

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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