The relationship between CEO' remuneration and firm performance: Evidence from ATX and DAX

Master degree in International Business

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Dissertation under the supervision of Professor Magali Pedro Costa, and Professor Inês Margarida Cadima Lisboa

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Originality and Copyright

This dissertation is original, made only for this purpose, and all authors whose studies and publications were used to complete it are duly acknowledged.

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Abstract

Chief Executive Officers' (CEO) remuneration became a more discussed topic in the media in recent years as CEOs have, on average, higher remuneration in comparison to the average salary of the company's employees. On the one hand side, the risk and the responsibility which they bear needs to be valued. With their broad knowledge and experience, they contribute to the overall firm performance and may improve it. On the other hand, with positive performance results and possible raises of the share price, the CEOs can benefit from variable remuneration components in the form of bonuses or share packages of the firm. Our work aims to shed light on the impact of the CEO remuneration on firm performance and vice versa, i.e., the impact of the firm performance on the CEO remuneration and the simultaneous influence. The analysis is done with secondary data of Austrian and German firms listed in the leading share indices ATX (Austrian Traded Index) and DAX (Deutscher Aktienindex), respectively, during the period from 2012 to 2019. CEO remuneration specified into their main components: a fixed and a variable (performance-related) part, is analyzed. Both accounting-based (ROA – Return on Assets, EVA – Economic Value Added) and market-based measures (TQ - Tobin's Q, TSR – Total Shareholder Return) are used to measure the firm performance. Our key findings of this analysis are that total remuneration and the two accounting-based performance indicators ROA and SEVA, have a simultaneous relationship in Austria. For Germany, we found out that all remuneration components influence ROA significantly positively and that all remuneration components are statistically significantly influenced by ROA. Despite that, we found evidence for a simultaneous relationship between bonus and total remuneration, respectively, and SEVA and TQ. This research contributes to the literature since three perspectives of the relationship are considered; both accounting-based and market-based performance, with two indicators each, are used; and different remuneration components are considered instead of just analyzing total remuneration.

Keywords: Chief Executive Officers' remuneration, firm performance, ATX, DAX, agency theory, Austria, Germany.

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List of Abbreviations and Acronyms

2SLS	Two-Stage Least Squares
AG	Aktiengesetz (DE); engl. stock corporation law
AktG	Aktiengesetz (AT); engl. stock corporation law
AktRÄG	Aktienrechts-Änderungsgesetz (AT); engl. Stock Corporation Law Amendment Act
AT	ISO 3166-1 for Austria
ATX	Austrian Traded Index
CEO	Chief Executive Officer
COVID-19	Coronavirus SARS-CoV-2
CV	Control Variable
DAX	Deutscher Aktienindex
DCGK	Deutscher Corporate Governance Kodex; engl. Government Commission of the German Corporate Governance Code
DE	ISO 3166 for Germany
EBIT	Earnings before Interest and Tax
EPS	Earnings per Share
EU	European Union
EVA	Economic Value Added
FE	Fixed Effects
GPD	Gross Domestic Product
GRETL	Gnu Regression, Econometrics and Time-series Library
HGB	Handelsgesetzbuch (DE); engl. German Commercial Code
IC	Invested Capital
LEV	Leverage
NOPAT	Net Operating Profit After Tax
OLS	Ordinary Least Squares
OECD	Organization for Economic Co-operation and Development
RE	Random Effects
ROA	Return on Assets
ROE	Return on Equity

ROI	Return on Investment
SEVA	Standardized Economic Value Added
SPSS	Statistical Package for the Social Science
TQ	Tobin's Q
TSR	Total Shareholder Return
UGB	Unternehmensgesetzbuch; engl. Austrian Commercial Code
USA	United States of America
VorstOG	Vorstandsvergütungs-Offenlegungsgesetz (DE), engl. Executive Compensation Disclosure Act
WACC	Weighted Average Cost of Capital

1. Introduction

The top position in a company is held by Chief Executive Officers (CEOs), who are responsible for the firm operation and performance. The firms hire them based on their expertise, experience, and ability to create value for shareholders. When they are successful, achieve the set targets, and increase the firm performance, they can benefit in the form of bonus payments which the firm distributes. The population has always been interested in the income of the executives in large corporations, especially if the company is involved in a scandal or a (world) crisis occurs. For example, it is often heard that employees have to be laid off to reduce costs, or fewer dividends will be distributed, but in rare cases, the remuneration of the CEO is reduced (Sommer, 2020). Even during the COVID-19 pandemic, the remuneration of the DAX-CEOs (Deutscher Aktienindex) decreased negligibly while the net profit of the shareholder decreased by 3,5 billion euros (Spiegel.de, 2021).

Data from 2018 shows that the USA (United States of America) was the country that pays the most to CEOs; the income of a CEO in the USA was 265 times higher than the average worker pay (Szmigiera, 2019). India and the United Kingdom ranked in the second and third positions with a gap ratio of 229 and 201, respectively. 1,86 million euros was the average wage for an executive who worked for an ATX-firm (Austrian Traded Index) in 2019. It is 57 times more than a worker or employee earns on average per year. Only in 2018 did the discrepancy present its highest value with a factor of 64 (Wieser, 2020). In Germany, the ratio was a total of 136. However, if only the remuneration of the 30 DAX CEOs is considered, the remuneration in 2018 was only 52 times higher than the average wage of an employee (Bonnet, 2019; Szmigiera, 2019).

Some studies stated that company managers generally have too much power to determine their own contracts (Carter & Lynch, 2001; Conyon & Peck, 1998; Yermack, 1997). The contracts are made between the managers and the supervisory board composed of shareholders, employees, and external people (Peres, 2019). The different interests and aims of shareholders may conflict with the ones of the CEO, which leads to an agency problem (David, Kochhar & Levitas, 1998; Hartzell & Starks, 2003). An agency conflict occurs when the interests of the agent and the principal are not matching due to the opportunistic behavior of the agent, maximizing his/her own wealth and disregarding the principal's interests and wealth (Jensen & Meckling, 1976).

The principal, in this case, is the shareholder, while on the agents' side are the managers who allocate the resources and act on behalf of the principals (Crespi-Cladera & Gispert, 2003; Young & Buchholtz, 2002). The agency problem is enhanced by asymmetric information because the principal cannot prove whether the agent is putting all his/her efforts into the business to improve the firm performance. For this reason, it is also difficult to evaluate whether the remuneration is reasonable or not. To weaken or overcome the agency problem, there will be incentives for the CEO to show his/her true ability in order to improve firms' performance (Jensen, Murphy & Wruck, 2004).

Previous research investigating the relationship between executives' remuneration and firms' performance did not reach a consensus on it. While some studies found evidence for a strong relationship between remuneration and performance (Main, Bruce & Buck, 1996; Raithatha & Komera, 2016; Sheikh, Shah & Akbar, 2018), other researchers concluded a weak relationship (Gómez-Mejía, Larraza-Kintana & Makri, 2003; Gregg, Jewell & Tonks, 2005) or even no significant relationship (Abdullah, 2006; Doucouliagos, Haman & Askary, 2007).

This work aims to shed light on the relationship between CEOs' remuneration and firm performance in Austria and Germany, using secondary data of firms listed in the Austrian leading share index, ATX, and German leading share index, DAX, from 2012 to 2019.

In order to measure financial performance, past performance in the form of accounting-based measurements and market-based measurements that are future-orientated (Sharma & Carney, 2012) are taken into account with two key performance indicators each. The key performance indicators are Return on Assets (ROA) and Economic Value Added (EVA), both accounting-based measures, Tobin's Q (TQ), and Total Shareholder Return (TSR), both market-based measures. As far as we know, the EVA has rarely been taken into account. However, it combines the company's profits with the cost of financing the capital invested in the company, giving additional information regarding efficiency compared to return ratios (Bussin & Modau, 2015; de Wet, 2012). In addition to this contribution, our study considers the subdivision of the remuneration into its components fixed salary and performance-related bonus. The effect with total remuneration was often analyzed, whereby the effect on the various components was neglected. We intend to verify whether the relationship between remuneration and performance is significant for the various remuneration components.

We also contribute with the way we look at the relationship since we analyze the influence of CEO remuneration on firm performance, the influence of firm performance on CEO remuneration, and the simultaneous influence of remuneration and performance. Most studies look at this relationship only one-sided. Analyzing the interrelation simultaneously, the research has been done with a mixed sample of European countries, in Pakistan and the United States. Therefore, we contribute to the literature review by expanding this analysis.

Finally, our research differs from the current literature essentially in that most of the research was carried out in non-European countries (Aslam, Haron & Tahir, 2019; Azim, Ai Me & Rahman, 2011; Murphy, 1985; Raithatha & Komera, 2016). Germany was chosen for its standing in the European Union as the main contributor (European Union, 2020b). To compare the findings, Austria, one of the neighboring countries of Germany was selected, because of some similarities such as language, culture, and legislation. Therefore, our study gives an insight into how the effect on CEO remuneration and firm performance and vice versa behaves in Austria and Germany.

This dissertation is composed of six chapters. It starts with an introduction and is followed by the literature review, focusing on CEO remuneration and firm performance, as well as their (simultaneous) relationship. In the third chapter, the hypotheses are presented. The empirical procedure, consisting of the sample and the methodology, is explained in chapter four. The following section contains the empirical results of our investigation before a conclusion is drawn in the last chapter. Chapter six also briefly describes the limitations of the work and gives suggestions for further research.

2. Literature Review

2.1. CEO remuneration

The remuneration can be used as a motivation tool to align the interests of the CEOs with those of the shareholders. In doing so, it is the responsibility of the shareholders, respectively the board of directors, to define the general strategy of the firm and the goals (Cordeiro, Veliyath & Eramus, 2000; Oehmichen, Jacobey & Wolff, 2020). This financial motivation can be necessary due to the different views of the firm orientation between the managing director and the owners. However, these differences can lead to a conflict, as well as the separation of ownership and control and information asymmetry. This problem is called agency theory and started to deserve literature's attention in the early 1970s. Jensen and Meckling (1976) defined the agency relationship as an agreement where one or more persons – the principal(s) – allow another person – the agent - to act and make decisions on their behalf. The theory aims to bring the individual actors into equilibrium to achieve the results.

Both agent and principal are interested in maximizing the personal economic gain, which may lead to a misalignment. The company's owner (principal) often has a contradictory view as the firm management (agent) regarding goals, risk preferences, and time horizon perspectives (Lagoarde-Segot, 2016). While the agent aims to increase the profit in an opportunistic way and make decisions from which he/she participates the most, this may not mean that it is the best for the shareholders or the owners' wealth (Dey, 2008; Villalonga & Amit, 2006).

The remuneration can serve as a tool to mitigate conflicts of interest. Monem and Ng (2013) found out that changes in remuneration of the CEO change the shareholders' wealth. Nevertheless, not only due to this, an optimal contract is beneficial. To develop the firm, the CEOs need to take a particular risk (Oehmichen et al., 2020). In doing so, the optimal contract - an attractive remuneration based on firm performance - is seen as a solution that motivates CEOs to make a maximum effort. Thereby, the agent aims to fulfill the principals' interest to acquire high remuneration to maximize his/her wealth (Aslam et al., 2019; Crespi-Cladera & Gispert, 2003). However, suppose the set targets, which need to be reached to gain the bonus payments, appear to be unachievable. In that case, the incentive contract could backfire in the form of manipulated reports or statements and excessive risk (Oehmichen et al., 2020).

According to Davis and Stobaugh (1995), the agreement also has to cover the responsibility and liability risk as well as to be consistent with transparency in the CEO remuneration setting. Besides that, the principal can limit the divergences, but the contract is made in a context of asymmetric information. In comparison to owners and shareholders, agents can continually observe all firm actions, and therefore, they can influence the set objectives (Dey, 2008; Jensen & Meckling, 1976). Also, just from the view of the CEO's performance, their effort is private information. This private information makes it difficult to evaluate their actual efforts, and some activities cannot be monitored (Crespi-Cladera & Gispert, 2003; Jensen & Murphy, 1990; Smirnova & Zavertiaeva, 2017).

In general, with controlling and monitoring, it is possible to observe transparency, accountability, fairness, or the responsibility of organizational operations. The board of directors plays an important role in this controlling and monitoring process based on the agency theory. Their job, which would be enhanced with the company's corporate governance, is to observe the CEOs' actions or delegate this work to committees (Aslam et al., 2019; Harymawan, Agustia, Nasih, Inayati & Nowland, 2020). Those special committees should protect the shareholders' interests and analyze the actions from a neutral perspective. Among others, there are committees that are responsible for remuneration, budget review, or audit. It makes the structure more complex; hence it may be reflected in the CEO remuneration. However, there is evidence from Indonesia and Malaysia, which documented the opposite. In these two countries, the existence of a remuneration committee leads to higher remuneration of the executives (Harymawan et al., 2020). Brick, Palmon, and Wald (2006) found a highly positive relationship between CEOs' remuneration and those of other directors, which could indicate that they support each other.

Primarily, the CEO's remuneration is based on three components: fixed salary, cash bonus, and share-based bonus (Kirsten & Du Toit, 2018; Liu & Stark, 2009; Smirnova & Zavertiaeva, 2017). On top, firms sometimes pay pension benefits and/or offer one-time payments. While the fixed salary is an amount that is guaranteed to the CEO, without any restrictions, the other two components are connected to conditions. The cash-based remuneration, mainly in the form of a bonus, is focused on current profits. To calculate it, the actual performance is compared to the aimed performance (target). There are different intermediate steps to reach the target, and depending on the steps reached in the defined period, the bonus is distributed. The targets are measured financially or non-financial (Aranda, Arellano & Davila 2019; Choi & Suh, 2019).

In the '90s, stock options became a more important part of a CEO contract (according to Lilling (2006), in 1980, the USA presented 30% stock options in their contracts, within 14 years, it increased by 40%). This change in remuneration structure might indicate that the firms tend to set up more efficient remuneration contracts caused by environmental and institutional changes. It should be an incentive for the CEOs to undertake riskier investments to maximize shareholders' wealth, which is supported by previous studies that found a positive association between equity-based compensation and firms' investment opportunities (Lilling, 2006; Matolcsy, Shan & Seethamraju, 2012). Stock options lead the CEOs to focus more on long-term decisions and put their efforts to increase and maximize the firms' value and long-term performance, which is in line with the interests of the shareholders. Especially, firms who are operating in complex businesses and uncertain environments benefit from this remuneration component, as the decisions and actions of the CEO are harder to control (Choi & Suh, 2019; Jensen & Meckling, 1976; Matolcsy et al., 2012).

However, this subdivision is not always considered in the literature. Some, who took it into account, are, for example, Azim et al. (2011), Banker, Darrough, Huang, and Plehn-Dujowich (2013), Chen and Huang (2010), Gómez-Mejía et al. (2003), and Smirnova and Zavertiaeva (2017). Other scholars sum up the fixed salary and the cash bonus calling it short-term remuneration (Faria, Martins & Brandão, 2014) or cash remuneration (Aslam et al., 2019; Chen & Huang, 2010; Kato & Kubo, 2006; Kirsten & Du Toit, 2018; Lambert & Larcker, 1987; Unite, Sullivan, Brookman, Majadillas & Taningco, 2008), while the share-based bonus (Chen & Huang, 2010; Kirsten & Du Toit, 2018) is also considered on its own as long-term remuneration (Faria et al., 2014). Nevertheless, others completely neglect the single components and use instead only the total remuneration (i.a., Afrifa & Adesina, 2018; Akter, Ali, Abedin & Hossain, 2020; Alves, Couto & Francisco 2014; Bin, Chen & Xuan Ngo, 2020; de Wet, 2012; Parthasarathy, Menon & Bhattacherjee, 2006). In rare cases, non-cash remuneration (Aslam et al., 2019), benefits (Smirnova & Zavertiaeva, 2017), and stock options (Azim et al., 2011) have been used as a proxy for remuneration.

In many countries, disclosure of executive board compensation is required by law so that shareholders can understand the costs and benefits of remuneration plans. However, how detailed the remuneration breakdown has to be is up to each nation (OECD, 2015). This broad interpretation may limit how remuneration can be studied and explains why researchers considered different remuneration components in their studies. For instance, in

Pakistan, a stock-based bonus is rarely considered in CEO contracts. Sheikh et al. (2018) reasoned it with a highly volatile bourse and that, therefore, it is not advisable to set the market performance as a benchmark.

2.2. Firm performance

In the literature, there are different approaches for organizational performance to measure the effectiveness of a business. One approach, the so-called goal-based approach, takes solely the goals which an organization sets for itself into account and evaluates whether these goals are reached or not. The system approach provides another perspective. It considers the achievement of several performance aspects at the same time and thus gives a better overall overview. The third approach is the multiple constituency approach, combining the agenda of various stakeholder groups and their satisfaction (Murphy, Trailer & Hill, 1996). These three theoretical organization perspectives can be divided into hierarchical constructs: financial performance and operational performance. While financial performance is split into profitability, growth, and market value, operational performance is measured as quality, satisfaction (employee, customer), market share position, and innovation (Venkatraman & Ramanujam, 1986). The financial dimension is mainly used for research, as the achievements of the firms' targets can be estimated (Bawa, 2019). According to Bawa (2019) and Carton and Hofer (2006), there are two main approaches for measuring financial performance: accounting-based and market-based. Information obtained from the financial statements are the basis for the accounting method and represents a backward-looking analysis. In contrast, the second approach, which considers the market information, is considered to be forward-looking, demonstrating the current and expected firm performance (Chen & Huang, 2010).

Return on Assets (ROA), Return on Equity (ROE), and Return on Investment (ROI) are the most popular indicators measuring the average efficiency and profitability of a firm from the accounting-based view (Carton & Hofer, 2006; Murphy, Trailer & Hill, 1996). Beyond that, although less commonly used, the Economic Value Added (EVA) counts to the accounting-based measurements as well. ROA is used to measure firms' operations results (de Wet, 2012). ROI indicates the relation between profit and the capital invested (debt and equity) to finance the company (Azim et al., 2011), while ROE shows the firm's owners' return (Heikal, Khaddafi & Ummah, 2014). It is said that those traditional measures (profitability ratios) mislead the corporate performance, as it is derived periodically, and only the income

is considered that has been realized (ex-post). At the same time, for EVA, it is different, and therefore it gained more attention (Kim, 2006).

Compared to the return figures (ROA, ROE, ROI), value creation metrics are based on economic income and not on accounting income. Besides that, in EVA, the gambled risk is included, which arises for the decision-makers, when they try to increase firms' growth and profitability (Bussin & Modau, 2015; de Wet, 2012; Hall, 2013; Kim, 2006). EVA is an internal risk-adjusted measure, balancing too aggressive and too conservational behavior, deducting the income by the product of invested capital and the cost of capital (de Wet, 2012; Kim, 2006; Uyemura, Kantor & Pettit, 1996).

In the market approach, the firms' total value is usually represented by the stock price assumed that the market is efficient. From the theoretical point of view, this approach is more accurate since all relevant firm information is considered and not only a single performance aspect. However, there is a positive relationship between accounting-based and market-based measures (i.a., Abarbanell & Bushee, 1998; Hoskisson, Johnson & Moesel, 1994). So, accounting measures are still seen as a good predictor for future firm performance (Bawa, 2019).

The most used market-based performance indicators are Earnings per Share (EPS) (i.a., Doucouliagos et al., 2007; Faria et al., 2014; Kirsten & Du Toit, 2018); Tobin's Q (TQ) (i.a., Afrifa & Adesina, 2018; Aslam et al., 2019; Raithatha & Komera, 2016); and Total Shareholder Return (TSR) (i.a., Alves et al., 2014; Doucouliagos et al., 2007; Jeppson, Smith & Stone, 2009), while the measures of price-to-book value (Azim et al., 2011), and the Sharpe Index (Smirnova & Zavertiaeva, 2017) were the exceptions.

EPS is an estimator for corporate value and shows how much money a company makes for each share of its stock (net profit/shares outstanding). This measure creates an explicit incentive for the CEO, as it reflects directly excellent and impaired performance in its value (Azim et al., 2011; Faria et al., 2014). The market-based indicator of Tobin's Q represents firm investments and growth opportunities, which expresses the relationship between market valuation and book value. A growth opportunity is assumed to be positively linked to future firm performance (Fu, Singhal & Parkash, 2016; Harymawan et al., 2020). If the market value does not equal the costs for replacement and the book value, the company is seen as overvalued (TQ > 1) or undervalued (TQ < 1) (Blose & Shieh, 1997). A sign for a firm's development and change in the firm value is TSR. TSR measures the increase or decrease of

the stock price and takes into account the results, risk, and growth of the firm (de Mortanges & Van Riel, 2003). The result of the division of price per share by its book value is the price-to-book value (Dita & Murtaqi, 2014). This metric allows firms to compare their market value with their book value. With the Sharpe Index (the difference between average annual stock return and risk-free return divided by annual stock volatility), Smirnova and Zavertiaeva (2017) take into account the risk and return at the same time.

2.3. CEO remuneration and firm performance

The relationship between CEO remuneration and firm performance can be analyzed in two ways; individually and together. It means the impact can be investigated one-sided: remuneration on performance or performance on remuneration, but also two-sided, considering the performance and remuneration simultaneously. In the literature, studies can be found that analyze the relationship between CEO remuneration and firm performance. Contrary to that, the impact of firm performance on CEO remuneration is less considered. The inter-relation is often neglected; only a few researchers investigated both directions of this connection together (i.a., Chen & Huang, 2010; Smirnova & Zavertiaeva, 2017).

The agency theory assumes that there may be a lack of trust between the parties and that the management team behaves more opportunistically instead of pro-organizational (Glinkowska & Kaczmarek, 2015). Critical and warning voices arise that the CEOs' remuneration has driven too far from firm performance (Bebchuk & Fried, 2004). The increased remunerations cannot be explained by the firm's performance and the growth in firm size (Bebchuk & Grinstein, 2005). To overcome this conflict, financial incentives had been implemented into the executives' contracts. The intention was to align the objectives of executives and shareholders. With the aim to maximize the shareholders' value, CEOs should be rewarded, in line with the firm performance, when they were successful, and penalized when they failed the defined targets (Ahn, 2015; Harvey, Maclean & Price, 2019). As a result, the agents' motivation is mainly financial and not the intrinsic satisfaction of doing a job well. This implementation might be a reason why the inner motivation of the CEOs decreased over time, and the offered bonus as compensation might have been insufficient to absorb a motivation loss (Glinkowska & Kaczmarek, 2015; Unger, Szczesny & Holderried, 2020).

But not only the executives have to be motivated. The trend that the remuneration for the top management is rising and a connection to firm performance is not directly observable may lead to dissatisfaction with lower-level management. They could have the feeling that their work is not valued enough. Due to a large remuneration gap, consequently, some employees may decrease their work efforts and avoid taking responsibility. It could end in a weaker performance of the firm (Lin & Lu, 2009).

2.3.1. The impact of CEO remuneration on firm performance

With increased firm performance and the achievement of the previously defined targets of the firm, it is on the CEO to do his/her best, as he/she may benefit from it in the form of bonus payments. A missing relationship between the firm performance and the CEO remuneration and the power of a CEO enhance the agency conflict. This leads to that the CEOs can fulfill their self-interest, such as higher remuneration with less pay-performance sensitivity (Lei, Lu & Ren, 2019). According to the agency theory, the remuneration and the performance should be linked to each other to balance the agent and the principal.

Previous research found out that there is no consistent involvement of CEO remuneration in firm performance (see table 1). Afrifa and Adesina (2018) found robust evidence that the relationship between performance and remuneration is non-linear. Higher remuneration leads only to a certain point to an increase in firm performance. After the breakpoint is reached, an increase in remuneration reduces the performance of the company. It was a new approach which the authors followed, as previous studies mostly assumed a linear relationship.

The study by Akter et al. (2020) also shows that higher salaries do not necessarily lead to better firm performance. Focusing on textile companies listed on the stock exchange in Bangladesh, they found a significant negative link between the two dependent variables, ROA and ROE, and total compensation. The author reasoned that the results could be attributed to an illiquid capital market in Bangladesh and the lack of share-based remuneration. Other control mechanisms are also missing or inadequate so that remuneration and firm performance cannot be reconciled. This observation is against the Corporate Government Code of 2018, which should tie firm performance and remuneration.

Investigating the relationship between performance and remuneration before and after the financial crisis (2006-2009) in Australia, Azim et al. (2011) came to the conclusion that salary, bonus, and options are rather linked to market-based indicators than to accounting

metrics. Large Australian firms have primarily linked their remuneration plans to EPS and price-to-book ratio, leading CEOs to increase these metrics to gain their rewards. After the crisis, they found a positive and significant link between EPS and the components bonus and option. The other performance indicators were not significantly related to the remuneration. The authors reasoned that the salary and other remuneration are generally fixed. It does not matter how the CEOs perform, while EPS is set as a hurdle for the other two components.

Table 1 – Findings of pay on performance relationship

Author	Sample	Dependent Variable	Independent Variable	Control Variable	Methodology	Findings
Afrifa & Adesina (2018)	- United Kingdom - 2005-2012 - Listed SME's (AIM) w/o financial firms, firms w/ anomalies & missing information	- Tobin's ratio - Market value of firm to total assets - Market value of equity to book value of equity	- Total remuneration - Total remuneration^2	- Assets tangibility - Company age - Company size - Leverage - Liquidity ratio - Short-term financing - Dummy (industry)	Panel data analysis with fixed effects	Total remuneration is significant and positively related to Tobin's Q, market value of firm to total assets, and market value of equity to book value of equity.
Akter et al. (2020)	- Bangladesh - 2011-2017 - Listed textile firms (DSE)	- ROA - ROE	- Total remuneration	- Age of firm - Efficiency - Leverage - Percentage of independent directors - Size	Generalized Method of Moment (GMM)	Total remuneration is significant and negatively related to ROA and ROE.
Azim et al. (2011)	- Australia - 2007-2008 -Listed firms (ASX) w/o financial firms	- Accounting-based (ROA, ROE, ROI) - Market-based (EPS, dividend yield, price-earnings ratio, price to book value)	- Salary - Bonus - Options - Other remunerations	- Firm size - Market capitalization - Total assets	Ordinary Least Square (OLS)	Options are significant and positive (negative) related to EPS and price-to-book value (ROA). Bonus is significant and positively related to EPS and dividend yield, however not significantly related to ROA, ROE, and ROI. Salaries are positive and significantly related to EPS, dividend yield, and price-to-book ratio, however, ROA and ROE are insignificant.

2.3.2. The impact of firm performance on CEO remuneration

From the organization for economic co-operation and development (2011), better known as OECD, is a remuneration structure recommended that promotes the firm's long-term sustainability with remuneration based on performance. Also, non-financial criteria should be considered. Many countries followed the recommendation of the OECD (2015) and implemented it into their national law. Therefore, the relationship between executives' remuneration and firms' performance has been analyzed by several researchers. Table 2 presents a set of studies investigating this relationship applied to listed companies (exception: Kato and Kubo (2006) also considered unlisted firms).

Kirsten and Du Toit (2018), who used accounting-based and market-based measures for firm performance, did not find a significant relationship between remuneration and the performance metrics ROA and ROE. They concluded that these traditional performance measures do not directly impact remuneration in the consumer goods and service industry, while performance measured as share price affected remuneration more. Their findings may indicate that the share price serves as a base for the remuneration guidelines. Contrary, de Wet (2012), investigating also listed firms in South Africa, reported significant relationships between total remuneration and traditional performance indicators (ROA, ROE) and EVA and the market value added. However, the relationship between the accounting measures ROA and ROE was stronger than those with EVA, and the market value added. With regard to South Africa, he concludes that remuneration is more geared towards accounting profit than value creation.

After new legislations in 2009 and overcoming the economic cycle, Bin et al. (2020) analyzed the pay-performance relationship in China. He noticed robust evidence that ROA and stock return – two performance indicators are positive and significantly linked to CEO remuneration, even though the Chinese stock market was volatile and fluctuating. Furthermore, it is observable that the incentives are more driven by accounting measure (ROA) than market value measure (stock return). However, this connection is influenced by some other factors, such as ownership and duality.

Further studies in Asia have been made in Japan, where the considered indicators were ROA and stock return. ROA was significant for all analyzed models (Kato & Kubo, 2006). However, the significant association with stock return needs to be interpreted with care, as

only a small number of listed firms were analyzed. Similar to Bin et al. (2020), Kato and Kubo (2006) affirm a bigger tendency towards a less stock market-sensitive remuneration.

The studies of Raithatha and Komera (2016) and Doucouliagos et al. (2007) differ from the before-mentioned studies. They considered the last year's performance besides the previous year's current performance. Raithatha and Komera (2016) used ROE and TQ to measure performance. Their findings evidence for both metrics - contemporaneous and last year's performance - a significant link to remuneration. This connection is explained by the firms' past performance and the gained information, which can be used to forecast the executive's future ability. On the other way round, past remuneration might influence contemporaneous remuneration. Positive and statistically significant findings are provided by Doucouliagos et al. (2007), who investigated the responsiveness of total CEO remuneration and different performance measures within a lag of one year in the Australian banking sector. This association between total remuneration and EPS, ROA, ROE, and shareholder return, respectively, shows that at least in one dimension the remuneration is tied to firms' performance.

There are also results from Europe about the relationship between CEO remuneration and firm performance. Based on a study in Portugal, Alves et al. (2014) found out that specific company factors are the main drivers for the differences in pay, not performance. According to the authors, firm performance, measured in TSR, explains only a small percentage of CEO remuneration (3,2%). Nevertheless, the positive and significant relationship, both for the current and the previous year, confirms the performance-driven remuneration. Gibbons and Murphy (1989) (mixed sample) also used the shareholder return to measure firm performance in their study. They found that CEO salaries and bonuses were positively and significantly related to shareholder return. In addition, they included the industry return. They found out that it has a negative impact on remuneration, which led them to conclude that CEO remuneration is being adjusted in line with industry trends. Besides, they observed that the more broadly the industry was defined, the closer it was to the CEO salary.

While Gibbons and Murphy (1989) used industry codes, Faria et al. (2014) focused on one specific industry: the high-tech industry. The benchmark for the high-tech companies was the listing in the American share index Standard & Poor's 1500. They found that EPS is negatively and significantly linked to long-term CEO remuneration. This result makes it clear that there is no contractual regulation that combines CEO remuneration and firm

performance. However, when firm performance is measured using ROA, there is a positive and significant relationship. It was found that differentiated performance measurements were used to determine the CEO remuneration. In addition, by dividing the remuneration into short-term and long-term, it was observed that short-term influences have less of an impact on long-term remuneration

Table 2 - Findings of performance on pay relationship

Author	Sample	Dependent Variable	Independent Variable	Control Variable	Methodology	Findings
Alves et al. (2014)	- Portugal - 2002-2011 - Listed firms	- Total remuneration	- Shareholder return	- BoD characteristics - CEO characteristics - Firm characteristics - Shareholders & ownership characteristics	Pooled Ordinary Least Squares (POLS) and panel data	Shareholder return is positively related to the total remuneration but only explains a fraction.
Bin et al. (2020)	- China - 2009-2015 - Listed firms (SHSE, SZSE)	- Total remuneration	- Annual stock price return - ROA	- Board structure - Leverage - Ownership - Risk - Size - Tobin's Q - Dummy (area, industry, year)	Pooled Ordinary Least Square (OLS) and panel data with fixed effects	ROA is positively and significantly related to the total remuneration. Also, an annual stock price return is significantly related to total remuneration.
de Wet (2012)	- South Africa - 2006-2010 - Listed firms (JSE)	- Total remuneration	- ROA - ROE - EVA - MVA - WACC		Panel data	EVA, MVA, ROA, and ROE are significantly positively related to the total remuneration. In comparison to findings for the USA, the impact of ROA and ROE, considered together, on the total remuneration is higher than of EVA and MVA.
Doucouliagos et al. (2007)	- Australia - 1992-2005 - Australian listed banks (ASX)	- CEO remuneration	- EPS - ROA - ROE - Shareholder return	- CEO/directors age - Governance - Size - Ownership	Ordinary Least Squares (OLS) and panel data with fixed effects	With a one-year lag, all variables are significant and positively related to the total remuneration.

Author	Sample	Dependent Variable	Independent Variable	Control Variable	Methodology	Findings
Faria et al. (2014)	- USA - 2000-2010 - High-Technology firms listed in S&P 1500	- Short-term (salary, bonus) - Long-term (equity-based)	- Change of assets in % - EPS excluding extraordinary items - Net income before extraordinary items - Operating income before depreciation - ROA - Total assets - Total annual net sales	- Increase in sales - Shareholder wealth - Size	Seemingly Unrelated Regression (SUR)	Sales growth and total assets are significant and positively related to cash remuneration, EPS is significant and negative related to share-based remuneration.
Gibbson & Murphy (1989)	- Firms which were listed in Executive Compensation Surveys by Forbes - 1974-1986 - Publicly held corporations	- CEO pay (salary & bonus)	- Shareholder return	- Industry - Market return	Ordinary Least Square (OLS)	CEO pay is positively and significantly related to shareholder return, industry and market return are both negative and significantly related to CEO pay.
Kato & Kubo (2006)	- Japan - 1986-1995 - 18 listed and 33 unlisted firms (survey)	- Annual cash compensation (salary & bonus)	- Changes in ROA - Pre-tax profit/negative profit - Sales growth - Stock return		Ordinary Least Square (OLS)	Sales growth, stock return, and ROA change, each considered individually, are significantly related to the total remuneration. If they are considered together, only the change in ROA is significant.
Kirsten & Du Toit (2018)	- South Africa - 2006-2015 - Listed firms (consumer goods & service industry)	- Remuneration (salary & bonus) - Share-based	- ROA, ROE (percentage) - EPS, Price per Share - Turnover (total)	- Debt to equity ratio	Generalized Least Square	ROA and ROE are not significantly related to cash-based and share-based remuneration.

Author	Sample	Dependent Variable	Independent Variable	Control Variable	Methodology	Findings
Raithatha & Komera (2016)	- India - 2002-2012 - Listed firms w/o financial, state-owned, joint sector firms & w/ negative net worth	- Total remuneration	- Accounting measure (ROE) - Market measure (Tobin's Q)	- Leverage - Market risk - Size - Dummy (year)	Pooled Ordinary Least Squares (POLS) and panel data with fixed effects	ROE and Tobin's Q are significantly and positively related to total remuneration. Also, when ROE and Tobin's Q are lagged.

2.3.3. The simultaneous impact of CEO remuneration and firm performance

From psychologists' perspective, it is affordable to define challenging and specific targets, which the CEO has to achieve. They assume, as long as the goal does not seem unachievable, that all employees are motivated to get the bonus and try their very best. Those targets are formulated by shareholders, whereby the principals are able to guide the CEO in the direction of their interests (Aranda et al., 2019; Gerhart & Milkovich, 1990). It is a method to align the agent and the principal, while the opportunistic behavior of the CEO is reduced, and his/her actions increase the wealth of the shareholder. It can be said that corporate performance may impact CEO remuneration, which can, on the other side, affect firm performance (Aranda et al., 2019; Lilling, 2006; Oehmichen et al., 2020). However, the formulation of the targets should not be over-explicit. In case the other goals of the CEO besides the monetary ones, such as his/her reputation and career perspective, are not in line with the strategic goals of the firm, the motivation might decrease, as well as the performance of the firm because of unfulfilled targets (Oehmichen et al., 2020).

Therefore, an effective remuneration arrangement is required. The salary has to be fair and needs to reward the CEO appropriately so that the CEO acts in the best for the company. Smirnova and Zavertiaeva (2017) found a positive and significant link between accounting-based indicators and remuneration. It accords with the results of Chen and Huang (2010), saying that, in the British banking sector, the remuneration is sensitive to ROE (see table 3). Also, Banker et al. (2013) had similar findings for the relationship between remuneration components and ROE. But the results for the relationship of stock return differ compared to those of Chen and Huang (2010).

In contrast, Aslam et al. (2019) documented a positive and significant relationship of cash-based remuneration with market-based measures (EPS and TQ), indicating that CEO pay in Pakistan is related to firms' market performance. Furthermore, researchers observed a link between the firms' market value and the remuneration, which is closer in the short term, especially for bonus payments, than the previous year's performance. On the other hand, salary and stock options are less responsive to short-run performance (Chen & Huang, 2010). It supports Banker et al. (2013) observations that salary and stock options are more sensitive for previous ROE, and previous stock return is positive and significantly related to these two remuneration components.

Table 3 - Findings of the inter-correlation of pay and performance

Author	Sample	Dependent Variable	Independent Variable	Control Variable	Methodology	Findings
Aslam et al. (2019)	- Pakistan - 2009-2016 - Listed firms (KSE), w/o financial firms and firms w/ incomplete financial statement	- Cash-based remuneration - Non-cash remuneration	- EPS - ROA - Tobin's Q	- Board size - CEO duality - Debt to equity - Family ownership - GDP - Remuneration committee - Total assets	Generalized Method of Moment (GMM)	Tobin's Q and EPS are positively and significantly related to the cash-based remuneration. The relationship between non-cash remuneration and the performance indicators are insignificant and for EPS negative.
		- EPS - ROA - Tobin's Q	- Cash based remuneration - Non-cash remuneration	- Board size - CEO duality - Consumer price index - Debt to equity - Family ownership - GDP - Total assets		Cash-based remuneration is negatively related to Tobin's Q and EPS. Non-cash remuneration is positive and significantly related to all dependent variables.
Banker et al. (2013)	- USA - 1993-2006	- Salary - Bonus - Total remuneration - Equity Pay	- ROE_t - ROE_{t-1} - Stock $return_t$ - Stock $return_{t-1}$	- Size	Feasible Generalized Least Square (FGLS)	ROE_t is positive and significantly related to salary, bonus, total remuneration. Stock $return_t$ is positive and significantly related to all remuneration parts. ROE_{t-1} is significantly related to salary, bonus, and equity pay, whereas, for bonus, it is negative. Stock $return_{t-1}$ is positive and significantly related to salary and equity pay.
		- ROE_{t+1}	- Salary - Bonus - Total remuneration - Equity Pay - ROE_t - ROE_{t-1} - Stock $return_t$ - Stock $return_{t-1}$			While salary and total remuneration are positively and significantly related to future ROE, equity pay has a significant negative relationship. ROE_t, ROE_{t-1}, and stock $return_t$ are positive and significantly connected with future ROE.

Author	Sample	Dependent Variable	Independent Variable	Control Variable	Methodology	Findings
Chen & Huang (2010)	- USA - 1992-1997 - Banking industry	- Total remuneration - Salary - Bonus - Cash (salary & bonus) - Stock option	- ROE - Stock return	- Market-to-book value - Standard deviation daily stock returns - Total assets	Ordinary Least Square (OLS) & Two-Stage Least Square (2SLS)	ROE is significant and positively related to the total remuneration, salary, bonus, and cash-based remuneration, the stock option is positively related. Stock return is negatively related to the salary.
		- ROE - Stock return	- Salary - Bonus - Cash-based (salary & bonus) - Stock option			Cash-based remuneration and bonus are significant and positively related to ROE. With the two-stage least square method bonus, cash-based remuneration and stock option are significant and positively related to stock return (no significant relation using the ordinary least square method).
Smirnova & Zavertiaeva (2017)	- Great Britain, Germany, France, Switzerland, Italy, Spain, the Netherlands - 2009-2013 - Listed firms	- Total remuneration - Salary - Bonus - Benefits	- ROA - Sharpe Index	- CEO characteristics - Firm characteristics - Dummy (industry, year)	Panel data analysis with fixed effects	ROA is positively related to the total remuneration and bonus, while the Sharpe Index is negatively related to the fixed salary.
		- ROA - Sharpe Index (SI)	- Total remuneration - Salary - Bonus - Benefits	- Leverage - Liquidity ratio / ROE - Total assets - Sales growth - Dummy (industry, year)		Total remuneration and bonus are related to ROA, and bonus is significant and positively related to Sharpe Index.

3. Hypotheses

Most studies examining the relationship between CEO remuneration and firm performance have found a positive link. As referred to in the literature review, one of the factors that underline such a positive relationship is the agency theory. It is assumed that the CEOs are motivated to perform at their best with financial incentives, which has a correspondingly positive effect on firm performance (Smirnova & Zavertiaeva, 2017). Under certain circumstances, this can result in better monitoring of the CEO, so that the asymmetrical distribution of information could be reduced. The CEO is encouraged to reveal his/her true skills in order to achieve the goals, which in turn have a positive effect on remuneration and performance (Aslam et al., 2019; Banker et al., 2013).

In previous research, statistically significant support for a positive relationship can be found for accounting-based measures such as ROA (Bin et al., 2020; de Wet, 2012; Kato & Kubo, 2006; Smirnova & Zavertiaeva, 2017), and EVA (de Wet, 2012), but also for stock return (Bin et al., 2020; Kato & Kubo, 2006) and other market-based measures (Doucouliagos et al., 2007). Also, examining the relationship between current CEO remuneration and firm performance of the previous year, positive and statistically significant results were obtained (ROA, ROE, EPS, shareholder return) (Doucouliagos et al., 2007).

Taking into account the agency theory, the national law and combined with the largely positive results of previous research, we hypothesize:

Hypothesis 1: There is a positive impact of CEO remuneration on firm performance.

The total remuneration consists of different components, such as the base salary, cash bonus, long-term bonus, and other benefits (pensions, car, monetary benefits, etc.), whereby the long-term bonus is often granted in the form of stock options (share-based bonus) (Kirsten & Du Toit, 2018; Liu & Stark, 2009; Smirnova & Zavertiaeva, 2017).

While the base salary is a remuneration component that is contractually fixed, cash bonus and share-based bonus are variable remuneration components. Both variable salaries are incentives for the CEO to achieve the firms' targets. The cash bonus is an additional monetary payment related to the firm's past performance, and once it is paid, it is not affected by firms' risk, which could arise in the future (Atif, Huang & Liu, 2019). The main criterium is mostly the profit which the firm gained in the last fiscal year, from that the CEOs (and

sometimes also the other employees) participate in a certain percentage (1%-15%) (Han & Shen, 2007). Nonetheless, the shareholders see a cash bonus critically because it is a matter of short-term bonus and can be influenced by the CEO (e.g., earnings management) (Atif et al., 2019). The share-based bonus is long-term-oriented, taking into account the future value and performance of the firm (Atif et al., 2019).

It seems to be consistent with the common design of contracts made by the firms that some researchers state that the fixed salary does not depend on performance. Rather, the consensus is that the bonus is the incentive-based component and is, therefore, the main driver for a significant pay-performance relationship (Chen & Huang, 2010; Doucouliagos et al., 2007; Smirnova & Zavertiaeva, 2017). Analyzing the specific case of the linkage between fixed salary and firm performance, there are mixed findings, while much positive evidence has been found investigating the relationship between the variable remuneration and firm performance.

On the one hand side, there are several findings for the influence of base salary on performance, considering with accounting-based (ROA, ROE) measures as well as market-based (EPS, shareholder return) measures where no statistically significant relationship could be found (Chen & Huang, 2010; Doucouliagos et al., 2007; Smirnova & Zavertiaeva, 2017). Thus, the independence of base salary from performance and the dependence of the influence of the variable remuneration is supported. However, on the other hand, some findings show significant positive evidence. An argument for a positive relationship is the information about the ability of the CEO (higher salary = higher ability), which is enhanced by using the past performance (ROE, stock return). It indicates that past performance is more sensitive to contemporaneous remuneration (Banker et al., 2013; Doucouliagos et al., 2007). Besides, a significant negative result was reported using Sharpe Index as a market-based performance indicator (Smirnova & Zavertiaeva, 2017), but this indicator was rarely used in the literature.

The bonus remuneration, especially the short-term payment, is a part of most CEO contracts, as it is seen as a good incentive to improve firm performance (Chen & Huang, 2010). A study reveals that better-paid executives tend to achieve better improvements in firm performance (Smirnova & Zavertiaeva, 2017). These reasons are in line with the agency theory. Additionally, some firms defined in their policies or directly in the contract individual metrics that serve as the bonus base. Evidence for a significantly positive

relationship was obtained with market-based indicators such as shareholder return and share price. Setting share performance as a metric, it is directly observable whether the shareholder wealth could be improved or not (Gibbons & Murphy, 1989; Kirsten & Du Toit, 2018). Also, for accounting performance metrics, positive and significant connections have been reported (ROA - Faria et al., 2014; Smirnova & Zavertiaeva, 2017; ROE - Chen & Huang, 2010). But there are not only positive results: in a specific case (high-tech industry), analyzing the pay on performance relationship, where performance was measured in EPS, the findings were significantly negative. The researcher concluded that the country where the firms are located and the regarding circumstances plays a role (Kirsten & Du Toit, 2018) as well as the branch and the individual company policies (Akter et al., 2020; Faria et al., 2014; Smirnova & Zavertiaeva, 2017).

In both laws, Austria's and Germany's, it is defined that the variable part of the remuneration should be connected to financial and non-financial criteria. However, it is not clearly defined which performance measures should be linked to the remuneration. Also, Faria et al. (2014) concluded that the determination of the CEO remuneration is dependent on the use of sophisticated performance measurements of the firm. It can be assumed that especially the variable remuneration component has an impact on the firm performance, as the CEOs can participate directly and can increase their remuneration, while the salary is a fixed amount that they earn, does not matter how good or bad their personal performance was. However, some significant and positive relationships were found.

Hence, hypothesis 1 can be divided into the following hypotheses:

Hypothesis 1a: There is a positive impact of CEOs' fixed salaries on firm performance.

Hypothesis 1b: There is a positive impact of CEOs' variable remuneration on firm performance.

The literature provides evidence that there is an interrelation. Not only does higher remuneration leads to better firm performance, but vice versa: increasing firm performance also leads to an increase in CEO remuneration.

Both the contractual agreements and the agency theory sustain a positive impact of remuneration on performance. The OECD (2015) recommended that the remuneration of the executive board should be linked to financial and non-financial firm performance. Many countries introduced it into national law, thus certain goals are linked directly to performance

indicators. As the CEO is familiar with these goals in advance, he/she could work explicitly towards the achievement of the goals in order to benefit financially (Chen & Huang, 2010). If a higher bonus is paid to the CEO, the improvements in market performance are greater (Smirnova & Zavertiaeva, 2017). Several authors found positive results for a performance-pay relationship (Afrifa & Adesina, 2018; Azim et al., 2011; Chen & Huang, 2010; Smirnova & Zavertiaeva, 2017).

However, other authors came to different results examining the relationship between firm performance and CEO remuneration. One factor why a positive relationship was not found could be the declaration of the remuneration; fixed remuneration may not be influenced by performance but the variable component. Another factor is discrepancies with both individual performance indicators and the general relationship between accounting and market-based measures and the remuneration components. Splitting the remuneration into different components could help to understand those mixed results.

The accounting-based measure ROA was linked with bonus and total remuneration (Smirnova & Zavertiaeva, 2017), and ROE was significantly related to cash-based remuneration and bonus (Chen & Huang, 2010). Significant and positive relationships were also detected using market-based measures; Smirnova and Zavertiaeva (2017) used the Sharpe Index as metrics which was significant and positively related to the bonus. For EPS, a significant connection with all remuneration components was found (Azim et al., 2011). Research from Pakistan provides evidence that TQ is positive and significantly connected to remuneration (Aslam et al., 2019).

However, some studies reached different results, arguing that the CEO acts pro-organizational contrary to the agency theory. Money is not the relevant motivator but instead the inner satisfaction to do a job well (stewardship theory) (Aslam et al., 2019). From the financial point of view, it is mentioned that a relatively high fixed salary is counterproductive as the CEO is not or insufficiently motivated to improve the company (Smirnova & Zavertiaeva, 2017). In general, it is believed that a higher remuneration cannot improve the firm performance on a sufficient dimension that the financial decrease that arises due to the rise in remuneration can be covered (Akter et al., 2020). Thus, some researchers came, different to the before-mentioned findings, to the result that some of these performance variables such as EPS (Aslam et al., 2019), ROA (Akter et al., 2020), ROE (Akter et al., 2020), Sharpe Index (Smirnova & Zavertiaeva, 2017), and TQ (Aslam et al., 2019) are

negative and significantly associated with CEO remuneration components. EPS and TQ, respectively, are significant and negatively related to the cash remuneration of a CEO. For the relationship between Sharp Index and fixed salary, it was also a negative relationship found. A study analyzing the textile industry in Bangladesh provides evidence for a negative and significant relationship between the performance metrics ROA and ROE, respectively, and board remuneration (Akter et al., 2020).

A factor that needs to be kept in mind studying this relationship is the analyzed period and if it is used present or future impact, as it may influence the results and conclusions. For example, during a crisis, the impact of firm performance on the CEO remuneration is greater than in normal periods. Hence a lower performance affects the CEO's remuneration sharply (Afrifa & Adesina, 2018; a dummy CRISIS extended the model; the coefficient of the new dependent variables were greater than the regular ones). Moreover, the belief in asymmetric information about the CEOs' competencies which is connected with the agency theory, was enhanced by a different approach made by Banker et al. (2013). They investigated the link between future ROE and the remuneration components. While salary and total remuneration are positively and significantly related to future ROE, equity pay has a significant negative relationship. From previous firm results, it can be drawn a conclusion of the CEO's future ability. Was the past performance high, the fixed remuneration could be increased, and at the same time, the bonus component could be decreased because, from the actual salary, the future firm performance can be predicted (because of positive correlation over time).

There is no consensus on the extent to which firm performance is linked to the CEO's remuneration in the literature. However, since the CEO's performance is often seen as a decisive factor in how the company's performance is, we hypothesize:

Hypothesis 2: There is a positive impact of performance measures on CEOs' remuneration.

4. Empirical Procedures

4.1. Sample

4.1.1. Sample countries

This work aims to shed light on the relationship between CEO remuneration and firm performance. For it, we investigated the influence of remuneration on performance, the influence of performance on remuneration, and as remuneration and performance may influence each other at the same time, the simultaneous impact. For this undertaking, we consider listed firms since they have to disclose several key performance indicators and their executives' remuneration. In addition, for listed firms, we obtain market-based data, why we are able to analyze the relationship from two performance perspectives (market and accounting perspective). Taking into account the literature review carried out, we observed that most of the studies were made in non-European countries. Therefore, to fulfill the lack of studies exploring European countries, this study considers two: Austria (AT) and Germany (DE).

Germany was chosen because of its standing in the European Union (EU). A gross domestic product of 3.231 billion euros in 2019 (The World Bank, 2020) makes the founding member of the EU the largest economy of the compound of states. With a budget of 1.552 billion euros, Germany is the main contributor to the EU budget (AT: 192 billion euros) (European Commission, 2019). Furthermore, Germany delegates 96 of the 705 members of the European Parliament (AT: 19 seats) (European Union, 2020b). That is the maximum number that is allowed and enhances the impact of this country.

To compare results, we decided to include another country, which is Austria. Both Austria and Germany not only have in common that they are neighboring countries, but they also have the same currency and speak the same national language. Besides that, the two countries are also comparable in terms of quality of life, economy, and culture.

From an economic point of view, the gross domestic product (GDP) per capita is almost identical at 46.550 euros in Austria and 46.927 euros in Germany (The World Bank, 2020), as is the inflation rate (AT: 1,5%; DE: 1,4% - Statistisches Bundesamt, 2020). On average, an Austrian employee earned 3.254 euros per month, the monthly gross income in Germany for a full-time employee was 461 euros above the Austrian average (Statista Research

Department, 2020). What must be considered in the evaluation is the fact that the top tax rate in Austria is 55%, while in Germany, it is 45% (Rudnicka, 2020). Both countries are connected due to strong trade relations, in which Austria is more dependent on Germany (30% of 71% Intra-EU export, 41% of 78% Intra-EU import) (European Union, 2020a). According to Hofstede's six dimensions (power distance, individualism, masculinity, uncertainty avoidance, long-term orientation, and indulgence), Austria and Germany achieved similar scores (Hofstede Insights, 2020).

Therefore, this study focuses on listed firms from Austria and Germany, specifically on their leading share index.

Leading share index

The Austrian Traded Index (ATX) is Austria's most important share index, started on January 2nd, 1991. It is a price index of blue-chip[1] enterprises listed at Wiener Börse. ATX is composed of 20 of these enterprises and reviewed twice a year (March and September), at which a maximum of three changes could be made. The main criteria for inclusion or deletion are capitalized free float and stock exchange turnover (Martinović, Hunjet & Turcin, 2020; Wiener Börse, 2021).

The German stock index, in short DAX (*Deutscher Aktienindex*), was introduced on December 30th, 1987. The DAX contains the share values of 30 German listed companies (Börse, 2020)[2].

Around 75% of the market capitalization of listed stock corporations in Germany is represented by the DAX. To be included in the DAX, a company must be at least 10% in free float. The company should also be based in Germany, but the trading volume of shares must be focused in Frankfurt or another European country. Further criteria include exchange turnover and market capitalization to remain in the DAX or be included (Börse, 2020).

Remuneration legislation

In relation to remuneration legislation, since July 1st, 2012, a law has been in force in Austria that requires listed companies to transparently disclose executives' remuneration and also to clarify their appropriateness. It is the duty of the supervisory board to determine whether the

[1] Blue-chip is the description of listed companies with high solvency, good growth prospects, and regular distribution of dividends.
[2] In the middle of September 2021, there will be reforms. Among other things, the number of firms included in the DAX increase by ten (Deutsche Börse, 2021).

total remuneration of the members of the management board is appropriate. This is stipulated in §78 of the AktG (stock corporation law; *Aktiengesetz*), where it is also defined that, among other things, salaries, profit sharing, commissions, and fringe benefits of any kind are part of the total remuneration. The remuneration must be in an appropriate relationship to the tasks and performance of each member of the management board and take into account the situation of the company as well as the remuneration customary in the industry.

This requirement is specified in the C-27 rule of the Austrian Corporate Governance Code, which does not form a legal basis, but deviations must be explained and justified. The rule states that the variable remuneration should be linked to long-term, sustainable, and multi-year performance criteria, and non-financial criteria should also be included.

The Austrian Commercial Code (*Unternehmensgesetzbuch*; UGB) stipulates, among other things, the legal basis for accounting and the supplementary regulations for publicly listed companies, whereby §239 is of particular importance for remuneration and §243b to ensure transparency.

With the passage of the Stock Corporation Law Amendment Act (*Aktienrechts-Änderungsgesetz*; AktRÄG) in 2019, there were some changes, especially for listed companies. §78 AktG is significantly affected. Criteria for determining the remuneration of board members have been defined, the remuneration policy must be voted on at the annual general meeting at least every four years and earlier in the case of major changes, and an annual remuneration report must be prepared. This report must be submitted to the shareholders for a vote; however, the result of the vote is not binding, it is merely a recommendation.

In Germany, regarding remuneration legislation, §161 AG (stock corporation law; *Aktiengesetz*) requires that the management board and the supervisory board of a listed company comply with the behavior of the "Government Commission of the German Corporate Governance Code" *(Deutscher Corporate Governance Kodex;* DCGK) and follow the recommendations. Additionally, a law came into force on August 5th, 2009, regarding the appropriateness of the remuneration of the management board of stock corporations. One of the goals is to tie manager remuneration to the company's success. The German Commercial Code (*Handelsgesetzbuch;* HGB) serves as the basis for the remuneration of executives; in § 285 paragraph 1, number 9 HGB is stated that all total remuneration for the financial year must be disclosed in the balance sheet by the management

board and the supervisory board of a listed company. In the Executive Compensation Disclosure Act (*Vorstandvergütungs-Offenlegungsgesetz,* VorstOG), the disclosure requirements are further specified. Since 2005 the VorstOG has been in force and states that all publicly listed companies must disclose the remuneration components for each executive, which can be, for example, salary, expense allowance, commission, profit-sharing, or other share-based payments.

Furthermore, in November 2019, new guidelines regarding shareholder rights were adopted, which, once implemented, will also affect the guidelines on the structure and disclosure of executive salaries.

4.1.2. Data

As our sample, we selected the companies listed in the leading share index of Austria, called ATX, and Germany, called DAX. Secondary data of those companies are collected from 2012 until 2019. We chose this period to have a homogenous sample, as in Austria, it was not mandatory to disclose the executives' remuneration of publicly listed companies before 2012. The data for 2019 is the latest that we can obtain.

The data of the Austrian CEO remuneration was provided by AK Wien[3], an organization to advocate and represent the social, cultural, economic, and job-related interests of workers and employees. They collected the data from the corporate governance, financial- and annual reports of the firms to publish it in their studies. These studies deal with the background, development, and trend of the remuneration of all executives of ATX companies.

To obtain data for the CEO remuneration in Germany, we use a database from Professor Daniel Beck and his colleagues from the Technical University Munich (Germany)[4]. They constructed a database similar to the American database ExecuComp, adapted its structure, and standardized the data as much as possible to facilitate empirical research (Beck, Friedl & Schäfer, 2020). Besides the information on the remuneration, the database also contains information about the CEO as well, such as age, nationality, board entry, and board exit.

[3] This data was made available to us free of charge. Contrary to the published studies of AK Wien, this data set was specially prepared for our needs.
[4] This data was made available to us free of charge. If this work is to be published, written approval must first be obtained from the data collector. If there is a fundamental interest in the data set, this can be requested from Daniel Beck (see also the article in the references).

The firms' accounting and market data were obtained from Thomson Reuters Datastream, one of the leading professional market and financial data databases. Additionally, we used data (10-year government bond) from the OECD database to get the risk-free rate of return. As a proxy for the market return, historical data of ATX from the Vienna Stock Exchange and DAX from boerse.de, respectively, were collected.

Due to their specific accounting practice, financial firms such as banks and insurance companies are excluded from our sample, following Azim et al. (2011), Afrifa and Adesina (2018), and López-Iturriaga, García-Meca, and Tejerina-Gaite (2015). In addition, the real estate management firms are neglected because their business – renting and selling properties – is not comparable to the other ones. Also, Wirecard is not considered in our research, as they are involved in a scandal of fake financial statements, which led to bankruptcy after it became public.

After taking this into account, the sample consists of 18 Austrian and 31 different German companies listed in the ATX or DAX between 2012 and 2019. In total, we achieved 392 firm-year observations - 144 from Austria and 248 from Germany. It is an unbalanced panel because the firms listed in the Austrian and German leading share index could change over the years, as mentioned before, some companies did not meet the requirements (e.g. market capitalization), and therefore, other firms were included.

4.2.Methodology

4.2.1. Variables

Remuneration variables

Among others, Banker et al. (2013) and Smirnova and Zavertiaeva (2017) came in their studies to different conclusions regarding the influence of performance indicators on the components of remuneration. A base salary is a fixed sum that the employer pays his employees, regardless of the employee's performance and the company's economic performance. In addition, the employee can still receive special payments that are linked to certain previously defined benefits and/or goals.

In Austria, the firms report, besides the fixed salary (SALARY), a variable remuneration, which includes the annual bonus as well as payments of mid-and long-term incentive programs (BONUS) (Wieser, 2020). In Germany, the remuneration consists of six components that have to be disclosed; fixed salary, one-year bonus, multi-year bonus, stock-

based compensation, pensions, and one-time payments (Beck et al., 2020). For better comparability, we summed up the separate listed variable remuneration components one-year bonus, multi-year bonus, and stock-based compensation to one variable remuneration component. We neglect pension and one-time payments because they do not need to be disclosed in Austria. Therefore, it would complicate the comparison between the two countries.

For this reason, CEO remuneration is split into two main endogenous variables for analysis into their components: salary and bonus. In addition, we have total remuneration (TOTAL), where besides SALARY and BONUS also other benefits (pension, rent, one-time payments, etc.) are considered. We follow most of the research and use the natural logarithm of the remuneration instead of the absolute value in euro (e.g. Afrifa & Adesina, 2018; Alves et al., 2014; Aslam et al., 2019; Bin et al., 2020; Kato & Kubo, 2006).

Performance variables

The second main variable of this study is firm performance. We distinguish the measurement of firm performance between accounting-based and market-based perspectives like Aslam et al. (2019), Azim et al. (2011), Bin et al. (2020), Kirsten and Du Toit (2018), and Raithatha and Komera (2016), among others, as mentioned before the results may be different.

In the literature, there are different measures used for an accounting-based perspective. We choose ROA and EVA. ROA is considered as a traditional indicator, showing how effectively the firms' assets are used and was considered by many researchers before (i.a. Bin et al., 2020; Doucouliagos et al., 2007; Smirnova & Zavertiaeva, 2017). Therefore, it allows us to compare our findings with previous ones. There are different ways to calculate ROA, for example, earnings before interest and taxes divided by total assets (Harymawan et al., 2020; Raithatha & Komera, 2016; Sheikh et al., 2018) or operating income divided by total assets (Aslam et al., 2019; Bin et al., 2020). We followed the approach of Akter et al. (2020), Crespi-Cladera and Gispert (2003), Hoskisson et al. (1994), Lei et al. (2019), Smirnova and Zavertiaeva (2017), and Unite et al. (2008) by calculating ROA as shown in equation 1, a way which is usually used in European studies (Crespi-Cladera & Gispert, 2003; Smirnova & Zavertaeva, 2003).

$$ROA_t = \frac{\text{Net Income}_t}{\text{Total Assets}_t} \times 100 \qquad [1]$$

EVA measures performance based on residual wealth. From the view of shareholders, only activities are seen as value-creating, where the profitability is higher than the cost supported to invest in the firm. Therefore, it aligns the interests of the principal and agent. We use the capital charge-formula (Keller & Plack, 2001; equation 2) to calculate EVA, where the Net Operating Profit After Tax (NOPAT) is declared as profit variable, Invested Capital (IC) is an item that indicates the invested capital for operations and the Weighted Average Cost of Capital (WACC), which is based on the cost of equity and debt. The calculation of the three elements are made as follows (Kim, 2006; Morard & Balu, 2009; equations 3-5):

$$EVA_t = NOPAT_t - WACC_t \times IC_{t-1} \quad [2]$$

Where:

$$NOPAT_t = EBIT_t - T_t \quad [3]$$

$$WACC_t = K_{eq,t} \times \frac{Equity_{t-1}}{IC_{t-1}} + K_{d,t} \times \frac{\text{long-term debt}_{t-1}}{IC_{t-1}}, \text{ where} \quad [4]$$

- $K_{eq,t} = R_{f,t} + (R_{M,t} - R_{f,t}) \times \beta_t$ [4.1]
- $K_{d,t} = i_t \times (1 - t_t)$ [4.2]

$$IC_t = Equity_t + \text{long-term } Debt_t \quad [5]$$

β_t	Sensibility of stock returns to changes in market returns
$EBIT_t$	Earnings Before Interest and Tax
i_t	Interest rate
IC_{t-1}	IC at the beginning of the year
$K_{d,t}$	Cost of debt
$K_{eq,t}$	Cost of equity
$R_{f,t}$	Risk-free return in period t
$R_{M,t}$	Market return in period t
T_t	Corporate income tax
t_t	Income tax rate

In order to facilitate the comparability of EVA with the other performance indicators, whose result is a ratio, we follow the method of de Wet (2012) by standardizing EVA (SEVA) in dividing EVA by the IC at the beginning of the year (equation 6).

$$SEVA_t = \frac{EVA_t}{IC_{t-1}} \times 100 \quad [6]$$

TQ and TSR are selected as market-based measures. TQ is an estimator that indicates whether a market or business is under- or overvalued; that is when the market value does not equal the costs for replacement and the market value (Blose & Shieh, 1997). The calculation is shown in equation 7.

$$TQ_t = \frac{\text{Total Market Value of Firm}_t}{\text{Total Assets}_t} \text{ x } 100 \qquad [7]$$

In TSR, the share price movement and dividends are considered (equation 8), thus whether the CEO is acting in the interests of the shareholders (Azim et al., 2011).

$$TSR_t = \frac{\sum_{t=1}^{N} \ln\left(\frac{\text{Share Price}_t}{\text{Share Price}_{t-1}}\right)}{N} \text{ x12} \qquad [8]$$

Control Variables

Referring to previous research, the Control Variables (CV) included in this study are: Firm Size (SIZE), Leverage (LEV), CEO age (AGE), and CEO change (CHANGE).

Bigger companies pay their executives more money because of their business. They generate higher profits and revenues because those firms' tasks are more complex than smaller ones. Moreover, the responsibility for the decisions that need to be made is bigger, and the damage caused by a wrong decision has a higher value (Doucouliagos et al., 2007; Parthasarathy et al., 2006). Most of the studies use firm size measured as the natural logarithm of total assets (i.a., Abdullah, 2006; David et al., 1998; Faria et al., 2014; Firth et al., 2006; López-Iturriaga et al., 2015). Besides that, other proxies were used, for instance, total employment (Conyon & Peck, 1998), the (average) value of firm sales (Gómez-Mejía et al., 2003; Parthasarathy et al., 2006), firms market value (Beck et al., 2020), or real total capital (Doucouliagos et al., 2007). We follow the first definition and measure SIZE as a natural logarithm of total assets.

The financial leverage can have an impact on the firm's reputation, as it indicates how much of the total firm assets is carried by debt (Smirnova & Zavertiaeva, 2017). Equation 9 shows the calculation which is used by researchers (i.a., Barker III & Mueller, 2002; Brick et al., 2006; Choi & Suh, 2019; López-Iturriaga et al., 2015; Raithatha & Komera, 2016) to evaluate whether a firm has enough financial resources to meets its debt and whether the firm can pay a return on its investment. A ratio below 1 means that the assets are also paid

by equity, while a ratio greater than 1 indicates that the firm has more liabilities than assets (negative equity).

$$LEV_t = \frac{\text{Total Debt}_t}{\text{Total Assets}_t} \text{ x } 100 \qquad [9]$$

Taking the knowledge and experience of the CEO into account, AGE is added to the analysis. David et al. (1998) assume that the older the CEO, the more experience he/she has. Also, the years in the firm leads to more experience resulting in quality, observable in firm performance, which is valued in higher remuneration (Doucouliagos et al., 2007; Smirnova & Zavertiaeva, 2017). Several other researchers used AGE, measured in the number of years of the CEO (i.a., Choi & Suh, 2019; Doucouliagos, Graham & Haman, 2012; Doucouliagos et al., 2007; Hall & Liebman, 1997; Lei et al., 2019).

Additionally, we add the dummy variable CEO change (CHANGE), which is one (1) when the CEO was replaced and zero (0) otherwise (Sheikh et al., 2018). With CHANGE, we want to control the possibility that the remuneration components could be lower as the CEOs are not leading the company for the whole financial year.

4.2.2. Empirical method

Firstly, we investigate the one-sided relationship, which means the impact of CEO remuneration on firm performance and vice versa. To test which model is the most suitable for every single relationship, we analyze the Hausman-test and the Breusch-Pagan-test (for results, see appendix 1).

Then we provide evidence of the simultaneous impact, as Aslam et al. (2019), Lilling (2006), and Smirnova and Zavertiaeva (2017), among others. For it, we conduct a Two-Stage Least Square (2SLS) regression, in the second step, following Chen and Huang (2010). They proceeded with 2SLS after discovering that the estimators gained from an Ordinary-Least-Square (OLS) regression could be biased and inconsistent due to correlation because remuneration is determined endogenously.

As mentioned before, our sample is unbalanced. We use the statistical software SPSS (Statistical Package for the Social Sciences) and GRETL (Gnu Regression, Econometrics and Time-series Library) for the statistical analysis.

Based on our hypotheses, we are investigating the relationship of firm performance on the components and the total of CEO remuneration and, as it is inter-related, the relationship of CEO remuneration on the four firm performance indicators. For this reason, we obtain two regression models; the first one (equation 10) deals with hypothesis 1, while the second model considers hypothesis 2 (equation 11).

$$Performance_{i,t} = \alpha + \beta_1 Remuneration_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} + \beta_4 AGE_{i,t} + \beta_5 CHANGE_{i,t} + \varepsilon_{i,t} \quad [10]$$

where

- performance = {ROA, EVA, TQ, TSR};
- remuneration = {SALARY, BONUS, TOTAL};
- i = number of firms, t = years in the sample.

$$Remuneration_{i,t} = \alpha + \beta_1 Performance_{i,t} + \beta_2 SIZE_{i,t} + \beta_3 LEV_{i,t} + \beta_4 AGE_{i,t} + \beta_5 CHANGE_{i,t} + \varepsilon_{i,t} \quad [11]$$

where

- remuneration = {SALARY, BONUS, TOTAL};
- performance = {ROA, EVA, TQ, TSR};
- i = number of firms, t = years in the sample.

5. Results

5.1. Descriptive statistics

Figures 1 and 2 present the results of the average remuneration of all CEOs whose firms were listed in the ATX (figure 1) or DAX (figure 2) in the period between 2012 to 2019. The remuneration is divided into the components salary and bonus, and in addition, the total remuneration is displayed in the bar chart.

Figure 1 - Average remuneration of an ATX CEO between 2012 and 2019

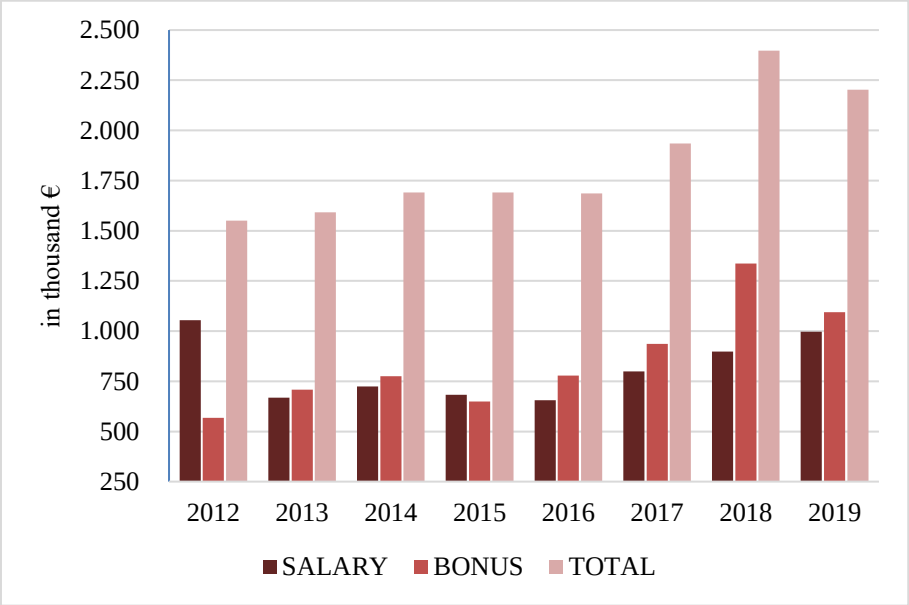
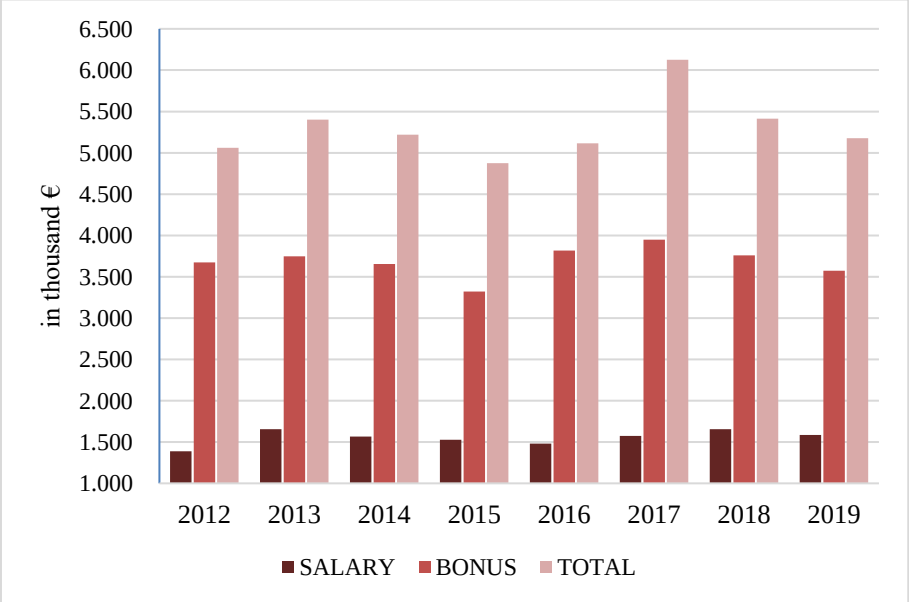


Figure 2 - Average remuneration of a DAX CEO between 2012 and 2019



Bonus consisting of short-term and long-term performance-based payment is an eminent part of the remuneration structure. While it has become more and more important in Austria over the years, in Germany, the bonus payment was and is still the dominant remuneration part, compared to salary, the fixed remuneration part. In the comparison of the first and the last year of our observed period, in Austria, the fixed component decreased by 5,5%, and the bonus rose by 92,5%. On average, the CEOs of DAX companies had an increase of 14,2% of fixed salary and a slight decrease of 2,7% in bonus payments. However, the amount of money received by the German CEOs did not change a lot during the years and remains still around 3.686 thousand euros. It stands out that the earnings of DAX CEOs are much higher than those of their Austrian counterparts. Furthermore, it is observable that after the year with the highest remuneration (AT: 2018, DE: 2017), there was a decline in total remuneration, and the fixed salary rose, while the bonus payments were reduced.

Figure 3 presents the composition of the remuneration.

Figure 3 - Composition of average ATX (left) and DAX (right) remuneration

Considering only 2019, almost half (49,7%) of the remuneration of ATX CEOs was performance-related (45,3% fixed salary, 5% others; figure 3 - left). The remuneration in Germany (figure 3 - right) is more performance-related, as more than two-third are bonus payments (30,6% fixed salary, 0,4% others). Other components are, for example, pension or one-time payment, which are included in total remuneration.

Table 4 provides the main descriptive statistics, namely minimum, maximum, mean, median, and standard variation of the variables of the sample.

Table 4 - Sample descriptive statistics

	Panel A: Austria					Panel B: Germany					Mann-Whitney-U	
Variable	Minimum	Maximum	Mean	Median	Std. Deviation	Minimum	Maximum	Mean	Median	Std. Deviation	Z	r
SALARY [ln]	12,465	14,558	13,415	13,417	0,330	13,377	14,924	14,155	14,143	0,281	-12,952***	0,740
SALARY [th €]	259,30	4.913,20	749,83	675,00	489,94	78,00	3.029,00	1.453,20	1.386,00	424,38	-12,602***	0,720
BONUS [ln]	11,626	15,394	13,540	13,362	0,849	13,363	16,388	15,066	15,105	0,517	-12,253***	0,701
BONUS [th €]	0,00	4.850,00	1.031,30	626,00	900,25	119,00	13.098,00	3.920,50	3.605,00	2.021,30	-12,308***	0,704
TOTAL [ln]	13,032	15,795	14,259	14,122	0,579	14,137	16,787	15,427	15,464	0,417	-12,489***	0,714
TOTAL [th €]	457,30	7.239,82	1.856,30	1.358,00	1.223,90	197,00	19.522,00	5.435,70	5.136,00	2.475,70	-12,370***	0,707
ROA [%]	-7,538	11,149	3,708	3,931	3,409	-13,573	18,883	4,505	4,280	3,881	-1,617	0,092
SEVA	-23,441	32,558	4,092	2,965	13,360	-24,740	51,484	3,000	1,795	13,205	-0,885	0,051
TQ	0,172	1,886	0,741	0,616	0,421	0,000	3,281	0,835	0,589	0,757	-0,943	0,054
TSR [ln]	-0,647	1,220	0,080	0,084	0,296	-0,785	0,917	0,068	0,094	0,250	-0,146	0,008
SIZE [ln]	13,247	17,497	15,093	14,872	1,150	15,515	19,979	17,578	17,405	1,083	-12,254***	0,701
SIZE [th €]	566,46	39.689,00	6.945,00	2.875,30	8.887,00	5.472,00	474.965,00	75.137,00	36.208,00	86.986,00	-12,254***	0,701
LEV [%]	0,375	57,716	26,559	26,605	12,661	0,683	54,538	25,048	23,560	13,207	-1,242	0,071
AGE [years]	42	74	57,16	58,00	6,965	39	72	55,85	56,00	4,896	-2,162**	0,124
CHANGE	0	1	0,06	0,00	0,240	0	1	0,11	0,00	0,315	-1,409	0,081

With salary: natural logarithm (ln) of fixed salary, bonus: natural logarithm of short-term and long-term bonus payments, total: natural logarithm of the total remuneration, ROA: return on assets in %, SEVA: standardized economic value added, TQ: Tobin's Q, TSR: natural logarithm of total shareholder return SIZE: natural logarithm of total assets, LEV: leverage in %, AGE: age of the CEO in years, CHANGE: dummy variable for a replacement of the CEO during the financial year
*,**,*** level of significance (2-tailed) of 10%, 5% and 1%, respectively

Panel A presents information to Austria, panel B to Germany, and the Mann-Whitney test is also provided to compare median values between the two countries. This test was carried out to understand to what extent the median values of the two study countries, panel A: Austria and panel B: Germany, differ. We used this test because most of the variables are not normally distributed.

A CEO in Austria received between 259 to 4.913 thousand euros of fixed salary, up to 4.850 thousand euros bonus payments, and the total remuneration was between 457 to 7.239 thousand euros. The ROA was on average 3,71%, indicating that the firm was operating profitably. On average, the firms had a positive SEVA (4,09), which means that they create value since they add economic value after paying all costs to finance their investment. However, the range was between -23,44 up to 32,56 within the years, showing huge differences among firms in the sample. Most of the ATX listed firms are undervalued (0,74), as their book value is higher than their market value. The natural logarithm of TSR ranges from -0,65 to 1,22, whereas the average was slightly positive (0,08). It means the overall return, including capital gains and dividends, was positive in mean, so the shareholder made a profit with his/her investment. Size, measured as the natural logarithm of total assets, varies a lot across the sample with a minimum of 13,25 and a maximum of 17,5 (566 to 39.689 thousand euros). On average, a quarter of the firms' assets purchased are funded by debt, which means that a business is mainly operated by equity. However, the range between the firms is wide; while the leverage of one firm is almost zero (0,38%), another firm has a ratio of 57,72%, which means the majority of their assets are financed by debts. The youngest CEO, working for a company listed in ATX, was 42 years old, the oldest had an age of 74 years (Ø 57,16). The dummy variable CHANGE (0,06) indicates that the position of CEO is mainly filled in usual terms and changes during the financial year are the exceptions.

For Germany, the maximum fixed salary that a CEO gained was 3.029 thousand euros, while the minimum was 78 thousand euros. Every firm granted a bonus payment which ranges between 119 and 13.098 thousand euros with a mean of 3.921 thousand euros. A CEO earns on average 5.436 thousand euros per year, while the discrepancy of the total remuneration is enormous (197 to 19.522 thousand euros). In most of the years, the companies were operating profitable and gained a return on their assets of 4,51%. The mean value of SEVA was 3,00 hence, it can be concluded that an economic value was added to their operations. However, the ratio fluctuates between the firms and years with a minimum of -24,74 and a maximum of 51,48. Also, the outcome of TQ ranges from highly undervalued (0,00) to

overvalued (3,81). In the analyzed period, the shareholders obtained a return of 6,8% measured as a natural logarithm. But not always could the shareholder benefit, since the minimum return is -78,5% and the maximum return is 91,7%. A company listed in Germanys leading share index had on average total assets of 75.137 thousand euros, whereat the amount of the smallest firm in our observation was 14 times lower and of the biggest firm more than six times higher. On average, three-fourths of the assets purchased are financed by the firms' equity, but it varies between the firms (min. 0,68%, max. 54,54%). Furthermore, the descriptive statistics show that German DAX CEOs, who were between 39 and 72 years old when they came into power (Ø 55,85), rarely changed during the financial year (0,11).

Our positive mean values for the indicators ROA (e.g., Aslam et al., 2019; Bin et al., 2020; Chen & Huang, 2010; Doucouliagos et al., 2007) and TQ (e.g., Afrifa & Adesina, 2018; Bin et al., 2020; Raithatha & Komera, 2016) are in line with previous research, indicating that the firms in the sample were able to improve those key indicators on average within the analyzed period. Also, the positive shareholder return can be confirmed by the findings of Doucouliagos et al. (2007), however, there were negative observations as well (Alves et al., 2014). So far, SEVA was not often considered in previous studies; the average value in South Africa was marginal negative (de Wet, 2012), while in our context SEVA is positive. Nevertheless, this difference can be explained due to a different investigation area (South Africa and Austria/Germany) and a different period in which the analysis was made.

Comparing both countries, German firms present higher median values of remuneration variables compared to Austrian firms, which is statistically significant for all remuneration components. These differences could be explained due to a more than eight times higher GDP than Austria's (The World Bank, 2020). In addition, there is a huge discrepancy in SIZE (measured as total assets) among the countries; the German median is more than eleven times higher than the one of Austria, and the difference between the two sample countries is statistically significant. It could be anticipated because more global players are listed in DAX, for example, Adidas, Siemens, and Volkswagen. To compete successfully in the market and strengthen the firm's position, it can be assumed that higher remuneration needs to be paid to hire the best CEOs. Furthermore, it can be stated that remuneration and SIZE between Austria and Germany are strongly correlated ($r > 0,5$), while all other variables have a weak correlation. The age of Austrian CEOs is significantly higher than of their German counterparts. One explanation could be that the CEOs can come into power in Germany at a younger age (DE: 39, AT: 42) and retire earlier (DE: 72, AT:74). Despite this, Austrian

CEOs might have a longer tenure and, therefore, get older over time. It is supported by the median value of the control variable CHANGE, which is slightly higher in Germany, indicating that there is more often a change in the CEO position. However, this difference in CHANGE and the difference of the control variable LEV is insignificant among the two countries. To performance variables, even if the median values of ROA and TSR are slightly higher to German firms and SEVA and TQ to Austrian firms, there are no significant differences between both panels.

Table 5 displays the Pearson correlation matrix among the variables; panel A presents information regarding Austria, while panel B considers the German sample.

Analyzing the sample of Austria, we can observe a strong correlation between each of the remuneration components, which were expected as SALARY and BONUS are part of the total remuneration. However, we can neglect this correlation because each component is analyzed individually. Also, the performance variables are positively correlated, except for the relationship of TSR and SEVA, where we have a significant negative value. Again, as the four performance indicators are alternative variables that are considered separately, it has no consequence for our analysis.

Furthermore, we can observe that the connection between SALARY and TQ is significant and negative. As TQ is a market-based indicator, it could be attributed that the market directly reflects an increase in SALARY. Due to an entrenchment effect and potential conflicts of interest between the shareholders may lead to a negative performance (Conyon & Sadler, 2001). In addition, BONUS and ROA are significantly positively related, indicating a performance-orientated bonus payment. The other relationships between remuneration and performance variables are statistically insignificant and reach a value around 0 (largest deviation: ±0,144). Our findings are mostly in line with the ones of Azim et al. (2011), who could not find that most performance measures were not correlated to remuneration.

The control variable LEV is negatively and significantly correlated with BONUS and TOTAL, as well as with the performance measures ROA, SEVA, and TQ. The negative signs of LEV indicate an overshadowing of the positive equity multiplier effects in regard to the increasing interest expenses (Chen & Huang, 2010).

Table 5 - Pearson correlation matrix

Panel A: Austria	SALARY	BONUS	TOTAL	ROA	SEVA	TQ	TSR	SIZE	LEV	AGE
SALARY	1									
BONUS	0,538***	1								
TOTAL	0,720***	0,877***	1							
ROA	-0,052	0,205**	0,137	1						
SEVA	-0,040	0,111	0,144	0,231**	1					
TQ	-0,298***	-0,017	-0,107	0,407***	0,175	1				
TSR	-0,114	-0,024	-0,102	-0,010	-0,426***	0,174*	1			
SIZE	0,495***	0,374***	0,495***	-0,191*	-0,046	-0,678***	-0,098	1		
LEV	-0,112	-0,375***	-0,377***	-0,402***	-0,182*	-0,489***	0,002	0,149	1	
AGE	0,486***	0,235**	0,390***	0,061	0,133	0,087	-0,104	0,038	-0,309***	1
Panel B: Germany										
SALARY	1									
BONUS	0,512***	1								
TOTAL	0,646***	0,846***	1							
ROA	0,039	0,109	0,144*	1						
SEVA	0,118	0,076	0,083	0,272***	1					
TQ	-0,016	-0,018	0,003	0,615***	0,079	1				
TSR	-0,003	0,043	0,011	0,177**	-0,451***	0,224***	1			
SIZE	0,485***	0,450***	0,450***	-0,412***	0,008	-0,565***	-0,077	1		
LEV	0,245***	0,225***	0,296***	-0,271***	-0,209***	-0,421***	-0,096	0,451***	1	
AGE	0,277***	0,383***	0,381***	-0,074	-0,009	-0,226***	-0,066	0,266***	0,246***	1

With salary: natural logarithm (ln) of fixed salary, bonus: natural logarithm of short-term and long-term bonus payments, total: natural logarithm of the total remuneration, ROA: return on assets in %, SEVA: standardized economic value added, TQ: Tobin's Q, TSR: natural logarithm of total shareholder return SIZE: natural logarithm of total assets, LEV: leverage in %, AGE: age of the CEO in years

*,**,*** level of significance (2-tailed) of 10%, 5% and 1%, respectively

AGE and SIZE, respectively, are positive and significantly linked among each remuneration component, confirming our expectations. It is assumed that older CEOs have more experience and, therefore, get more money (David et al., 1998). Another assumption is that bigger firms can pay higher wages, and the job is more complex and riskier, which needs to be valued in the remuneration (Doucouliagos et al., 2007; Parthasarathy et al., 2006).

Additionally, SIZE has a negative and significant correlation with ROA and TQ, respectively. It could be assumed that the bigger the firm size, the better the performance, however, firms with a greater size are larger and more diversified. Decisions and changes tend to take longer, so these firms are less efficient, and additionally, the monitoring costs could increase. From the other point of view, it can be argued that smaller firms can outperform bigger ones, as they could adapt their business faster (Akter et al., 2020; Chen & Huang, 2010; Smirnova & Zavertiaeva, 2017). Finally, large-size firms are the ones with greater leverage since firms need external funds to sustain their growth, while older CEOs use less leverage and use more self-funding.

For Germany, we have similar statistical relationships regarding the correlation of the remuneration components; all are positive and significantly linked. Moreover, performance components are also correlated, usually positively, with the exception of SEVA and TSR. This strong association could be explained due to the components which influence TSR, like market-to-book value, firm value, and increasing shareholders' wealth. These components increase when SEVA increases, as it creates a positive premium between the input (capital) and output (value). For TOTAL-ROA, the correlation is positive and significant. According to the agency theory (Jensen & Meckling, 1976), our expectations to enhance the firm performance due to higher remuneration and vice versa can be confirmed.

All control variables are positively and significantly related to the remuneration components, while the connection with the performance indicators ROA and TQ is negative and significant. The positive correlations were expected, as we said before. On the one hand, it is assumed that older CEOs earn more due to their experience and knowledge, and on the other hand, the responsibility, which tends to be bigger in larger firms, need to be valued (Aslam et al., 2019; David et al., 1998; Doucouliagos et al., 2007). Despite that, SEVA and LEV are significantly and negatively correlated. The negative relationship between LEV and the performance indicators could be reasoned that debt holders defined restrictions that could not be aligned with the performance. An increase in remuneration enhances the firm's profit, according to the agency theory, therefore it has a positive impact on leverage. Our findings

for the German sample are similar to the one of Austria. Finally, large-size firms are the ones more indebted and led by older CEOs.

Considering the results of this correlation analysis, we can conclude that there is no potential multicollinearity ($r \leq \pm 0{,}7$) between those variables that are considered together in the regression.

5.2. Empirical results based upon panel data regression

5.2.1. CEO remuneration on firm performance

To analyze if CEO's remuneration affects the performance of a firm; that is, a higher remuneration leads to better firm performance (hypothesis 1), equation 10 was estimated using fixed effects (FE) or random effects (RE) depending on which was more appropriate to each specific case based on the Hausman test and Breusch-Pagan test (results in Appendix 1). Twenty-four models were developed, twelve per country: models 1 to 12 belong to Austria, and models 13 to 24 belong to Germany. We considered four performance indicators - two accounting-based (ROA, SEVA) and two market-based (TQ, TSR) - and analyzed the influence of SALARY, BONUS, and TOTAL on each of them. In the end, we obtained three results for each dependent variable per panel. Results are presented in tables 6 (Austria) and 7 (Germany).

In Austria, the total remuneration is statistically significant to explain a firm's performance measured as ROA or TQ. This result is in line with our expectations that remuneration positively impacts performance (hypothesis 1). Afrifa and Adesina (2018) and Smirnova and Zavertiaeva (2017) obtained similar findings. In addition, BONUS has a significantly positive impact on ROA, indicating a performance-orientated bonus payment. Similar are the observations reported by Smirnova and Zavertiaeva (2017). However, Banker et al. (2013) explanatory note - the importance of dividing remuneration into its components is only partly relevant for our sample. When remuneration components are analyzed individually, we can see that neither SALARY nor BONUS, except for BONUS on ROA, has a significant impact on performance.

Table 6 – Pay on performance relationship to Austria

Dependent variable	ROA			SEVA			TQ			TSR		
Model	1	2	3	4	5	6	7	8	9	10	11	12
(Constant)	13,896 (1,173)	3,743 (0,073)	-24,260 (-0,586)	-371,277** (-2,421)	-377,349** (-2,366)	-408,492** (-2,509)	8,391** (2,189)	8,926** (2,644)	8,497*** (2,471)	0,896 (1,129)	6,739* (1,845)	8,250** (2,468)
SALARY	0,043 (0,028)			4,044 (0,629)			0,084 (0,720)			-0,019 (-0,302)		
BONUS		1,388* (1,898)			-0,362 (-0,111)			0,028 (0,751)			-0,024 (-0,418)	
TOTAL			2,636*** (3,047)			4,464 (0,854)			0,109* (2,056)			-0,018 (-0,245)
SIZE	-0,390 (-0,749)	-0,526 (-0,144)	0,233 (0,939)	19,365* (1,784)	23,290* (1,981)	21,144** (2,223)	-0,561** (-2,681)	-0,539** (-2,617)	-0,585*** (-2,917)	-0,022 (-0,953)	-0,378 (-1,386)	-0,486* (-2,089)
LEV	-0,113*** (-3,823)	-0,116* (-1,802)	-0,132** (-2,262)	-0,389** (-2,344)	-0,396* (-2,029)	-0,353** (-2,324)	-0,012*** (-4,235)	-0,011*** (-3,158)	-0,010*** (-3,412)	-0,000 (-0,088)	-0,005 (-0,655)	-0,003 (-0,463)
AGE	-0,032 (-0,394)	-0,135 (-1,098)	-0,169 (-1,291)	0,679* (1,992)	0,770** (2,624)	0,674** (2,482)	-0,000 (-0,000)	-0,002 (-0,293)	-0,004 (-0,455)	-0,004 (-1,175)	-0,009 (-0,905)	-0,009 (-0,896)
CHANGE	-0,578 (-0,373)	-0,016 (-0,011)	-0,374 (-0,261)	1,808 (0,592)	0,777 (-0,376)	1,149 (0,780)	-0,004 (-0,027)	-0,037 (-0,296)	-0,019 (-0,148)	0,024 (0,304)	0,051 (0,677)	0,048 (0,639)
F / Chi²	15,877***	4,970***	5,514***	7,091***	11,210***	27,910***	11,395***	10,126***	15,669***	1,808	3,718**	3,130**
Model	RE	FE	FE	FE	FE	FE	FE	FE	FE	OLS	FE	FE

With salary: natural logarithm of fixed salary, bonus: natural logarithm of short-term and long-term bonus payments, total: natural logarithm of the total remuneration, ROA: return on assets in %, SEVA: standardized economic value added, TQ: Tobin's Q, TSR: natural logarithm of total shareholder return, SIZE: natural logarithm of total assets, LEV: leverage in %, AGE: age of the CEO in years, CHANGE: dummy variable for a replacement of the CEO during the financial year.
Below the parameters, in parentheses are the values of the t-statistic for FE and OLS models and for RE models the z-statistic.
*,**,*** level of significance of 10%, 5% and 1%, respectively.

Table 7 - Pay on performance relationship to Germany

Dependent variable	ROA			SEVA			TQ			TSR		
Model	13	14	15	16	17	18	19	20	21	22	23	24
(Constant)	2,608 (0,123)	0,187 (0,022)	-21,546** (-2,409)	-403,741*** (-3,253)	-216,310 (-1,516)	-231,863 (-1,574)	2,207 (0,828)	3,244** (2,346)	2,101 (1,169)	10,416*** (4,758)	6,678*** (4,720)	6,858*** (4,540)
SALARY	1,586 (1,477)			21,648*** (3,103)			0,262 (1,510)			-0,290* (-1,936)		
BONUS		2,418*** (3,375)			4,168 (1,132)			0,190*** (3,626)			0,068 (1,258)	
TOTAL			3,809*** (4,724)			4,810 (0,992)			0,251** (2,570)			0,042 (0,555)
SIZE	-1,083 (-1,126)	-1,703*** (-3,486)	-1,735*** (-3,722)	4,142 (0,435)	6,770 (0,707)	7,021 (0,735)	-0,260*** (-4,043)	-0,265*** (-3,540)	-0,263*** (-3,632)	-0,347*** (-4,102)	-0,418*** (-4,638)	-0,407*** (-4,550)
LEV	-0,100** (-2,257)	-0,054* (-1,862)	-0,066** (-2,386)	-0,446* (-1,924)	-0,404* (-1,852)	-0,411* (-1,866)	-0,005 (-1,042)	-0,004 (-0,740)	-0,004 (-0,848)	0,006 (1,319)	0,007 (1,338)	0,006 (1,265)
AGE	0,019 (0,322)	-0,013 (-0,248)	-0,011 (-0,205)	0,668* (1,803)	0,837* (1,953)	0,836* (1,969)	-0,007 (-0,898)	-0,009 (-1,280)	-0,008 (-1,105)	-0,005 (-0,639)	-0,008 (-0,918)	-0,008 (-0,877)
CHANGE	-0,575 (-0,882)	-0,388 (-0,718)	0,097 (0,171)	11,304** (2,420)	6,715 (1,571)	6,915 (1,539)	0,050 (0,743)	0,017 (0,426)	0,043 (0,946)	-0,167** (-2,290)	-0,065 (-0,839)	-0,072 (-0,956)
F / Chi²	7,200***	35,660***	40,744***	8,570***	5,166***	5,288***	27,919***	28,900***	23,527***	6,412***	5,526***	5,595***
Modell	FE	RE	RE	FE	FE	FE	RE	RE	RE	FE	FE	FE

With salary: natural logarithm of fixed salary, bonus: natural logarithm of short-term and long-term bonus payments, total: natural logarithm of the total remuneration, ROA: return on assets in %, SEVA: standardized economic value added, TQ: Tobin's Q, TSR: natural logarithm of total shareholder return, SIZE: natural logarithm of total assets, LEV: leverage in %, AGE: age of the CEO in years, CHANGE: dummy variable for a replacement of the CEO during the financial year.
Below the parameters, in parentheses are the values of the t-statistic for FE models and RE models the z-statistic.
*,**,*** level of significance of 10%, 5% and 1%, respectively.

The control variable LEV is significant and negatively linked to ROA, SEVA, and TQ. This finding suggests that less leveraged firms outperform more indebted ones, indicating an inefficient investment of the borrowed funds or that the firms used the leverage too extensively. As a result, the financial cost could be so high that the firm performance decreased (Akter et al., 2020; Smirnova & Zavertiaeva, 2017). Despite that, SIZE negatively affects TQ (models 7, 8, 9) and TSR (model 12), but when SEVA is the dependent performance variable, we found positive and significant relationships. The observations for SEVA are inconsistent with those we made before.

Also, AGE has a significant and positive impact on SEVA, meaning that older CEOs have more ability to create value.

Table 7 (Germany) shows that BONUS and TOTAL positively influence ROA and TQ. Moreover, SALARY impacts SEVA significantly positively, while TSR is negatively affected on a 10%-level by SALARY. The obtained result for accounting-based performance is in line with the evidence provided by Akter et al. (2020), Chen and Huang (2010), and Smirnova and Zavertiaeva (2017). Further, our significant positive relation with TQ can be confirmed by Afrifa and Adesina (2018). Similar to what we reasoned previously, the decrease of firm performance measured as TSR while the SALARY of the CEO is rising could be explained with an anchoring effect and interest conflicts within the shareholders. Smirnova and Zavertiaeva (2017) reasoned their results with the market-based measure that the negative relationship is an indicator for insufficient motivation of the CEO to increase the firm's market performance when the fixed salary is relatively high.

The control variable SIZE has a significantly negative effect in models 14, 15, and 19 to 24. LEV affects both dependent accounting-based variables ROA in the model with SALARY and all three models with SEVA as dependent performance indicator significantly negative. These observations are similar to what we obtained for Austria. Since SEVA considers the economic added value after all costs incurred for an investment, an increase in leverage means that more borrowed capital was used for investments. Thus, the costs are increased, which is why the added value indicated by SEVA decreases. Contrary are the results for the influence of CHANGE on SEVA and TSR, respectively, together with SALARY. While SEVA is significantly positively affected, as an atmosphere of departure is created with the hope for progress, the effect on TSR is negative. This could be reasoned that an unexpected change in the most important position in a firm during the financial year bears a high risk.

Such negative news can impact the market value of the firm. The positive and statistically significant relationship between SEVA and AGE confirms our expectations, as it is assumed that older CEOs have more experience and, therefore, know what to do to increase the performance (David et al., 1998).

5.2.2. Firm performance on CEO remuneration

We also intend to understand if SALARY, BONUS, and TOTAL are explained by performance measures. Equation 11 is estimated after the Hausman test, and the Breusch-Pagan test has been done (results in Appendix 1). It was tested how the four firm performance indicators – ROA, SEVA, TQ, and TSR – impact each of the remuneration components. Furthermore, the models were controlled by the four factors SIZE, LEV, AGE, and CHANGE. Table 8 presents the results to Austria and table 9 to Germany.

Analyzing table 8, consisting of the observations from Austria, we found out that the remuneration components BONUS and TOTAL are significantly influenced by the performance measure ROA. We expected BONUS to be the most performance-sensitive part, as the goals, which need to be achieved to be rewarded, are defined in advance so that the CEO can work towards these goals (Chen & Huang, 2010). For us, it is not a big surprise that we did not find any other significant evidence, as none of the business reports of the firms listed in ATX mentioned one of our chosen performance indicators (Wieser, 2018). The significant finding for the relationship of ROA on TOTAL can be explained with the result for BONUS, as it is a part of the total remuneration variable.

Moreover, SIZE is positive and significant for all models, except for model 1, indicating the bigger firms can pay their CEOs a higher remuneration (Doucouliagos et al., 2007; Parthasarathy et al., 2006). LEV has a statistically significant impact on BONUS and TOTAL, which is negative. An increase in LEV implies more debt financing activities, which influences the firm performance negatively. Hence, some goals cannot be reached, and the CEO does not gain all incentive payments. Furthermore, the creditors' monitoring could lead to a different managing behavior towards a more pro-organizational one.

Table 8 - Performance on pay relationship to Austria

Dependent variable	SALARY				BONUS				TOTAL			
Model	1	2	3	4	5	6	7	8	9	10	11	12
(Constant)	2,519 (0,367)	9,606*** (10,840)	9,853*** (9,584)	9,928*** (10,860)	6,566*** (3,385)	6,779*** (3,512)	6,470*** (2,600)	7,542*** (4,002)	8,099*** (6,924)	8,441*** (7,343)	7,249*** (4,414)	8,602*** (7,915)
ROA	0,00 (0,652)				0,047*** (2,875)				0,027*** (2,832)			
SEVA		0,001 (0,880)				0,003 (0,568)				0,003 (0,968)		
TQ			0,007 (0,058)				0,218 (0,632)				0,277 (1,189)	
TSR				-0,021 (-0,860)				-0,101 (-0,572)				-0,036 (-0,438)
SIZE	0,678 (1,438)	0,168*** (4,346)	0,163*** (3,516)	0,160*** (4,039)	0,391*** (3,819)	0,402*** (3,813)	0,414*** (3,743)	0,364*** (3,626)	0,298*** (4,878)	0,313*** (5,110)	0,351*** (4,811)	0,285*** (4,862)
LEV	-0,001 (-0,437)	-0,000 (-0,008)	-0,001 (-0,3313)	-0,001 (-0,483)	-0,023*** (-2,663)	-0,027*** (-3,022)	-0,026** (-2,257)	-0,029*** (-3,311)	-0,012*** (-2,563)	-0,013*** (-2,657)	-0,012* (-1,923)	-0,015*** (-3,381)
AGE	0,012 (0,961)	0,023** (2,480)	0,020** (2,077)	0,020** (2,066)	0,026 (1,266)	0,024 (1,090)	0,023 (1,101)	0,022 (1,046)	0,032** (3,048)	0,025* (1,934)	0,032*** (2,838)	0,031*** (2,720)
CHANGE	-0,397*** (-2,954)	-0,237* (-1,866)	-0,363** (-2,517)	-0,362** (-2,475)	-0,004 (-0,019)	0,168 (0,509)	-0,001 (-0,004)	-0,013 (-0,055)	-0,121 (-1,328)	-0,079 (-0,597)	-0,104 (-1,058)	-0,122 (-1,497)
F / Chi²	3,629**	31,245***	37,411***	43,873***	31,092***	23,365***	30,922***	33,430***	44,333***	41,911***	37,496***	48,646***
Model	FE	RE	RE	RE	RE	RE	RE	RE	RE	RE	RE	RE

With salary: natural logarithm of fixed salary, bonus: natural logarithm of short-term and long-term bonus payments, total: natural logarithm of the total remuneration, ROA: return on assets in %, SEVA: standardized economic value added, TQ: Tobin's Q, TSR: natural logarithm of total shareholder return, SIZE: natural logarithm of total assets, LEV: leverage in %, AGE: age of the CEO in years, CHANGE: dummy variable for a replacement of the CEO during the financial year.
Below the parameters, in parentheses are the values of the t-statistic for FE models and for RE models the z-statistic.
*,**,*** level of significance of 10%, 5% and 1%, respectively.

Table 9 - Performance on pay relationship to Germany

Dependent variable	SALARY				BONUS				TOTAL			
Model	13	14	15	16	17	18	19	20	21	22	23	24
(Constant)	10,517***	11,074***	10,604***	11,205***	9,189***	9,340***	8,888***	8,973***	11,026***	11,226***	10,955***	11,287***
	(9,003)	(16,860)	(16,290)	(16,110)	(3,714)	(3,624)	(3,350)	(3,362)	(6,054)	(5,590)	(5,655)	(5,404)
ROA	0,004				0,029***				0,025***			
	(1,200)				(3,092)				(3,583)			
SEVA		0,002***				0,002				0,001		
		(4,924)				(1,186)				(1,086)		
TQ			0,079**				0,275***				0,180***	
			(2,408)				(3,347)				(3,381)	
TSR				-0,078**				0,112				0,036
				(-1,983)				(1,301)				(0,562)
SIZE	0,181**	0,152***	0,175***	0,147***	0,304**	0,307**	0,308*	0,322**	0,223**	0,219*	0,221*	0,215*
	(2,493)	(4,138)	(4,912)	(3,665)	(2,144)	(2,112)	(2,029)	(2,087)	(2,168)	(1,956)	(2,001)	(1,817)
LEV	0,001	0,000	0,001	0,000	-0,007	-0,010	-0,009	-0,010	-0,005	-0,008	-0,006	-0,007
	(0,380)	(0,183)	(0,298)	(0,178)	(-1,131)	(-1,481)	(-1,441)	(-1,525)	(-1,043)	(-1,652)	(-1,498)	(-1,533)
AGE	0,008	0,007	0,007	0,007	0,011	0,012	0,014	0,013	0,009	0,011	0,011	0,010
	(1,132)	(1,201)	(1,195)	(1,112)	(1,294)	(1,339)	(1,643)	(1,374)	(1,301)	(1,498)	(1,588)	(1,359)
CHANGE	-0,285***	-0,278***	-0,288***	-0,297***	-0,239***	-0,277***	-0,256***	-0,258***	-0,256***	-0,278***	-0,273***	-0,277***
	(-5,805)	(-5,149)	(-5,767)	(-6,111)	(-4,622)	(-4,752)	(-4,682)	(-4,315)	(-5,449)	(-5,115)	(-5,641)	(-5,464)
F / Chi²	11,092***	77,772***	79,796***	78,497***	13,625***	10,159***	12,730***	9,456***	14,707***	10,680***	13,219***	11,630***
Model	FE	RE	RE	RE	FE	FE	FE	FE	FE	FE	FE	FE

With salary: natural logarithm of fixed salary, bonus: natural logarithm of short-term and long-term bonus payments, total: natural logarithm of the total remuneration, ROA: return on assets in %, SEVA: standardized economic value added, TQ: Tobin's Q, TSR: natural logarithm of total shareholder return, SIZE: natural logarithm of total assets, LEV: leverage in %, AGE: age of the CEO in years, CHANGE: dummy variable for a replacement of the CEO during the financial year.
Below the parameters, in parentheses are the values of the t-statistic for FE models and for RE models the z-statistic.
*,**,*** level of significance of 10%, 5% and 1%, respectively

The control variable AGE is positive and significantly related to SALARY with the performance proxies SEVA, TQ, and TSR. Also, TOTAL is significantly positively influenced by AGE, it does not matter which performance indicator is used. We assumed that older CEOs receive a higher base salary, justified by their broad knowledge and experience (David et al., 1998). The change of a CEO lowers SALARY significantly for all performance measures. A new CEO starts with a lower base salary, as his/her true ability is unknown. Over time, it may increase due to factors such as improved firm performance, longer tenure, more experience, and knowledge about his/her new employer where the recommended course of action can be deduced.

For Germany (table 9), we found evidence for a positive and significant connection of BONUS and TOTAL with the performance metrics ROA (accounting-based measure) and TQ (market-based measure). While Bin et al. (2020) and Chen and Huang (2010) reported significant relationships with accounting-based performance indicators, Aslam et al. (2019) and Raithatha and Komera (2016) evidence our findings for the relationship with TQ. Moreover, SALARY is positive and significantly related to SEVA and TQ. These results confirm our expectations as they indicate that all three remuneration components are somehow connected to the firm performance, hence, the regulations and recommendations are followed by the DAX companies. However, an increase in TSR affects SALARY significantly negatively. Chen and Huang (2010) provided similar evidence; they found that the only linkage between stock return and remuneration is a statistically significant and negative connection with SALARY. Firm announcements can lead to a variation in the demand for the shares. An increase of the base salary of the CEO may be a reason, from the perspective of the shareholders, why the demand sinks and therefore, TSR as well.

The control variable SIZE is significantly and positively linked to all models, which denotes the larger the firm, the greater the remuneration. A change in the position of the CEO influences the remuneration significantly negatively, which means that every new CEO has to demonstrate his/her ability.

Our results of Austria and Germany regarding the relationship of remuneration and the market-based measure TSR are different from those of previous investigations, which found a positive and significant link (Alves et al., 2014; Gibbons & Murphy, 1989). The missing linkage is unexpected, as TSR directly measures the shareholders' wealth, and we supposed that the aim of the CEO should be the maximization of the shareholder wealth (similar to

Chen & Huang, 2010). On the other side, Beck et al. (2020), who analyzed German CEOs' remuneration, did not find a relationship with TSR as well, which emphasizes our findings for panel B.

The absence of any significant relationship between remuneration and performance in Austria, except for BONUS and TOTAL with ROA, may be reasoned with the individually chosen performance metrics by the firms. Mostly, the goals were set in a way that was easy to achieve and aligned with the owners' interests (Wieser, 2018).

To conclude, we can observe for Austria as well as for Germany that the statements made by David et al. (1998) considering the age of a CEO and the statements of Doucouliagos et al. (2007) and Parthasarathy et al. (2006) regarding the size of a firm, partly come true. Both, the older the CEO gets, and a bigger firm has a positive effect on the remuneration.

The following figure presents a synthesis of the obtained results of the one-sided panel data regression:

Figure 4 - Summary one-sided regression results

Our first hypothesis argues that total CEO remuneration has a positive impact on firm performance. Our results can partly substantiate this, as for Austria and Germany, we obtained two pieces of evidence (ROA and TQ). Different are the findings for the modified hypothesis 1a, in which a positive influence of the fixed salary on performance was predicted, and hypothesis 1b, where the effect of variable remuneration on performance was examined. While no significant connection was obtained for panel A, SEVA and TSR have

been significantly influenced by CEO's fixed salary (hypothesis 1a) in panel B. Hypothesis 1b cannot be rejected for panel A, as only ROA is significantly affected. Similar is the situation for Germany, where, in addition, TQ is statistically significantly influenced. In the second hypothesis, we predicted that firm performance has a positive impact on CEO remuneration. This hypothesis could partially be confirmed. A significant relationship could only be observed in Austria between the performance indicator ROA and BONUS and TOTAL, respectively. In Germany, the SALARY is positively influenced by SEVA and TQ. TSR also has a significant influence on SALARY, but it is negative. ROA and TQ impact BONUS and TOTAL positively and significantly.

5.2.2.1. Results when performance measures are lagged

The results in tables 8 and 9 considered the contemporaneous firm performance and their influence on the CEOs' remuneration. In this section, we employ the previous financial year's firm performance to investigate if it affects the actual remuneration. According to Raithatha and Komera (2016), past performance may provide more information that can be used for a forecast. Table 10 presents the results with lagged performance for Austria. The results for Germany are shown in table 11.

For Austria, we observed changes in the performance on pay relationship when the performance measures were accounting-based (ROA, SEVA) and the remuneration component was fixed salary. Lagged ROA and lagged SEVA became significant to explain remuneration but, while SEVA influences SALARY positively, ROA has a negative sign. Banker et al. (2013) assumed that CEO ability is time-specific, which means a good firm performance in the previous year leads to an increase in the CEOs' fixed salary. This would explain the finding for lagged SEVA. Regarding the negative value of ROA, it looks like that the fixed salary had been increased to motivate the CEOs when the result of the previous year was smaller, as ROA of the same year has no impact on fixed salary.

Table 10 - Lagged performance on pay relationship to Austria

Dependent variable	SALARY				BONUS				TOTAL			
Model	1	2	3	4	5	6	7	8	9	10	11	12
(Constant)	9,939***	10,185***	9,740***	10,013***	6,908***	-9,975	5,728*	7,129***	8,249***	8,464***	7,559***	8,462
	(12,270)	(11,710)	(10,860)	(12,320)	(3,318)	(-1,356)	(1,738)	(2,862)	(6,769)	(6,896)	(4,576)	(6,529)
ROA $_{(t-1)}$	-0,007**				0,063***				0,025***			
	(-2,153)				(3,483)				(2,928)			
SEVA $_{(t-1)}$		0,003**				-0,004				0,002		
		(2,251)				(-0,778)				(0,573)		
TQ $_{(t-1)}$			0,030				0,409				0,203	
			(0,312)				(0,516)				(0,808)	
TSR $_{(t-1)}$				-0,053				0,222				0,025
				(-1,237)				(0,639)				(0,165)
SIZE	0,157***	0,155***	0,163***	0,150***	0,412***	1,531**	0,492***	0,424***	0,304***	0,319***	0,348***	0,305***
	(3,211)	(2,964)	(2,943)	(3,121)	(3,667)	(2,375)	(3,344)	(3,493)	(4,510)	(4,456)	(4,382)	(4,635)
LEV	-0,002	-0,002	0,000	-0,001	-0,027***	-0,035**	-0,032**	-0,036***	-0,014***	-0,017***	-0,016**	-0,019***
	(-0,995)	(-1,028)	(0,104)	(-0,634)	(-2,685)	(-2,233)	(-2,220)	(-3,174)	(-2,812)	(-2,777)	(-2,309)	(-3,304)
AGE	0,021***	0,017*	0,021***	0,021***	0,016	0,021	0,016	0,016	0,030***	0,025	0,030***	0,030**
	(3,420)	(1,838)	(3,256)	(3,007)	(0,617)	(0,480)	(0,663)	(0,665)	(2,705)	(1,631)	(2,764)	(2,512)
CHANGE	-0,505***	-0,628***	-0,477***	-0,489***	0,158	0,082	0,035	-0,007	-0,140*	-0,274***	-0,183**	-0,215***
	(-3,654)	(-5,102)	(-3,065)	(-2,957)	(0,556)	(0,284)	(0,115)	(-0,027)	(-1,802)	(-2,588)	(-2,336)	(-3,183)
F / Chi²	118,445***	131,919***	76,031***	65,847***	90,944***	14,219***	52,446***	36,763***	80,821***	82,561***	133,005***	203,89***
Model	RE	RE	RE	RE	RE	FE	RE	RE	RE	RE	RE	RE

With salary: natural logarithm of fixed salary, bonus: natural logarithm of short-term and long-term bonus payments, total: natural logarithm of the total remuneration, $ROA_{(t-1)}$: lagged return on assets in %, $SEVA_{(t-1)}$: lagged standardized economic value added, $TQ_{(t-1)}$: lagged Tobin's Q, $TSR_{(t-1)}$: lagged natural logarithm of total shareholder return, SIZE: natural logarithm of total assets, LEV: leverage in %, AGE: age of the CEO in years, CHANGE: dummy variable for a replacement of the CEO during the financial year.

Below the parameters, in parentheses are the values of the t-statistic for FE models and for RE models the z-statistic.

*,**,*** level of significance of 10%, 5% and 1%, respectively.

Table 11 - Lagged performance on pay relationship to Germany

Dependent variable	SALARY				BONUS				TOTAL			
Model	13	14	15	16	17	18	19	20	21	22	23	24
(Constant)	11,145***	11,239***	10,615***	11,229***	9,505***	9,705***	9,752***	9,544***	11,964***	12,603***	11,629***	11,145***
	(16,570)	(16,280)	(16,630)	(16,330)	(6,957)	(7,357)	(3,330)	(7,135)	(5,505)	(5,774)	(5,502)	(4,708)
ROA (t-1)	0,008*				0,010				0,006			
	(1,692)				(0,990)				(0,778)			
SEVA (t-1)		0,001				0,002				0,002		
		(0,452)				(0,708)				(0,892)		
TQ (t-1)			0,130***				0,264**				0,230***	
			(3,809)				(2,550)				(3,213)	
TSR (t-1)				0,006				0,143				0,064
				(0,220)				(1,222)				(0,756)
SIZE	0,148***	0,139***	0,174***	0,144***	0,268***	0,257***	0,264	0,263***	0,171	0,140	0,185	0,218
	(3,683)	(3,613)	(4,667)	(3,616)	(3,765)	(3,584)	(1,549)	(3,803)	(1,358)	(1,163)	(1,532)	(1,656)
LEV	0,000	0,000	0,000	0,000	-0,007	-0,008	-0,009	-0,006	-0,007	-0,009	-0,007	-0,006
	(0,009)	(0,079)	(0,191)	(0,049)	(-1,304)	(-1,329)	(-1,324)	(-1,036)	(-1,419)	(-1,626)	(-1,455)	(-1,307)
AGE	0,007	0,009	0,007	0,008	0,018*	0,019**	0,013	0,019**	0,011	0,011	0,010	0,011
	(1,018)	(1,223)	(1,055)	(1,096)	(1,942)	(2,341)	(1,437)	(2,057)	(1,414)	(1,551)	(1,380)	(1,444)
CHANGE	-0,314***	-0,324***	-0,322***	-0,317***	-0,220***	-0,234***	-0,260***	-0,218***	-0,272***	-0,288***	-0,288***	-0,279***
	(-5,799)	(-5,261)	(-6,334)	(-5,770)	(-3,054)	(-3,226)	(-4,174)	(-3,148)	(-4,394)	(-4,333)	(-5,554)	(-4,577)
F / Chi²	83,449***	81,664***	88,396***	86,524***	48,037***	43,840***	10,817***	41,070***	9,862***	8,895***	14,296***	9,881***
Model	RE	RE	RE	RE	RE	RE	FE	RE	FE	FE	FE	FE

With salary: natural logarithm of fixed salary, bonus: natural logarithm of short-term and long-term bonus payments, total: natural logarithm of the total remuneration, $ROA_{(t-1)}$: lagged return on assets in %, $SEVA_{(t-1)}$: lagged standardized economic value added, $TQ_{(t-1)}$: lagged Tobin's Q, $TSR_{(t-1)}$: lagged natural logarithm of total shareholder return, SIZE: natural logarithm of total assets, LEV: leverage in %, AGE: age of the CEO in years, CHANGE: dummy variable for a replacement of the CEO during the financial year.

Below the parameters, in parentheses are the values of the t-statistic for FE models and for RE models the z-statistic.

*,**,*** level of significance of 10%, 5% and 1%, respectively

Furthermore, in some remuneration and lagged performance relationships, control variables became significant. AGE has a positive and significant impact on SALARY in combination with the lagged performance of ROA. As the age of the CEO can be seen as a proxy for the experience which may contribute to better firm performance, it is rewarded with an increase in fixed salary. Changes in the position of the CEO have a significantly negative impact on TOTAL for all lagged performance measures – we can observe that the results of SALARY are the dominant factor, where CHANGE was already significantly negative. LEV combined with all four lagged performance indicators have a significant negative impact on BONUS and TOTAL. Like in the previous regression without lagged performance, a bigger firm size, measured in total assets, affects all remuneration components considered together with lagged performance indicators significantly positively.

Table 11 presents our findings for Germany. We observe that lagged ROA does not significantly influence BONUS and TOTAL anymore but instead SALARY. Also, lagged SEVA and lagged TSR became insignificant when SALARY was the remuneration component. It indicates that the previous firm performance in Germany is not really considered and used to determine the CEO remuneration. However, TQ from the previous year affects the CEO remuneration significantly and positively, which would be in line that the CEOs' future ability is more predictable considering the performance of the last year (Banker et al., 2013; Raithatha & Komera, 2016)

Compared to the results with the contemporaneous performance, SIZE became insignificant when TOTAL is the dependent variable and in combination with BONUS and TQ, respectively. Furthermore, the AGE has a significant positive effect on BONUS for models 17, 18, and 20.

5.3. Empirical results based upon 2SLS regression

As we find evidence that CEO remuneration and firm performance can be endogenous, we analyzed the interrelation estimating equations 10 and 11 simultaneously. To analyze the impact of remuneration and performance together, tables 12 to 15 provide our findings of the Two-Stage-Least-Square regression[5]. However, all results need to be seen with caution

[5] In the first step we modeled a Least Square Dummy Variable regression, following a standard econometric methodology that all exogenous variables are employed as instruments in the first stage estimation (Chen & Huang, 2010). We controlled for year and firm specific cases. The second step was the simultaneous regression, using the predictors from the first step.

because they are very sensitive, which means changes in the composition can lead to different results.

Like in the previous regressions for the pay on performance, each remuneration component is considered individually. The same applies to the performance on pay regression; each remuneration component and each performance indicator were taken into account individually. The results are split into panel A (Austria) and panel B (Germany), but also by the performance indicators (identified by each table: table 12 ROA, table 13 SEVA, table 14 TQ, and table 15 TSR).

All models applied in table 12 are statistically significant. We can observe that the results which we obtained compared to the findings of the previous regressions differ for panel A. While SALARY affects ROA significantly in the simultaneous regression, the bonus payment is no longer influenced by ROA. The last finding is contrary to our assumption, as the literature and the corporate governance codex of Austria suggest that BONUS is tied to performance indicators. The positive and significant influence of SALARY is an indicator that the CEO is motivated due to an increase in his/her fixed salary to show their true ability. Only for TOTAL and ROA, we found a simultaneous relationship. In the results of panel B, we observe that the combinations SALARY-ROA and ROA-SALARY become statistically significant. It means all remuneration components are significantly connected to ROA and vice versa, so it accords with our expectations.

Table 12 - 2SLS estimation on remuneration and ROA

Models	Panel A: Austria						Panel B: Germany					
	SALARY & ROA		BONUS & ROA		TOTAL & ROA		SALARY & ROA		BONUS & ROA		TOTAL & ROA	
	SALARY	ROA	BONUS	ROA	TOTAL	ROA	SALARY	ROA	BONUS	ROA	TOTAL	ROA
(Constant)	9,225***	1,673	-12,215	15,528	7,112	45,822	12,111***	54,873**	9,775***	55,364**	11,239***	55,183**
	(3,127)	(0,051)	(-1,232)	(0,301)	(1,331)	(0,947)	(10,204)	(2,548)	(3,505)	(2,564)	(5,456)	(2,524)
ROA [Predicted]	0,007		0,191		0,149**		0,052*		0,190***		0,125***	
	(0,202)		(1,579)		(2,283)		(1,936)		(2,974)		(2,649)	
SALARY [Predicted]		0,999***						2,235***				
		(3,068)						(3,683)				
BONUS [Predicted]				0,380						1,571***		
				(0,615)						(3,611)		
TOTAL [Predicted]						1,602***						1,477***
						(3,215)						(3,101)
SIZE	0,286	0,441	1,747**	-0,227	0,400	-2,140	0,099	-2,704**	0,272	-2,692**	0,213*	-2,699**
	(1,337)	(0,185)	(2,432)	(-0,061)	(0,202)	(-0,614)	(1,382)	(-2,091)	(1,617)	(-2,078)	(1,719)	(-2,058)
LEV	0,002	-0,109**	-0,013	-0,223***	0,002	-0,155**	0,002	-0,091**	-0,006	-0,055	-0,005	-0,058
	(0,448)	(-2,513)	(-0,877)	(-3,131)	(0,202)	(-2,259)	(0,952)	(-2,069)	(-1,047)	(-1,236)	(1,250)	(-1,303)
AGE	0,002	0,009	0,022	-0,017	0,017	-0,087	0,008**	-0,051	0,011	-0,051	0,010	-0,048
	(0,282)	(0,102	(0,777)	(-0,121)	(1,146)	(-0,655)	(2,035)	(-0,718)	(1,178)	(-0,717)	(1,525)	(-0,668)
CHANGE	-0,329***	1,283	0,173	0,741	-0,106	0,450	-0,281***	-0,083	-0,288***	-0,070	-0,258***	0,039
	(-3,657)	(1,334)	(0,565)	(0,510)	(-0,644)	(0,335)	(-7,701)	(-0,116)	(-3,356)	(-0,096)	(-4,078)	(0,051)
R^2	0,873	0,739	0,766	0,528	0,853	0,586	0,849	0,666	0,736	0,667	0,781	0,658
Adjusted R^2	0,806	0,604	0,640	0,321	0,776	0,409	0,807	0,581	0,661	0,581	0,719	0,571
F	13,071***	5,470***	6,085***	2,550***	11,162***	3,312***	19,818***	7,869***	9,805***	7,723***	12,521***	7,603***

With salary: natural logarithm of fixed salary, bonus: natural logarithm of short-term and long-term bonus payments, total: natural logarithm of the total remuneration, ROA: return on assets in %, SEVA: standardized economic value added, TQ: Tobin's Q, TSR: natural logarithm of total shareholder return, SIZE: natural logarithm of total assets, LEV: leverage in %, AGE: age of the CEO in years, CHANGE: dummy variable for a replacement of the CEO during the financial year.
*,**,*** level of significance of 10%, 5% and 1%, respectively

Table 13 - 2SLS estimation on remuneration and SEVA

Models	Panel A: Austria						Panel B: Germany					
	SALARY & SEVA		BONUS & SEVA		TOTAL & SEVA		SALARY & SEVA		BONUS & SEVA		TOTAL & SEVA	
	SALARY	SEVA	BONUS	SEVA	TOTAL	SEVA	SALARY	SEVA	BONUS	SEVA	TOTAL	SEVA
(Constant)	9,225***	-18,210	-12,215	-159,868	7,112	-95,865	12,338***	102,370*	9,884***	103,410*	11,525***	106,123*
	(3,127)	(-0,178)	(-1,232)	(-1,544)	(1,331)	(-0,915)	(11,425)	(1,684)	(3,859)	(1,699)	(6,242)	(1,751)
SEVA [Predicted]	0,007		0,191		0,149**		0,016		0,177***		0,140***	
	(0,202)		(1,579)		(2,283)		(0,695)		(3,247)		(3,568)	
SALARY [Predicted]		-3,556***						3,430**				
		(-3,526)						(2,046)				
BONUS [Predicted]				1,503						2,441**		
				(1,245)						(2,037)		
TOTAL [Predicted]						3,010**						3,046**
						(2,361)						(2,335)
SIZE	0,286	1,255	1,747**	11,352	0,400	6,885	0,098	-7,041*	0,293*	-7,037*	0,217**	-7,167*
	(1,337)	(0,170)	(2,432)	(1,503)	(1,033)	(0,907)	(1,500)	(-1,919)	(1,900)	(-1,918)	(1,946)	(-1,961)
LEV	0,002	-0,353**	-0,013	-0,268*	0,002	-0,195	0,002	0,238*	-0,010*	0,294**	-0,007**	0,296**
	(0,448)	(2,625)	(-0,877)	(-1,855)	(0,202)	(-1,344)	(0,719)	(1,860)	(-1,943)	(2,262)	(-1,973)	(2,292)
AGE	0,002	-0,161	0,022	-0,194	0,017	-0,242	0,005	0,069	0,009	0,068	0,008	0,056
	(0,282)	(-0,593)	(0,777)	(-0,660)	(1,146)	(-0,833)	(1,531)	(0,348)	(1,046)	(0,344)	(1,388)	(0,285)
CHANGE	-0,329***	-0,057	0,173	-0,399	-0,106	-1,186	-0,309***	0,496	-0,272***	0,527	-0,254***	1,175
	(-3,657)	(-0,019)	(0,565)	(-0,123)	(-0,644)	(-0,376)	(-9,054)	(0,248)	(-3,366)	(0,263)	(-4,353)	(0,568)
R^2	0,873	0,906	0,766	0,890	0,853	0,895	0,839	0,807	0,733	0,808	0,785	0,809
Adjusted R^2	0,806	0,858	0,640	0,831	0,776	0,840	0,799	0,753	0,665	0,752	0,731	0,755
F	13,071***	18,676***	6,085***	15,044***	11,162***	16,204***	20,666***	14,729***	10,821***	14,395***	14,442***	14,885***

With salary: natural logarithm of fixed salary, bonus: natural logarithm of short-term and long-term bonus payments, total: natural logarithm of the total remuneration, ROA: return on assets in %, SEVA: standardized economic value added, TQ: Tobin's Q, TSR: natural logarithm of total shareholder return, SIZE: natural logarithm of total assets, LEV: leverage in %, AGE: age of the CEO in years, CHANGE: dummy variable for a replacement of the CEO during the financial year.
*,**,*** level of significance of 10%, 5% and 1%, respectively.

Table 14 - 2SLS estimation on remuneration and TQ

Models	Panel A: Austria						Panel B: Germany					
	SALARY & TQ		BONUS & TQ		TOTAL & TQ		SALARY & TQ		BONUS & TQ		TOTAL & TQ	
	SALARY	TQ	BONUS	TQ	TOTAL	TQ	SALARY	TQ	BONUS	TQ	TOTAL	TQ
(Constant)	9,079***	0,963	-7,799	8,841***	11,788**	9,572***	12,398***	5,279***	8,127***	5,298***	9,638***	5,475***
	(3,407)	(0,478)	(-0,790)	(2,787)	(2,156)	(3,055)	(9,744)	(2,706)	(2,753)	(2,710)	(4,483)	(2,805)
TQ [Predicted]	0,026		0,331**		0,183**		0,035		0,461***		0,379***	
	(0,774)		(2,586)		(2,580)		(0,531)		(3,016)		(3,403)	
SALARY [Predicted]		0,208***						0,115**				
		(10,468)						(2,080)				
BONUS [Predicted]				0,033						0,080**		
				(0,876)						(2,011)		
TOTAL [Predicted]						0,044						0,101**
						(1,357)						(2,359)
SIZE	0,326*	0,015	1,507**	-0,538**	0,096	-0,589**	0,081	-0,174	0,340*	-0,173	0,282**	-0,183
	(1,696)	(0,104)	(2,114)	(-2,339)	(0,243)	(-2,609)	(1,072)	(-1,484)	(1,950)	(-1,475)	(2,223)	(-1,566)
LEV	0,002	-0,007***	-0,024	-0,010**	-0,004	-0,008*	0,002	-0,004	-0,007	-0,002	-0,005	-0,002
	(0,515)	(-2,740)	(-1,636)	(-2,349)	(-0,459)	(-1,841)	(0,774)	(-0,897)	(-1,123)	(-0,433)	(1,248)	(-0,382)
AGE	0,003	-0,007	0,021	-0,006	0,020	-0,007	0,008**	-0,010	0,012	-0,010	0,011*	-0,010
	(-0,412)	(-1,253)	(0,797)	(-0,714)	(1,314)	(-0,824)	(2,030)	(-1,521)	(1,293)	(-1,516)	(1,687)	(-1,561)
CHANGE	-0,428***	-0,095	-0,015	-0,022	-0,160	-0,038	-0,280***	0,029	-0,265***	0,029	-0,238***	0,053
	(-5,771)	(-1,622)	(-0,054)	(-0,243)	(-1,037)	(-0,440)	(-7,484)	(0,441)	(-3,059)	(0,440)	(-3,776)	(0,771)
R^2	0,863	0,960	0,719	0,879	0,807	0,886	0,846	0,926	0,736	0,927	0,787	0,927
Adjusted R^2	0,805	0,939	0,595	0,826	0,726	0,837	0,802	0,908	0,661	0,908	0,726	0,908
F	14,821***	46,090***	5,811***	16,561***	9,948***	18,140***	19,172***	49,987***	9,742***	49,022***	12,900***	50,386***

With salary: natural logarithm of fixed salary, bonus: natural logarithm of short-term and long-term bonus payments, total: natural logarithm of the total remuneration, ROA: return on assets in %, SEVA: standardized economic value added, TQ: Tobin's Q, TSR: natural logarithm of total shareholder return, SIZE: natural logarithm of total assets, LEV: leverage in %, AGE: age of the CEO in years, CHANGE: dummy variable for a replacement of the CEO during the financial year.
*,**,*** level of significance of 10%, 5% and 1%, respectively.

Table 15 - 2SLS estimation on remuneration and TSR

Models	Panel A: Austria						Panel B: Germany					
	SALARY & TSR		BONUS & TSR		TOTAL & TSR		SALARY & TSR		BONUS & TSR		TOTAL & TSR	
	SALARY	TSR	BONUS	TSR	TOTAL	TSR	SALARY	TSR	BONUS	TSR	TOTAL	TSR
(Constant)	9,157***	-2,877	-13,572	4,115	6,797	3,649	12,372***	5,091***	9,699***	5,075***	11,248***	5,150***
	(3,051)	(-0,609)	(-1,336)	(0,856)	(1,213)	(0,711)	(10,224)	(2,898)	(3,434)	(2,885)	(5,375)	(2,922)
TSR [Predicted]	0,014		0,325		0,172		0,037		0,213***		0,130**	
	(0,202)		(1,371)		(1,339)		(1,175)		(2,910)		(2,392)	
SALARY [Predicted]		0,228***						0,021				
		(4,876)						(0,422)				
BONUS [Predicted]				-0,002						0,012		
				(-0,038)						(0,322)		
TOTAL [Predicted]						-0,018						0,022
						(-0,338)						(0,565)
SIZE	0,292	0,229	1,885**	-0,260	0,456	-0,225	0,081	-0,287	0,261	-0,286***	0,204	-0,290***
	(1,342)	(0,671)	(2,557)	(-0,746)	(1,122)	(-0,608)	(1,108)	(-2,726)	(1,537)	(-2,714)	(1,622)	(-2,748)
LEV	0,002	-0,001	-0,012	-0,006	-0,000	-0,004	0,002	0,001	-0,009	0,001	-0,007	0,001
	(0,447)	(-0,090)	(-0,721)	(-0,860)	(-0,029)	(-0,599)	(0,735)	(0,229)	(-1,480)	(0,305)	(-1,640)	(0,343)
AGE	0,002	-0,003	0,016	-0,002	0,013	-0,002	0,008**	-0,001	0,012	-0,001	0,011	-0,001
	(0,257)	(-0,025)	(0,554)	(-0,122)	(0,841)	(-0,164)	(2,095)	(-0,165)	(1,335)	(-0,155)	(1,639)	(-0,181)
CHANGE	-0,334***	0,066	0,046	0,080	-0,178	0,076	-0,282***	-0,009	-0,294***	-0,011	-0,263***	-0,002
	(-3,610)	(0,482)	(0,145)	(0,588)	(-1,016)	(0,532)	(-7,620)	(-0,155)	(-3,412)	(-0,185)	(-4,114)	(-0,040)
R^2	0,873	0,577	0,763	0,375	0,844	0,375	0,847	0,453	0,735	0,452	0,781	0,453
Adjusted R^2	0,806	0,357	0,636	0,101	0,763	0,108	0,803	0,315	0,659	0,314	0,717	0,315
F	13,071***	2,629***	5,999***	1,368	10,431***	1,406	18,904***	3,286***	9,687***	3,283***	12,150***	3,292***

With salary: natural logarithm of fixed salary, bonus: natural logarithm of short-term and long-term bonus payments, total: natural logarithm of the total remuneration, ROA: return on assets in %, SEVA: standardized economic value added, TQ: Tobin's Q, TSR: natural logarithm of total shareholder return, SIZE: natural logarithm of total assets, LEV: leverage in %, AGE: age of the CEO in years, CHANGE: dummy variable for a replacement of the CEO during the financial year.
*,**,*** level of significance of 10%, 5% and 1%, respectively.

Table 13 shows the estimations on remuneration and SEVA. In panel A, SEVA and TOTAL have a simultaneous impact – SEVA increases TOTAL, and a higher total remuneration enhances SEVA. It was not foreseeable because both remuneration components, which are part of the total remuneration, are insignificant. Besides, an increase in SALARY affects the performance measure significantly negatively. It indicates that the motivation incentive paid is higher than the value which was created. In the simultaneous regression for panel B, we see that the simultaneous relationship between SEVA, BONUS, and TOTAL, respectively, is significant. It is different from the one-sided results, as BONUS and TOTAL were not positively affected by SEVA and vice versa. However, SALARY is no longer influenced by SEVA. We adhere, the connection of both remuneration and performance is strengthened when observing the interrelation.

Analyzing the interrelation of remuneration and TQ (table 14), we see that all models are significant. For both panels, SALARY became a positive and significant predictor for TQ, indicating that the asymmetric information about the ability of the CEO can be reduced by observing the relationship simultaneously. Furthermore, compared to the one-sided regression, TQ is significant on a 5%-level related to BONUS and TOTAL's remuneration components in Austria. On the other way round, TOTAL does not influence TQ anymore. For panel B, there are no other differences from those reported in tables 7 and 9.

Our results using TSR as a performance indicator are displayed in table 15. Again, analyzing the relationship simultaneously, an increase in SALARY of the Austrian CEO has a significant and positive impact on the performance. In this case, on TSR. For panel B, in the pay on performance relationship, SALARY became insignificant. From the other point of view – performance on pay – BONUS and TOTAL are significantly and positively tied to TSR. However, SALARY is not significantly influenced anymore.

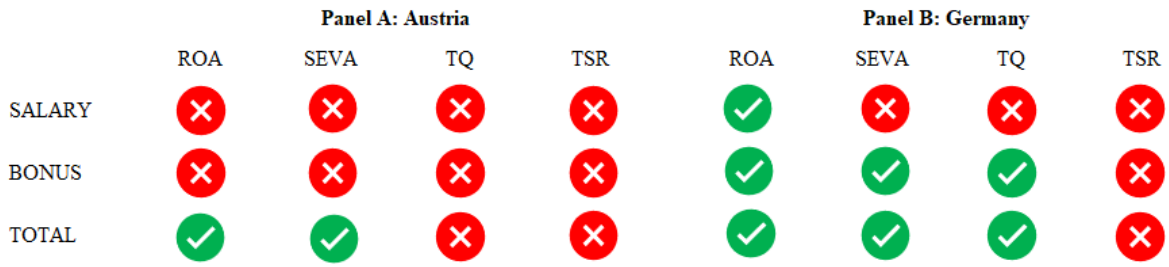
To summarize the findings of the 2SLS regression, we can conclude that there were several changes after changing the way how the relationship between CEO remuneration and firm performance of ATX and DAX firms are analyzed. For the Austrian sample, we can adhere that SALARY has an effect on all performance indicators when the dependence is considered together. The effort of the CEO showing his/her true ability pays off in the total remuneration when performance is measured as ROA, SEVA, or TQ, respectively. The performance metrics TSR is not set as a benchmark for the firms in panel A. Also, the only statistically

significant finding for ROA is not so strong to draw a conclusion. All in all, we found more significant evidence for a pay-on-performance relationship than the other way round.

In the simultaneous observation of the relationship, SEVA and TSR became a benchmark for BONUS and TOTAL as well. It is observable that BONUS is the most performance-sensitive part, which was expected, as the goals, which need to be achieved to be rewarded, are defined in advance so that the CEO can work towards these goals (Chen & Huang, 2010). Additionally, it complies with the regulation of the DCGK, aligning the remuneration to the firm performance. Moreover, all remuneration components affect the performance indicators, except TSR. What states out is that there are not many changes in the interrelation with ROA compared to the one-sided regressions. Hence, we can assume that ROA is especially widely used to tie the remuneration within the DAX firms. Again, as we used an estimator to conduct the simultaneous regression, combined with the observation that the results in 2SLS regression have been very sensitive, we need to be careful with interpreting the results for panels A and B.

Figure 5 shows a synthesis of the obtained simultaneous relationships.

Figure 5 – Summary of the simultaneous regression results



Summarizing our findings of the regressions where CEO remuneration and firm performance were considered simultaneously, we can adhere for Austria that only TOTAL is interrelated with both accounting-based measures. For Germany, it can be said that TSR and the remuneration components do not influence each other significantly at the same time. However, ROA and the three remuneration components are significantly interrelated. Also, we found a significant simultaneous relationship between the performance indicators SEVA and TQ, respectively, and BONUS or TOTAL.

6. Conclusion

The focus of our study is to see if there is an effect of the remuneration of ATX and DAX CEOs, respectively, on firm performance, vice versa, and whether CEO remuneration and firm performance have a simultaneous impact. Based on the agency theory, a conflict of interest between management and shareholders can be mitigated by incentive-based remuneration (Jensen & Meckling, 1976). Previous research has already provided evidence that remuneration impacts performance. Others also reported an influence of performance on remuneration, as an increase in performance also leads to an increase in remuneration, at least, the variable remuneration component. However, these one-sided relationships have not been tested for the same sample. Hence, we analyzed the interrelation of these indicators since both the remuneration and the performance can be viewed as endogenous. In addition to the one-sided relationship (pay on performance, performance on pay), we also considered the simultaneous influence, extending the literature with results of European countries, which are rarely considered.

Based on secondary data from 2012 until 2019 from companies listed in the leading share index of Austria and Germany, we analyzed in a first step the unilateral relationship. Therefore, we have broken down the remuneration into its components - fixed and variable remuneration - including the total remuneration. The firm's performance is viewed from both an accounting-based and a market-based perspective, for which the key figures return on assets, economic value added, Tobin's Q, and total shareholder return were selected. When looking at the relationship from both sides, which we carried out with the help of a two-stage least-square regression, the aim was to find out to what extent remuneration and performance influence one another.

Analyzing the relationship in Austria, we found only significant interrelations between the CEOs' total remuneration and both accounting-based indicators. The tendency towards those accounting metrics could be expected, as we obtained the most significant findings for it in the one-sided regressions. Also, it is in line with the reporting of Wieser (2018), who listed the financial criteria for executive remuneration, which were mainly accounting key figures. Moreover, we observed that any performance indicator does not influence the base salary, which some researchers already stated as it is the fixed component. The bonus payment was only affected by return on assets. Even if in the Austrian Corporate Governance Code is

written that the bonus should be performance-sensitive, our results do not validate it. We only confirm that higher remuneration leads to a better firm performance based on the agency theory.

For Germany, we found simultaneous relationships for return on assets, the standardized economic value added, and Tobin's Q, in which bonus and total remuneration stand out. No interrelation could be found for the total shareholder return. These findings partly validate what we observed in the one-sided regressions. Return on assets seems to be the most appropriate performance indicator as the findings for bonus and total remuneration are significant. Furthermore, the bonus payment and total remuneration are able to affect the firm performance significantly. A bit surprising is that performance has a bigger impact on the fixed salary (three significant findings) than on bonus (two significant findings). However, it provides evidence that the bonus payment is somehow tied to firm performance, as it is pretended by the German Corporate Governance Code.

Our results show that a comparison of Austria and Germany or different countries, in general, might be challenging as the firms can set their own key indicators for performance. However, return on assets, which counts to the traditional measures, is the metric where we obtained the most significant findings, indicating a closer connection to accounting-based measures. Also, because it seems that the CEO contract is not designed sensitively to the shareholder return, despite this, the firm size, measured as the natural logarithm of total assets, plays a statistically significant role. While a bigger firm is beneficial for the CEO's remuneration, it has a negative impact on the performance, but when the relationship is analyzed simultaneously, it becomes, in most cases, insignificant or is statistically weak.

This study contributes to the literature on these thematic, since most previous studies have been carried out in non-European countries, which makes this study relevant by analyzing Austria and Germany. Furthermore, so far, only a few studies have looked at all the possibilities for influencing CEO remuneration and firm performance; the influence of remuneration on performance, and vice versa, and the interrelation of both. Our findings prove that remuneration and performance are interrelated, so they should not only be analyzed in a one-sided way. Finally, there are many different outcomes due to the use of different methodologies and measures of performance and remuneration. By splitting the remuneration into two components (fixed and variable), we were able to observe which component is more performance-sensitive and that the variable remuneration component is

the main driver when the relationship between total remuneration and firm performance is analyzed. This observation would have been undetected, like Banker et al. (2013) said in his study. Taking more than one accounting-based and market-based measure into account was relevant so far, as the results for the performance metrics are mixed in the literature as well as in our study areas. For example, with the total shareholder return, we could have wrongly concluded that the remuneration is not linked to market-based indicators. However, the results from the second market-based key figure prove the opposite. For the accounting-based perspective, we considered, besides the traditional metric return on assets, the indicator economic value added, a key figure that indicates the increase in value of the firm, because it has so far only rarely been used, but getting more and more attention.

In a world where the richer become richer and the middle and lower class become more and more financial difficulties, it is hard to explain why the employees' work is enormously lower valued than the work of the directors. To overcome this huge gap, a new law, the Stock Corporation Law Amendment Act, came into force. It will be interesting to see how the remuneration will change over the years when the shareholders have a right to vote on the company's remuneration policies. A better understanding of the remuneration and more transparency should be achieved with the law that makes the disclosure of the remuneration of the board members mandatory. However, the firms still find a way to cover payments, such as pension or allowance in kind. The corporate governance codex should be extended by a more detailed disclosure of these remuneration components to regulate the grey areas. Also, the point in the corporate governance codex that remuneration, at least the variable component, should be tied to performance is unspecific. As our results show, we cannot say if all firms follow these rules, therefore we would appreciate a set of given performance indicators on which the firms can choose a minimum of one metric to which the bonus payment is linked. It would enhance the transparency on the one hand, and on the other hand, it would make a comparison between firms easier.

The aim of this work was accomplished. Although, as all works have limitations, our work also has some. We only considered the largest firms in Austria and Germany, so we cannot draw a conclusion on midsized and smaller firms. Future research should extend the type of firms analyzed and broaden the scope of examinations by analyzing different nationalities. This would be useful to see if and to which performance indicators the remuneration is related. Besides, we analyzed total remuneration, fixed salary, and variable remuneration. The variable remuneration component could be split into short-term and long-term bonuses.

This could result in other dependencies since the shareholders are primarily interested in sustainable, long-term positive performance development. These, in turn, can be measured with forward-looking market-based indicators such as the TSR.

Furthermore, we recommend including corporate governance factors such as board size and board composition, which have not been included in our study. Their job is to control the CEO, and they are responsible for the contract, to make sure that the remunerations are tied to the performance. Moreover, it could be interesting to investigate whether the remuneration follows a nonlinear curve, using its square. In the case it is nonlinear, it indicates that a higher remuneration leads only until a certain point to better firm performance, after this point, the performance declines. Finally, this research can be repeated after every major crisis, since in difficult times, other remuneration standards could apply to report positive news as quickly as possible.

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Appendix 1

Table 16 – Results F-, Hausman- & Breusch Pagan-test for Austria

F-test

	ROA	SEVA	TQ	TSR		SALARY	BONUS	TOTAL
SALARY	4,948***	7,091***	11,395***	2,11	ROA	3,629**	5,147***	4,566***
BONUS	4,970***	11,210***	10,126***	3,718**	SEVA	6,747***	2,519*	3,646**
TOTAL	5,514***	27,910***	15,669***	3,130**	TQ	3,352**	2,986**	2,153
					TSR	4,685***	4,100**	3,293**

Hausman-test

	ROA	SEVA	TQ	TSR		SALARY	BONUS	TOTAL
SALARY	7,858	21,786***	14,528**	9,026	ROA	11,577**	4,023	5,033
BONUS	12,648**	22,727***	10,503*	10,952*	SEVA	3,888	4,647	2,662
TOTAL	20,075***	22,794***	10,690*	11,115**	TQ	5,307	4,765	2,829
					TSR	3,260	4,982	0,980

Breusch-Pagan-test

	ROA	SEVA	TQ	TSR		SALARY	BONUS	TOTAL
SALARY	6,363**	2,293	58,720***	1,100	ROA	20,907***	41,428***	56,074***
BONUS	6,425**	1,848	62,030***	1,421	SEVA	11,203***	33,887***	50,594***
TOTAL	9,039***	2,013	66,354***	1,342	TQ	17,538***	35,502***	51,887***
					TSR	21,718***	37,033***	50,113***

Reported values for F-test: F-value, for Hausman- & Breusch-Pagan-test: Chi-Square.
*,**,*** level of significance of 10%, 5% and 1%, respectively.

Table 17 – Results F-, Hausman- & Breusch Pagan-test for Germany

F-test

	ROA	SEVA	TQ	TSR		SALARY	BONUS	TOTAL
SALARY	7,200***	8,570***	1,287	6,412***	ROA	11,092***	13,625***	14,707***
BONUS	4,275***	5,166***	3,440**	5,526***	SEVA	11,334***	10,159***	10,680***
TOTAL	5,554***	5,288***	2,006	5,595***	TQ	13,057***	12,730***	13,219***
					TSR	12,039***	9,456***	11,630***

Hausman-test

	ROA	SEVA	TQ	TSR		SALARY	BONUS	TOTAL
SALARY	14,343***	44,042***	9,441*	38,817***	ROA	10,604*	9,699*	16,924***
BONUS	3,260	43,017***	6,814	24,211***	SEVA	3,991	16,568***	34,176***
TOTAL	1,350	35,228***	7,855	25,707***	TQ	8,529	15,612***	22,028***
					TSR	3,264	19,225***	18,376***

Breusch-Pagan-test

	ROA	SEVA	TQ	TSR		SALARY	BONUS	TOTAL
SALARY	62,501***	1,218	375,315***	3,213*	ROA	208,058***	119,655***	126,979***
BONUS	68,876***	2,36	381,572***	3,550*	SEVA	237,965***	127,972***	136,41***
TOTAL	65,774***	2,28	360,256***	3,666*	TQ	195,723***	103,606***	105,451***
					TSR	256,591***	148,407***	160,467***

Reported values for F-test: F-value, for Hausman- & Breusch-Pagan-test: Chi-Square.
*,**,*** level of significance of 10%, 5% and 1%, respectively.

Table 18 - Results F-, Hausman- & Breusch Pagan-test for lagged performance

Panel A: Austria

F-test

	SALARY	BONUS	TOTAL
ROA	47,256***	28,407***	27,792***
SEVA	20,502***	26,207***	24,855***
TQ	23,447***	22,432***	20,979***
TSR	31,411***	20,305***	24,201***

Hausman-test

	SALARY	BONUS	TOTAL
ROA	1,44	4,677	2,326
SEVA	2,485	12,963**	3,336
TQ	1,095	4,862	1,605
TSR	1,028	4,111	2,272

Breusch-Pagan-test

	SALARY	BONUS	TOTAL
ROA	10,867***	50,365***	72,719***
SEVA	10,843***	39,081***	49,308***
TQ	8,571***	39,937***	67,524***
TSR	11,948***	42,364***	67,530***

Panel B: Germany

F-test

	SALARY	BONUS	TOTAL
ROA	46,204***	11,933***	12,853***
SEVA	163,330***	10,662***	9,910***
TQ	34,531***	12,564***	12,002***
TSR	164,207***	15,193***	15,758***

Hausman-test

	SALARY	BONUS	TOTAL
ROA	5,478	4,649	11,797**
SEVA	3,711	5,700	11,116**
TQ	3,457	9,618*	16,283***
TSR	7,711	8,522	12,448**

Breusch-Pagan-test

	SALARY	BONUS	TOTAL
ROA	145,660***	79,410***	82,085***
SEVA	153,043***	80,410***	87,740***
TQ	151,895***	72,038***	77,920***
TSR	177,400***	105,642***	113,978***

Reported values for F-test: F-value, for Hausman- & Breusch-Pagan-test: Chi-Square
*,**,*** level of significance of 10%, 5% and 1%, respectively.