
Are European CEOs rewarded by luck?

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Abstract

Much of the research on CEO compensation has been built around two perspectives: the optimal contracting view, which argues the CEO compensation is efficiently set by boards to maximize shareholder value, and in contrast, the managerial power view, which believes the compensation is rather set by CEOs themselves to maximize their own wealth. This last view is supported, among others, by the robust empirical finding that CEOs are rewarded by exogenous factors beyond their control, *i.e.*, by luck. The apparent paradoxical result of pay-for-luck along with the research gap observable on the European market built up the motivation for this study. Hence, our main goal is to analyse whether CEOs at European companies are rewarded by luck over the period between 2008 and 2018, contributing to the enrichment of a controversial research area on other countries than the United States. By measuring luck as the portion of firm performance that is driven by the mean industry performance, we find that European CEOs are strongly rewarded by luck. Moreover, we find not only stronger pay-for-luck in poorly-governed firms but also pay asymmetry, whereby CEOs are more rewarded for good luck than penalized for bad luck, particularly in firms with weak corporate governance. Finally, we observe a decline in pay-for-luck after the financial crisis of 2007-2008 which was followed by an increasing scrutiny of CEOs' compensation and stricter compensation disclosure rules. Overall, our findings are hard to reconcile with the optimal contracting interpretation of pay-for-luck and seem more consistent with the managerial power view, in which European CEOs appear to control the pay-setting process.

Key-words: Pay-for-luck, CEO compensation, Managerial power

JEL-Codes: G30, J31, J33, M12, M52

Resumo

Grande parte da literatura sobre a remuneração dos CEOs tem sido construída em torno de duas perspectivas: a visão de contratação ótima, que argumenta que a remuneração dos CEOs é eficientemente definida pelo conselho de administração por forma a maximizar a riqueza dos acionistas e, em contraste, a visão de poder de gestão que acredita que a remuneração é determinada pelos próprios CEOs para maximizar a sua própria riqueza. Esta última perspectiva encontra suporte, entre outros, na robusta evidência empírica de que os CEOs são recompensados por fatores exógenos fora do seu controlo, ou seja, pela sorte. Este resultado aparentemente paradoxal de remuneração por sorte, juntamente com a ausência de literatura observada no mercado europeu, despoletou a motivação para este estudo. Assim, o nosso principal objetivo é analisar se os CEOs de empresas europeias são remunerados pelo fator sorte no período entre 2008 e 2018, contribuindo para o enriquecimento de uma área de estudo controversa em outros países que não os Estados Unidos. Medindo a sorte como a parte do desempenho da empresa que resulta do desempenho médio da indústria, nós encontramos evidência de que os CEOs europeus são fortemente recompensados pela sorte. Além disso, mostrámos que, não só esta remuneração por sorte é mais visível em empresas com fraca *corporate governance*, mas também que existe uma assimetria na remuneração, i.e., os CEOs são mais recompensados pela “boa” sorte do que penalizados pela “má” sorte, especialmente em empresas com fraca *corporate governance*. Por último, é evidente um declínio na remuneração por sorte após a crise financeira de 2007-2008, a qual foi seguida por um escrutínio crescente da remuneração dos CEOs bem como regras de divulgação de remuneração mais rígidas. No geral, os nossos resultados são difíceis de conciliar com a visão de contratação ótima e parecem mais consistentes com a visão de poder de gestão enquanto justificação para a existência de remuneração por sorte, na qual os CEOs europeus aparentam controlar o processo de determinação salarial.

Palavras-chave: Remuneração por sorte, Remuneração dos CEOs, Poder de gestão

Classificação JEL: G30, J31, J33, M12, M52

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1. Introduction

Chief Executive Officer's (CEO) compensation has long attracted widespread attention, being one of the most widely studied topics in the finance literature. The CEO is the individual ultimately responsible for the management of the company's investments, financing decisions, operating activities and the overall firm performance. Therefore, providing CEOs with adequate incentives is crucial such that the survival of corporations will partially depend on that.

Although the level of CEO compensation has received a great deal of criticism among the financial press, how CEO compensation is set is the real issue. While the level of CEO pay amounts to only a small fraction of firm value, inefficient incentives, on the other hand, can lead to substantial losses. Despite researchers have been devoting much time and effort in understanding the drivers of CEO compensation, no consensus view has still emerged. Much of the debate has been built around two perspectives: the optimal contracting view, which argues the CEO compensation is efficiently designed by boards to maximize shareholder value, and in contrast, the managerial power view, which believes the compensation contracts are rather designed by CEOs themselves to maximize their own wealth at the expense of shareholders.

The managerial power view finds support in several empirical studies. One of the most robust findings belongs to Bertrand and Mullainathan (2001) who document that CEOs are often rewarded by exogenous factors beyond their control, *i.e.*, by luck. This stands in contrast to the standard agency theory, which predicts that luck should not affect incentive pay. Why firms would want to reward CEOs for factors that are completely unrelated with their effort is puzzling, making this phenomenon particularly interesting to study.

Since Bertrand and Mullainathan (2001) published their study almost two decades ago, the CEO compensation suffered an important reform process. The fraction of CEO compensation based on firm performance has nearly doubled; more sophisticated compensation mechanisms have emerged; there was a major worldwide financial crisis in 2008 followed by an increasing scrutiny of executives' compensation; and compensation disclosure requirements became stricter. Hence, it would be interesting to analyse whether pay-for-luck continues to hold under this new framework.

Furthermore, compared to the enormous body of studies on U.S. firms, little attention has been devoted to European companies. Although CEO pay levels and pay-performance sensitivities are lower in Europe relative to U.S., the trends are similar and the pay gap has been narrowing in recent years.

In view of above, the apparent paradoxical evidence of pay-for-luck along with the research gap observable on European market built up the motivation for this study. Thus, our main purpose is to analyse whether CEOs at European companies are rewarded by luck over the period between 2008 and 2018, contributing to the enrichment of a controversial research area on other countries than the U.S.

To accomplish the goals proposed, following Bertrand and Mullainathan (2001), we measure luck as the portion of firm performance that can be predicted by the mean industry performance. Then, we perform a two-stage procedure, resorting to an Instrumental Variable (IV) to isolate the firm performance that is driven by luck rather by CEO's actions or effort.

Beyond testing the general sensitivity of CEO pay to luck, we attempt to determine whether pay-for-luck can be driven by the CEO power over the pay-setting process. To achieve that, we test if pay-for-luck is greater across subsamples where, under the managerial power view, it is expected that rent extraction dominates. In this particular, we analyse whether pay-for-luck is stronger among poorly-governed firms and highly-paid CEOs, as well as whether there are asymmetric responses in pay-luck relationship. Furthermore, we investigate the impact of the financial crisis of 2007-2008 on the pay-for-luck phenomenon, which, as far as we are concerned, no study has still done.

It should be noted that our goal is not to rule out the optimal contracting view but rather to provide updated empirical facts, with an effort to extend our understanding about the exact nature of CEO compensation. We view our study as complementary to the existing literature on pay-for-luck in an era where the scrutiny and debate over CEO's compensation have been dramatically risen over the recent years.

The remainder of this dissertation is structured as follows. Section 2 reviews the prior literature on executive compensation, addressing topics such as the relationship between CEO compensation and the agency theory; the optimal contracting view *vs* the managerial power view; and the pay-for-luck phenomenon. Section 3 provides our research hypotheses while the data and empirical methodology are described in Section 4 and 5, respectively. Finally, Section 6 reports our main results and Section 7 concludes.

2. Literature Review

2.1. CEO Compensation and the Agency Theory

The research on CEO compensation has been carried on for more than four decades. It started to emerge in the early 1980s after Jensen and Meckling (1976) formalized the agency theory. Since then, most academic studies on CEO compensation has been built around this theory. The problem of how to optimally compensate CEOs is, after all, a classic application of the agency theory.

Given that shareholders (the principal) lack the necessary expertise (Shleifer & Vishny, 1997), the corporate decisions are usually delegated to managers (the agent). Therefore, if there is a misalignment of interests between shareholders and managers, executives are likely to use their power and discretion to pursue their own welfare at the expense of shareholders (e.g. through empire building, perquisite consumption or position entrenchment) and, consequently, the firm goal of value maximization may be jeopardized. In this sense, providing CEOs with adequate incentives is crucial so that no value diversion takes place.

The agency theory suggests that, in order to alleviate the agency problem between managers and shareholders, boards acting on shareholders' interest should design compensation packages that incentivize CEOs to take actions that maximize shareholder value (Core, Guay, & Larcker, 2003; Jensen & Meckling, 1976; Murphy, 1999). In particular, given that CEOs will maximize shareholder wealth if doing so also increases their own wealth (Rayton, 2003), part of their compensation should be tied to firm performance, rewarding (penalizing) CEOs for increases (decreases) in firm value, especially when they own a little percentage of the company (Murphy, 1999). Gerhart and Milkovich (1990) claim that linking pay to performance can motivate individuals to achieve and sustain greater performance levels and as Rayton (2003) points out, companies that better link pay to performance experience less agency costs and, consequently, exhibit a better performance.

2.2. Optimal Contracting or Managerial power?

The agency problem between managers and shareholders has been linked to CEO compensation according to two main perspectives: the *optimal contracting* view (or *shareholder value* view) and the *managerial power* view (also called *rent extraction* or *skimming view*)¹.

The *optimal contracting view*, in line with the agency theory, sees CEO compensation as a (partial) remedy to the agency problem (Kuo, Lin, Lien, Wang, & Yeh, 2014). That is, with the purpose of aligning the interests of managers with those of shareholders, compensation plans are designed by boards on behalf of shareholders in such a way that CEOs are properly incentivized to maximize shareholder value (Hölmstrom, 1979; Jensen & Meckling, 1976; Jensen & Murphy, 1990). Under this view, we should expect a positive relationship between CEO compensation and firm performance. Indeed, an extensive review of the literature on executive compensation performed by Frydman and Jenter (2010) indicate that, for most time periods and countries, CEO compensation is strongly positively related with firm performance. However, this positive link between pay and performance is controversial. It may be the outcome of an optimal contract between shareholders and CEO or it could be a product of the managerial power *vis-à-vis* the board of directors – a higher firm performance would allow CEOs to increase their pay level without drawing shareholders' attention.

In view of above, the *managerial power* view sees CEO compensation not only as an instrument to alleviate the agency problem between managers and shareholders but also as a product of this same agency problem (Bebchuk & Fried, 2004). This perspective was mostly promoted by Bebchuk and Fried (2004) who argue that many observed features of CEO compensation appear inconsistent with the predictions of the agency theory, being explained by the fact that compensation contracts are not designed by boards but rather by CEOs themselves to maximize their own wealth. Although in most companies the ultimate decision over CEO compensation is taken by outside members of the board, CEOs can exercise their power to at least influence the level and structure of their pay (Murphy, 1999). Part of the

¹ In addition to the optimal contracting and managerial power views, a third perspective has recently surged, arguing that institutional factors, such as regulation, tax and accounting policies, are important determinants of executive pay. Due to space constraints and considering the main purpose of the present dissertation, this perspective is not approached here. For a comprehensive debate about this topic, we recommend Murphy (2013).

current controversy over CEO compensation is in fact due to the perception that CEOs effectively set their own pay, disregarding the shareholders' interests.

The managerial power view finds support in several empirical findings. Firstly, under the optimal contracting view, the firm performance should be measured relative to their peers for compensation purposes so that exogenous factors unrelated to executives' effort are not considered (Hölmstrom, 1979; Holmstrom & Milgrom, 1987). Yet, despite recent evidence suggests that Relative Performance Evaluation (RPE) may be more common than traditionally argued (Edmans & Gabaix, 2016)², it is still far less common than the standard agency theory would predict. Besides, there is strong evidence that CEOs are frequently rewarded by factors beyond their control (e.g. Bertrand & Mullainathan, 2001; Garvey & Milbourn, 2006). Hence, these findings suggest that many observable exogenous shocks are not being filtered out, and consequently, compensation contracts continue to be strongly (and apparently unnecessarily) affected by factors beyond CEOs' control³.

Secondly, the severance payments made to CEOs at their departure (also called “golden handshakes”), which are often much higher than it was contractually specified (Goldman & Huang, 2014; Yermack, 2006), are suggestive of CEO power. Their use is especially prevalent among fired rather than retiring CEOs and some CEOs continue to be rewarded with benefits even after their departure (Bebchuk & Fried, 2004). Thereby, it appears that CEOs are being rewarded for “failure”.

Thirdly, CEO compensation contracts often includes “hidden” compensation elements difficult to be observed by outsiders, such as severance payments, perquisites and pensions, allowing CEOs to extract rents without the recognition of shareholders (Bebchuk & Fried, 2004; Jensen & Meckling, 1976; Kuhnlen & Zwiebel, 2008). If CEO compensation was consistent with shareholder value maximization, there would be no need to hide it from shareholders.

² Assuming a peer group only based on firm's industry or size may lead to measurement errors that underestimate the use of RPE, leading to the traditional conclusion that RPE is rarely used (e.g. Aggarwal & Samwick, 1999; Murphy, 1999). Albuquerque (2009) by defining firms according to not only industry, but also to size, finds significant evidence for RPE. Also, by defining peers as the primary competitors that firms report in their 10-Ks, Lewellen (2015) finds evidence for RPE.

³ The choice of boards to reward CEOs mostly through non-indexed stocks and stocks options (Edmans, Gabaix, & Jenter, 2017), which are directly tied to stock prices (a factor outside CEOs' control), could be a major contribution for the observed lack of indexing.

Finally, the decrease of CEO compensation after the introduction of regulatory laws that strengthen the board supervision (Chhaochharia & Grinstein, 2009) is also used as an argument in favour of the managerial power view.

Under the rent extraction view, firms with more powerful CEOs are expected to present higher levels of compensation and lower pay-for-performance sensitivities (Bebchuk & Fried, 2003). Empirical studies suggest that CEOs are likely to have more power when the corporate governance is weak, which can either result from ineffective boards or ineffective ownership structures (absence of large shareholders and/or institutional shareholders).

As pointed out by Bertrand and Mullainathan (2001), firms with high-quality board leadership are more effective in monitoring CEOs and preventing them from controlling the pay-setting process. Consistent with this, firms with more independent directors on the board and/or smaller board sizes⁴ present lower levels of compensation and higher pay-for-performance sensitivities (Conyon & He, 2011; Core, Holthausen, & Larcker, 1999; Fahlenbrach, 2009; Ryan & Wiggins, 2004; Yermack, 1996). In contrast, when the CEO is simultaneously the chairman of the board of directors, that position provides him enough power to extract rents and achieve higher levels of compensation (Core et al., 1999).

Similarly, the presence of large shareholders (also called blockholders), who have stronger incentives and power to discipline managers, will tend to restrain managerial rent-extraction practices. Consistent with this, Core et al. (1999) find that CEO compensation is lower in the presence of an external blockholder; Cyert, Kang, and Kumar (2002) document a negative relationship between the largest shareholder ownership and the level of CEO pay; and Conyon and He (2011) show that executive pay is lower in firms with more concentrated ownership structures.

Finally, institutional shareholders, because they have greater expertise, resources and usually larger stakes, are more likely to have the ability and incentive to actively monitor CEOs (Aghion, Van Reenen, & Zingales, 2013; Edmans et al., 2017). In this respect, Hartzell and Starks (2003) find that institutional ownership is positively related to the pay-for-performance sensitivity and negatively related to the CEO pay level. Bell and Van Reenen (2016) not only find a weaker relationship between CEO pay and performance in low institutional ownership firms but also find pay asymmetry in these firms. That is, while these firms reward CEOs with significantly higher pay levels when the returns are positive,

⁴ In smaller boards, a higher pressure is faced by each individual board member to monitor the CEO.

CEOs do not seem to be “punished” for poor performance. On the other hand, firms with higher institutional ownership appear to reward performance symmetrically. These findings are hard to reconcile with the optimal contracting view and seem more consistent with rent extraction by CEOs.

Beyond the direct cost associated with the excessive pay captured by CEOs – the difference between what CEOs’ power enables them to receive and what they would receive under an optimal scenario –, the largest cost arising from managerial power could be the distortion of CEOs’ incentives, potentially jeopardizing the firm performance (Bebchuk & Fried, 2003; Edmans et al., 2017). Furthermore, not only managerial power affects the compensation levels of the firm itself but also imposes negative externalities on other firms. Acharya and Volpin (2009) and Dicks (2012) show that poorly-governed firms that overpay their executives will force rival firms to also offer inefficiently higher levels of compensation to remain competitive (even if they are well-governed), creating a potentially large “contagion” effect on the whole market (Bereskin & Cicero, 2013; Gabaix & Landier, 2008).

A strong caveat of the managerial power view is that it is not able to explain the rapid rise in CEO pay over the last decades (Edmans et al., 2017). There is no evidence that corporate governance has weakened over the past 30 years. Instead, most indicators show that shareholders have been more empowered, informed and engaged and governance has strengthened over this period (Hermalin, 2005; Holmstrom & Kaplan, 2001; Kaplan, 2008). Indeed, the fraction of outside directors on boards and the level of institutional ownership have been increasing since the 1970s (Huson, Parrino, & Starks, 2001), while CEO turnovers have become more closely linked to firm performance (Jenter & Lewellen, 2014). In addition, Kaplan and Rauh (2009) show that executive pay has risen more slowly than in other high-skill professions such as private equity, venture capital, hedge funds and law.

Besides, recent shareholder value theories have challenged the managerial power view, showing that the features of CEO compensation typically used as arguments in favour of this perspective, can actually be consistent with efficient contracting. For instance, Gabaix and Landier (2008) argue that the rapid rise of CEO pay level since the 1980s can be fully attributed to the simultaneous growth in firm size, which increased the demand for managerial talent, putting upward pressure on CEO pay. Section 2.3.3. will present further justifications for apparent contradictory features of CEO compensation.

2.3. Pay-for-luck

2.3.1. Pay-for-luck and the Agency Theory

There is a large number of empirical studies that analyse whether CEOs are rewarded by luck. By luck, we refer to changes in firm performance that are not driven by CEO's actions or effort but rather by observable exogenous factors beyond CEO's control (e.g. industry movements).

The agency theory suggests that pay-for-performance should be efficient, *i.e.*, in order to induce CEOs to take actions that maximize shareholder value, CEOs should be compensated for their true contribution to firm performance, purged of factors beyond their control (Murphy, 1999). According to the informativeness principle introduced by Hölmstrom (1979), only performance measures that reveal information about CEO's actions should be considered in compensation contracts. Given that luck adds noise without reflecting CEO's effort, it should not affect her compensation. Beyond providing no incentive effects – it can actually be a disincentive –, linking pay to luck will only make compensation contracts riskier, lowering the utility of risk-averse executives (Hölmstrom, 1979). Therefore, compensation contracts should filter out observable luck from performance measures. This not only reduces the problem that CEO pay could merely increase because of positive shocks unrelated to her effort, but also decreases the variance of her compensation without reducing her incentives.

2.3.2. Evidence of Pay-for-luck

Despite the straightforward prediction of the agency theory, several empirical studies show that CEOs are often paid for luck (e.g. Aggarwal & Samwick, 1999; Bell & Van Reenen, 2016; Bertrand & Mullainathan, 2001; Davis & Hausman, 2018; Garvey & Milbourn, 2006; Murphy, 1999). Compensating CEOs for firm performance improvements that are completely unrelated with their actions and effort is puzzling not only under the agency theory but also under the optimal contracting view, which predicts that luck should not affect incentive pay.

A key contribution to the pay-for-luck literature belongs to Bertrand and Mullainathan (2001). By measuring luck as the portion of firm performance predicted by changes in oil prices (for oil industry), exchange rates (for traded goods industry) and mean industry

performance (for widespread industries), they find that CEO pay is equally sensitive to general firm performance as it is to firm performance that is only driven by luck. Moreover, they show that pay-for-luck is prevalent across each individual component of CEO compensation, *i.e.*, there is as much pay-for-luck on salary and bonus as there is on stocks awards and stock options. This excludes the notion that pay-for-luck mechanically arises because a great fraction of CEO compensation comes from stocks and options and thereby, as firm value rises so does the value of stocks and stock options grants. Since salary and bonus are the pay components over which boards have the most discretion and thus most easily manipulated, finding pay-for-luck on these elements suggests that firms are rewarding CEOs for luck even when they could easily filter it out.

Garvey and Milbourn (2006) confirm the findings of Bertrand and Mullainathan (2001), showing that CEO pay is strongly and positively related to luck. Similarly, almost twenty years after Bertrand and Mullainathan (2001) published their study, Davis and Hausman (2018), by measuring luck through changes in oil prices, find strong evidence that executives continue to be rewarded by luck, despite more sophisticated compensation mechanisms have become available.

Given that the above studies focus only on U.S. companies, we could argue that pay-for-luck is a phenomenon only characteristic of the U.S. market. However, Bell and Van Reenen (2016) also find evidence of substantial pay-for-luck in firms of the United Kingdom, where CEO pay increases with industry-wide positive shocks, even when her pay is explicitly condition on firm performance relative to peer firms of the same sector.

2.3.3. Explanations for Pay-for-luck

The question that can be raised now is why do firms reward CEOs for luck when that apparently contradicts the optimal contracting view? Given the extensive empirical evidence on pay-for-luck, a number of different rationalisations for this phenomenon has been given.

The most common explanation comes from Bertrand and Mullainathan (2001) who argue that pay-for-luck is driven by the managerial power, where the separation of corporate ownership from management allows the CEO to gain effective control over her own pay-setting process. Because a strong firm performance lets CEO to use the appearance of pay-for-performance to increase her pay level without drawing shareholders' attention, pay-for-luck arises, reflecting thereby inefficiencies on compensation contracts.

If CEOs can influence indeed how their own pay is set, they will seek to extract rents as much as possible, only benchmarking their performance when it is advantageous to do so. Therefore, we should observe stronger pay-for-luck when luck is rising than when it is falling (in which case, pay-for-luck would reduce their compensation). Consistent with this, Bertrand and Mullainathan (2001), Garvey and Milbourn (2006) and Davis and Hausman (2018) find that pay-for-luck is asymmetric, that is, while CEOs are rewarded for good luck, they are not penalized in the same extent for bad luck, “skimming” only the gains from good luck⁵. Specifically, Davis and Hausman (2018) document that the sensitivity of executives’ compensation to luck is more than three times stronger when luck is improving than when it is falling⁶.

The managerial power hypothesis is strengthened by the finding that pay-for-luck is more prevalent in poorly-governed companies, where CEOs are more likely to gain control over the pay-setting process (e.g. Bell & Van Reenen, 2016; Bertrand & Mullainathan, 2001; Davis & Hausman, 2018; Garvey & Milbourn, 2006). Beyond finding that pay-for-performance is independent of corporate governance, Bertrand and Mullainathan (2001) document that each additional large shareholder on the board reduces pay-for-luck by as much as 33 percent. Moreover, Garvey and Milbourn (2006)’s results show that pay-for-luck asymmetry is more prominent in firms with weaker corporate governance. Contrasting to these findings, DeVaro, Kim, and Vikander (2017) find little evidence that CEO compensation is more positively correlated with luck when shareholder rights are weaker. Likewise, Campbell and Thompson (2015) do not find evidence that well-governed firms have significantly lower pay-for-luck asymmetry.

Another strand of the literature, as opposed to the above hypothesis, suggests that pay-for-luck can be efficiently driven, not by incentive purposes, but rather by retention concerns. In this regard, Himmelberg and Hubbard (2000) and Oyer (2004) argue that if the value of the executives’ outside employment opportunities varies positively with industry or market performance (*i.e.*, with luck), and adjusting compensation contracts is costly, it can be optimal to reward CEOs for that performance to match their external opportunities. Similarly, DeMarzo and Kaniel (2017) and Liu and Sun (2014) show that, when CEOs have

⁵ In this respect, no asymmetry is found in general pay-for-performance (Bertrand & Mullainathan, 2001) neither in firm-specific performance (*i.e.*, the skill component of performance) (Garvey & Milbourn, 2006).

⁶ Recently, Daniel, Li, and Naveen (2019) using 200 different specifications, find no asymmetry in pay-for-luck, even when replicating the methodology adopted by Garvey and Milbourn (2006).

relative wealth concerns, it may be optimal to pay them for positive industry shocks to ensure that their pay is aligned with the one observed in their peers. Furthermore, Bizjak, Lemmon, and Naveen (2008), motivated by their finding that pay-for-luck asymmetry is strongest among CEOs paid below the peer group median⁷, suggest that the observed asymmetry can result from the board using competitive benchmarking when setting compensation, protecting lower-paid CEOs from bad luck and increasing consequently their retention. Consistent with this, Campbell and Thompson (2015) also provide evidence that poorly-paid CEOs receive significantly higher pay-for luck asymmetry, regardless of governance quality. Finally, Brookman and Thistle (2013) despite finding evidence that CEOs are rewarded by luck, document that pay-for-luck disappears when labor market opportunities are considered, proposing that luck may proxy for outside employment opportunities.

Notwithstanding, DeVaro et al. (2017) show that executives' outside opportunities vary indeed with luck but this effect operates entirely through the base salary, having no effect on performance-pay. Bertrand and Mullainathan (2001) also find little support for the retention hypothesis over the skimming one because they not only find that pay-for-luck is less prevalent in industries with higher rates of turnover but also estimate no asymmetry in general pay-for-performance. This is consistent with the finding of Garvey and Milbourn (2006), who document that pay asymmetry does not apply equally to the firm-specific portion of performance⁸. Additionally, Davis and Hausman (2018) find stronger pay-for-luck (and comparable asymmetry) among higher-paid executives, suggesting that pay-for-luck is not driven by retention concerns. Finally, Cremers and Grinstein (2014) claim that retention concerns can only explain pay-for-luck in industries with outsider CEOs – CEOs that come from outside industries – and where the overall supply of CEOs is relatively inelastic. Under these circumstances, boards may be forced to raise CEO compensation when there is a positive industry-wide shock. These empirical findings are consistent with the argument of Holmlstrom (2004), who defends that CEOs' outside opportunities do not fully explain changes in CEO compensation.

⁷ Under the rent extraction view, pay-for-luck asymmetry should be more prevalent among higher-paid CEOs since these are the ones more likely to influence the pay-setting process.

⁸ Given that a poor firm performance is usually associated to only lower wages but also to an increased probability of job-exit (e.g. Bell & Van Reenen, 2016; Huson et al., 2001), under the retention hypothesis, we should also observe an asymmetry in pay-for-performance.

A third strand of the literature suggests that pay-for-luck is efficiently driven by the board's desire to incentivize CEOs to forecast or respond to lucky events. Gopalan, Milbourn, and Song (2010) argue that by tying compensation to luck, CEOs are encouraged to invest in information about the industry outlook and, consequently, to shape proactively the firm's strategy and respond optimally to industry shocks. Albuquerque, Bennett, Custódio, and Cvijanovic (2019) show that most of pay-for-luck documented in prior literature is explained by CEOs being ex-post compensated for acting or responding to luck (*i.e.*, most of pay-for-luck corresponds to pay-for-action) and these responses add value to shareholders. In this sense, CEOs are not being rewarded purely for luck but rather for responding to unpredicted lucky events in a way that shareholder value is maximized. As suggested by Core et al. (2003) and Murphy (1999), it is optimal to reward CEOs for responding to lucky events when such action increases shareholder value. To argue against this, Bertrand and Mullainathan (2001) find that in oil industry, CEOs who respond to lucky shocks exactly the same way as every other oil CEO are rewarded⁹.

In view of above, Campbell and Thompson (2015), by independently and jointly testing each proposed explanation for the observed pay-for-luck asymmetry across multiple specifications, find that retention concerns is the primary determinant of the pay asymmetry while industry sensitivity concerns, governance quality and CEO power are only weakly related. However, pay asymmetry persists even after accounting for each of these explanations, suggesting that there are still determinants of pay-for-luck to be revealed.

2.4. Brief Summary

Following the prior literature review on CEO compensation, it is possible to infer that CEO compensation has become more complicated than ever, with several factors playing a role: on one hand, the board's desire to maximize shareholder value and, on the other hand, the CEOs' desire to maximize their own wealth at the expense of shareholders.

Although CEO compensation contracts overall appear efficient (e.g. Edmans & Gabaix, 2009; Gabaix & Landier, 2008), there is evidence that compensation practises are not always aligned with shareholders' interests, existing still individual cases of rent extraction. The rapid rise of CEO pay level, vastly outpacing the rise of the average worker compensation; the absence of RPE in compensation contracts; the observation of "hidden" compensation

⁹ Under this hypothesis, only CEOs who are exceptional in forecasting luck should be rewarded.

elements; the strong evidence that executives are rewarded by luck; and the finding of stronger pay-for-luck (and comparable asymmetry) in poorly-governed firms appear more consistent with rent extraction than with shareholder value maximization. Therefore, the increasing availability of more sophisticated compensation mechanisms, the increasing pay disclosures requirements (partially in response to perceived abuses (Murphy, 2013)), and the reform process the CEO pay has been suffered appear insufficient to align the CEO's interests with those of shareholders.

Notwithstanding, although the above empirical findings appear inconsistent with the optimal contracting view, they do not *per se* rule out this perspective. Many observed features of CEO compensation contracts are consistent with both rent extraction and optimal contracting. For instance, rewarding CEOs for luck can also be part of an efficient contract and consistent with shareholder value maximization. In this sense, the interpretation of those findings is still in debate and no consensus view has still emerged.

Indeed, much of the literature on executive compensation attempts to reconcile these two views. As claimed by Murphy (2013), these two perspectives are not mutually exclusive and both forces are important in determining the executive's compensation. Yet, neither alone accounts for all facts and historical trends observed (Edmans et al., 2017). Having said this, despite decades of research on CEO pay, there are still many open questions to answer and still much to learn about this topic.

In view of above, it is worth providing updated empirical facts on CEO compensation, analysing in particular whether CEOs at European companies are rewarded by luck over a recent time period. A summary of the studies reviewed on pay-for-luck and the explanations for this phenomenon can be found in Table 3 and Table 4 of the Annexes' Section, respectively.

3. Research Hypotheses

Following Bertrand and Mullainathan (2001) and Garvey and Milbourn (2006), we measure luck as the portion of firm performance that can be predicted by the mean industry performance, as a proxy for external shocks that affect all firms in the same industry. The main advantage of using industry performance as a measure of luck, rather than changes in exchange rates or oil prices, is that this measure is available for all industries, allowing larger-scale analyses and cross-industry comparisons (Davis & Hausman, 2018). On the other hand, we are forced to choose a peer comparison group which introduces ambiguity about which companies to include, as well as about how to weight the different observations. This may lead to measurement errors that have to be taken into account when interpreting our empirical results.

Having said that, the first hypothesis we test is whether “*CEO compensation is positively impacted by luck*”, that is, if CEO pay rises with firm performance improvements driven by industry shocks. Since the industry performance is easily observed and completely outside the control of CEO, under the optimal contracting view, the industry performance should be filtered out from firm performance for compensation purposes. However, there is robust evidence that there is a strong link between CEO pay and industry performance, suggesting that CEOs are rewarded by luck (*vide* Section 2.3.2.). In this sense, a strong and positive relationship between CEO compensation and luck is expected to be observed.

Finding pay-for-luck does not *per se* rule out the optimal contracting view. As presented in Section 2.3.3, there are alternative explanations for pay-for-luck that do not rely on inefficiency. In this sense, instead of arguing against each of these justifications, we attempt to determine whether CEO power can be the underlying driver of pay-for-luck by testing if this phenomenon is greater across subsamples where, under the managerial power view, it is expected that rent extraction dominates¹⁰.

Firstly, if pay for luck is suboptimal and driven by the managerial power, we should observe stronger pay-for-luck in poorly-governed firms, where CEOs are likely to have more power *vis-à-vis* the board of directors. Therefore, we test if “*CEO compensation is more impacted by luck in poorly-governed firms*”. In this respect, most studies on pay-for-luck report that CEO compensation is more sensitive to luck in firms whose corporate governance is weak

¹⁰ Even if we do not conclude for the presence of pay-for-luck on average, pay-for-luck can arise in particular subsamples.

(e.g. Bell & Van Reenen, 2016; Bertrand & Mullainathan, 2001; Davis & Hausman, 2018; and Garvey & Milbourn, 2006). Thereby, a positive relationship between pay-for-luck and poor governance is expected.

Secondly, if CEOs can truly influence their own pay, we should observe stronger pay-for-luck when luck is good (*i.e.*, when the industry performance is rising) than when luck is bad (in which case, luck would cause CEO compensation to decrease). Thus, the third hypothesis we test is whether “*CEO compensation is more impacted by good luck than bad luck*”. Despite recent contradictory evidence, most empirical studies on pay-for-luck document pay asymmetry (see Section 2.3.3). Hence, we expect a stronger relationship between CEO pay and good luck than with bad luck.

Thirdly, according to the managerial power view, pay-for-luck should be more prevalent among higher-paid CEOs since this group of executives is more likely to control the pay setting-process. Therefore, we test if “*CEO compensation is more impacted by luck among highly-paid CEOs*”. Among the empirical studies presented in Section 2.3.3., the evidence has been mixed regarding this hypothesis. While Bizjak et al. (2008) and Campbell and Thompson (2015) find stronger pay-for-luck among CEOs paid below the peer group median, arguing thereby that pay-for-luck is driven by retention concerns, Davis and Hausman (2018) find stronger pay-for-luck among higher-paid executives. Having said this, the expected result regarding this hypothesis is ambiguous¹¹.

Finally, given that we found no empirical study that analyses the impact of the global financial crisis of 2007-2008 on the pay-for-luck phenomenon, we decided to analyse how the sensitivity of CEO compensation to luck varies during *versus* after this major recession. Since companies (and CEOs) have become more exposed to public scrutiny and both compensation disclosure and governance’s rules have become stricter as a result of the financial crisis, if pay-for-luck is indeed suboptimal and driven by the managerial power, we should observe a decline in pay-for-luck after the crisis. Thus, our fifth and final hypothesis is: “*CEO compensation became less impacted by luck after the financial crisis of 2007-2008*”.

¹¹ This hypothesis testing not only provides information about the strength of the managerial power view but also allows us to determine the relevance of retention concerns as an explanation for pay-for-luck.

Table 1 – Summary of the research hypotheses

#	Hypothesis	Main empirical studies	Expected result
H1	CEO compensation is positively impacted by luck	Bertrand and Mullainathan (2001); Garvey and Milbourn (2006); Bell and Van Reenen (2016); Davis and Hausman (2018)	✓
H2	CEO compensation is more impacted by luck in poorly-governed firms	Bertrand and Mullainathan (2001); Garvey and Milbourn (2006); Bell and Van Reenen (2016); Davis and Hausman (2018);	✓
H3	CEO compensation is more impacted by good luck than bad luck	Bertrand and Mullainathan (2001); Garvey and Milbourn (2006); Davis and Hausman (2018)	✓
H4	CEO compensation is more impacted by luck among highly-paid CEOs	Bizjak et al. (2008); Campbell and Thompson (2015); Davis and Hausman (2018)	?
H5	CEO compensation became less impacted by luck after the financial crisis of 2007-2008	-	✓

4. Data

4.1. Sample

Our sample comprises 176 European companies listed in the S&P Europe 350 Index¹², over the period between 2008 and 2018. Following Garvey and Milbourn (2006), we have only included firms whose fiscal year ends on 31st of December – so that the performance comparison between firms is made over the same time period – and we have excluded financial and real-estate firms – firms whose Global Industry Classification Standard (GICS)¹³ Sector Code is 40 and 60, respectively. In this sense, of the initial sample of 350 firms¹⁴, 76 companies were excluded based on the sector criteria, 53 were excluded based on fiscal year criteria, and 45 were excluded due to lack of data, remaining 176 firms from 16 European countries and 9 sectors¹⁵. Given the extensive range of countries, we decided to group them in three regions: (i) *Northern Europe* (NE), comprising the countries of Denmark, Finland, Ireland, Sweden, Norway and United Kingdom; (ii) *Central Europe* (CE), which includes Austria, Belgium, France, Germany, Luxembourg, Netherlands and Switzerland; and (iii) *Southern Europe* (SE), composed by Italy, Portugal and Spain.

To compute the mean industry performance for each firm in each year, following Bertrand and Mullainathan (2001) and Garvey and Milbourn (2006), we proxy the industry by considering all European firms listed in Thomson Reuters Eikon's database with the same GICS sector code as the firm under analysis. Of the initial sample of 5.905 companies, 320 firms were excluded due to missing data, with our final industry sample being composed by 5.585 companies from 42 European countries and 9 sectors.

¹² The S&P Europe 350 Index is a stock market index that comprises 350 leading blue-chip companies from 16 developed European markets.

¹³ The GICS is a standardized industry classification system developed in 1999 by Morgan Stanley Capital International (MSCI) and S&P Dow Jones Indices. The GICS structure consists of 11 Sectors, 24 Industry groups, 69 Industries and 158 sub-industries.

¹⁴ The S&P Europe 350 Index is actually composed by 362 stocks given that 12 of the 350 constituent companies have two types of class shares listed on the market. It was only considered one stock per company, in which the secondary shares were excluded from the analysis.

¹⁵ It should be mentioned that for merged companies whose merger occurred during our sample period, the company considered in our analysis before the merger, is the major shareholder of the merged company.

Table 5 and Table 6 of the Annexes' Section present the distribution of our sample according to the company's domicile region and sector, respectively. In summary, 53% of the companies are headquartered in Central Europe (specifically, 19% are domiciled in France and 12% in Germany); 38% in Northern Europe (where 18% are domiciled in the United Kingdom); and the remaining 9% are headquartered in Southern Europe (where half are domiciled in Italy). Moreover, around 43% of the companies belong to the Industrials (29%) and Materials' Sectors (14%) and the sector with the lowest relevance is the Energy Sector, with only 4,5% of the total companies (corresponding to 8 companies). In this regard, it should be noted that, on average, the size of the industry sample is 36 times bigger than the one of the main sample of companies belonging to that sector.

4.2. Variables

Our variables can be divided into four groups: (i) Performance; (ii) CEO compensation; (iii) Corporate Governance; and (iv) Control Variables. In the following subsections, we present the composition of each group as well as information about how the data was collected. It should be mentioned that the data was collected by firm and year and hence, our sample is organized as panel data, combining time and cross-sectional data. This allows us to perform comparisons simultaneously over time and between different firms.

A list of all the variables, along with their definitions and data sources, can be found in Table 7 of the Annexes' Section.

4.2.1. Performance

The measure empirically used for firm performance (*Firm_Perf*) is usually based on accounting or stock-market performance. Given the importance of considering multiple empirical specifications when analysing pay-for-luck (Campbell & Thompson, 2015; Daniel et al., 2019), we use both measures for firm performance. Accounting performance is measured by the Return on Assets (ROA) – *Firm_ROA* –, corresponding to the ratio of the Earnings Before Interest and Taxes (EBIT) to the book value of total assets; and the market performance is measured by the Market Value of Equity – *Firm_MV* –, corresponding to the

end-year Market Capitalization¹⁶. In this regard, to minimize the impact of outliers on our results and potential data errors, both *Firm_ROA* and *Firm_MV* were winsorized at the 1% level, such that any value below (above) the 1st (99th) percentile has been set to the value of the 1st (99th) percentile. These variables are expected to be positively correlated with CEO compensation, as vastly suggested by the empirical evidence (e.g. Correa & Lel, 2016; Frydman & Jenter, 2010; Gabaix & Landier, 2008).

Regarding the mean industry performance (*Ind_Perf*) – our measure of luck –, we consider both ROA – *Ind_ROA* – and Market Value – *Ind_MV* –, in which, for each measure, we consider the mean weighted by firms' size, measured by the book value of total assets. It should be noted that given these variables contain accounting data, only firms whose fiscal year ends on 31st of December were considered. In addition, similar to the methodology adopted in our main sample, firms' ROA and market value, used to compute the mean industry performance, were winsorized at the 2% level¹⁷.

Both EBIT and Total Assets, required to compute ROA, and Market Capitalization were collected from Worldscope (via Thomson Reuters Datastream) in million euros.

4.2.2. CEO Compensation

For simplification purposes, we only consider short-term and cash compensation components. These are the pay components over which boards are likely to have the most discretion and thus, not only are they the easiest to be manipulated by executives, but also where luck would be easiest to be filtered out. Consequently, finding pay-for-luck in these compensation components would be notable, giving strong support to the managerial power hypothesis. Having said this, the total CEO compensation (*TComp*) considered for each firm and year is the total short-term cash compensation, corresponding to the sum of the base salary (*Salary*) – the fixed component – and the annual cash bonus (*Bonus*) – the variable

¹⁶ For consistency reasons, market value (static measure) was chosen over stock return (flow measure) given that ROA is as well a static measure. This is also the market performance measure considered by Bertrand and Mullainathan (2001) and Davis and Hausman (2018) in their empirical specifications.

¹⁷ We extended the winsorized range by one percentage point compared to the range adopted in our main sample (1% level) since, in some sectors, given the size of the sample, a higher percentage would be required to, at least, one extreme value be replaced.

component – awarded by the CEO during that year¹⁸. Deferred cash bonus, equity-based components (e.g. stock options and stock awards), pension fund contributions and benefits in-kind (such as company car, health insurance, social security contributions and minor taxable expenses) are therefore not considered. We additionally compute the portion of the bonus over the total compensation (*%Bonus*) for each company and year.

The data on CEO compensation was collected manually from the companies' Annual Reports¹⁹ and, whenever possible, in the currency in which the remuneration was paid, which was then converted to euros based on the annual average exchange rate published by the European Central Bank. Given that we analyse annual changes on compensation, we do not consider, for each firm, the years in which the CEO changes, unless the compensation package for the new CEO remains the same²⁰. In this regard, it should be noted that, in order to have longer time periods without “breaks”, since 2008 and 2018 are limit years, whenever the CEO changes in 2009 or 2017, we consider instead those years (annualizing the respective compensation), while the years of 2008 and 2018, respectively, are not considered (unless the compensation of the new CEO remains the same). Following this procedure, we reach to a final panel data set of 1.778 firm-year observations.

¹⁸ The annual cash bonus, contingent on the fulfilment of a number of short-term objectives pre-defined by the company at the beginning of the year, is usually paid to the CEO only at the beginning of the following year. Nevertheless, we consider the short-term cash bonus due on the year under analysis, independent of the moment when it is paid.

¹⁹ In contrast to U.S., which has required detailed disclosure of executive pay since the 1930s, the majority of other countries have historically required at most the disclosure of aggregate compensation for all top executives combined, with no individual data (Murphy, 2013). Fortunately, the disclosure requirements of executive pay have become stricter in recent years, helping researchers to extend their analysis outside the U.S. In 2006, following a prior recommendation by the European Union Commission in 2004 (Directive 2004/913/EC), most European countries started to require detailed disclosure of directors' remuneration. Therefore, by having publicly available the remuneration of CEOs at European companies, we were able to perform our empirical analysis.

²⁰ In these situations, the CEO compensation is annualized to reflect a full year.

4.2.3. Corporate Governance

To measure the corporate governance quality, we consider four measures: (i) the board size (number of board members) – *BoardSize*; (ii) the percentage of independent members in the board (members who do not have any kind of relationship with the company, *i.e.*, they are not employed by the company; they are not shareholders with more than 5% of holdings; and they have no immediate family ties to the corporation) – *IndepBM*; (iii) the blockholders' ownership (percentage of shareholdings of at least 5%) – *BlockOS*; and (iv) the CEO duality, that is, if CEO is simultaneously the chairman of the board (this variable takes the value of one when the CEO simultaneously chair the board and zero otherwise) – *CEODual*.

According to the empirical evidence presented in Section 2.2, while the CEO duality and a larger board size might lead to a weaker corporate governance and, consequently, to higher levels of CEO compensation, a higher percentage of independent board members and blockholders' ownership is likely to translate into a better governance and, consequently, to lower levels of compensation. In this respect, although there are other important measures of corporate governance, we focus on the above ones since not only were those variables easy to be obtained, but also they are well founded in the literature, providing a good proxy for the governance quality.

All the governance variables were obtained from Worldscope (via Thomson Reuters Datastream).

4.2.4. Control Variables

Finally, we control for certain firm and CEO's characteristics, which are empirically proven to be important determinants of CEO compensation, in order to ensure that our results are independent from these variables, *i.e.*, that the changes on CEO compensation are only explained by luck.

Following Albuquerque et al. (2019) and Brookman and Thistle (2013), we include as Firm Control Variables (*Firm_Control*): (i) the firm size (*Size*), measured by the book value of total assets; (ii) the Tobin's Q (*TobinQ*), as a proxy of the company's growth opportunities, which was measured by the book value of total assets minus the book value of common equity plus the market value of common equity, divided by the book value of total assets; and (iii) the leverage (*Levarage*), measured by the ratio of the book value of total debt to the book value of total assets. While the company size and the Tobin's Q are expected to be

positively correlated with CEO compensation (Fernandes, Ferreira, Matos, & Murphy, 2013; Frydman & Saks, 2010; Gabaix & Landier, 2008; Gayle, Li, & Miller, 2018; Murphy, 1999)²¹, a negative relationship between CEO compensation and leverage is expected (Titman & Wessels, 1988)²². In this regard, it should be noted that these variables were winsorized at the 1% level.

Considering not only the extensive range of the variable *Size* (see Table 8 of the Annexes' Section) but more importantly the fact that the firm size is one of the most relevant determinants of CEO compensation (Brookman & Thistle, 2013), we sort the companies by size. In this particular, each year, companies are classified as: (i) *Small*, when their size is situated below the first quartile; (ii) *Medium*, when they present a size that falls between the first and third quartile; and (iii) *Large*, when their size is situated above the third quartile.

As CEO Control Variables (*CEO_Control*), we consider: (i) the CEO's age (*CEOAge*); and (ii) the CEO's tenure (*CEOTenure*), measured by the number of years the CEO has been in that position. Given that the age and tenure of the CEO provide him power and influence over the board of directors (Brockman, Seung, & Salas, 2016; Bushman, Indjejikian, & Smith, 1996; Edmans et al., 2017), a positive relationship between these variables and CEO compensation is expected.

The book and market value of common equity, required to compute the Tobin's Q, and the book value of total debt, required to compute the leverage, were collected from Worldscope (via Thomson Reuters Datastream) in million euros; and the CEO's age and tenure were obtained manually from the companies' Annual Reports.

²¹ Larger companies are more complex, demanding higher-skilled and experienced CEOs, which results in higher levels of compensation.

²² Firms with higher levels of debt, by facing higher financial constraints, are expected to present lower levels of compensation.

5. Methodology

5.1. Pay-for-luck

In order to test our first hypothesis “*CEO compensation is positively impacted by luck*”, following what has been made on the previous studies on pay-for-luck (Bell & Van Reenen, 2016; Bertrand & Mullainathan, 2001; Davis & Hausman, 2018; Garvey & Milbourn, 2006), we estimate a two-stage regression, resorting to an IV – the mean industry performance – to isolate the firm performance that is driven by luck rather than CEO’s actions²³. That is, at a first stage, we estimate the firm performance that is driven by luck (measured by the mean industry performance), and secondly, we estimate the sensitivity of CEO pay to this predicted firm performance due to luck.

In view of above, our baseline specification is the following:

1st stage Regression:

$$Firm_Perf_{i,t} = \alpha + \beta.Ind_Perf_{i,t} + \varepsilon_{i,t} \quad (5.1)$$

where the dependent variable, $Firm_Perf_{i,t}$, is the performance of firm i in year t , corresponding to the firm’s ROA – $Firm_ROA_{i,t}$ – or to the logarithm of the firm market value – $Log(Firm_MV)_{i,t}$; $Ind_Perf_{i,t}$ represents our measure of luck, corresponding to the mean industry performance for firm i in year t – $Ind_ROA_{i,t}$ or $Log(Ind_MV)_{i,t}$; and $\varepsilon_{i,t}$ is the residual term, corresponding here to the skill component of the firm performance.

2nd stage Regression:

$$\begin{aligned} Log(TComp)_{i,t} = \\ \alpha + \delta_1.Luck_{i,t} + \delta_2.Firm_Control_{i,t} + \delta_3.CEO_Control_{i,t} \\ + \varepsilon_{i,t} \end{aligned} \quad (5.2)$$

²³ Since the industry performance is determined by exogenous factors not controlled by CEOs, by using this measure to instrument for firm performance, we are able not only to isolate the firm performance that is driven by industry shocks (*i.e.*, by luck), but also to interpret the IV estimate as the firm performance driven by luck. If there was any endogeneity in industry performance (for instance, if there was a reverse causality, in which the decisions on CEO compensation also impact the industry performance), a casual interpretation would not be possible. In this regard, it is important to note that the mean industry performance is an imperfect measure of luck and thereby, we may misclassify some luck as skill (*i.e.*, the firm-specific performance, affected by CEOs’ actions), and vice-versa.

where the dependent variable, $\text{Log}(TComp)_{i,t}$, is the logarithm of the total short-term cash compensation awarded by the CEO of firm i in year t ; $\text{Luck}_{i,t}$ is the firm performance driven by luck for firm i in year t , corresponding to the estimated value from the 1st stage regression (5.1) – $\widehat{\text{Firm_Perf}}_{i,t}$; $\text{Firm_Control}_{i,t}$ is the vector of firm-specific control variables for firm i in year t , which includes the logarithm of firm size – $\text{Log}(\text{Size})_{i,t}$ –, the Tobin's Q – $\text{TobinQ}_{i,t}$ – and the leverage – $\text{Leverage}_{i,t}$; and $\text{CEO_Control}_{i,t}$ is the vector of CEO-specific control variables for firm i in year t , which includes the logarithm of CEO's age – $\text{Log}(\text{CEOAge})_{i,t}$ – and the logarithm of CEO's tenure – $\text{Log}(\text{CEOTenure})_{i,t}$ ²⁴.

The pooled-regressions (5.1) and (5.2) are estimated using the Ordinary Least Squares (OLS) method with time and firm fixed-effects to account for unobservable time-invariant firm characteristics that could impact our results²⁵. This implies that the regression coefficients are estimated within firm variation (any constant effects of the firm are removed) and therefore, the variation in CEO compensation results from changes in the same firm over time²⁶.

Our coefficient of interest is δ_1 , which captures the sensitivity²⁷ of CEO pay to the firm performance driven by luck. Under the optimal contracting view, luck should not affect CEO compensation and hence, this coefficient should be zero. On the other hand, under the managerial power view, the coefficient should be positive and statistically significant, providing evidence of pay-for-luck²⁸.

In addition to total cash compensation, we also test pay-for-luck across its individual components, where our standard 2nd stage regression (5.2) is estimated with the logarithm of CEO Salary – $\text{Log}(\text{Salary})_{i,t}$ – and the logarithm of CEO Bonus – $\text{Log}(\text{Bonus})_{i,t}$ – as

²⁴ We use the logarithm in all variables not expressed in percentage – the ones whose the distribution's skewness is more pronounced (*vide* Table 8 of the Annexes' Section) –, in order to reduce the heteroskedasticity.

²⁵ This also captures industry-level fixed effects (unless the firm changes its industry over the sample period).

²⁶ Although the variation in CEO compensation might also come from having different CEOs at the same firm, this problem is attenuated by not considering, for each firm, the years in which CEO changes.

²⁷ Statistically, the correct term is elasticity given that our market value specification is a log-log one. However, for simplification purposes, we will use the term sensitivity indifferently throughout the text.

²⁸ Despite not being the focus of our study, our model specification also allows us to test for RPE, in which the industry is the peer group.

dependent variables²⁹. Besides, pay-for-luck is tested across different firm's sizes, European regions and sectors³⁰ by estimating separately the standard 2nd stage regression (5.2) for each subsample of firms.

Furthermore, we test whether our results change when we consider the following-year compensation instead of the current-year compensation. In our baseline specification, we estimate pay-for-luck based on the contemporaneous firm performance, *i.e.*, we consider a performance period that matches the compensation awarded by the CEO over that same year. However, while the bonus, typically paid at the beginning of the following year, depends on the current year performance, the salary level, paid throughout the year, might be determined based on the firm performance of prior year. Therefore, we estimate alternatively the following 2nd stage regression:

$$\begin{aligned} \text{Log}(TComp)_{i,t+1} = \\ \alpha + \delta_1.Luck_{i,t} + \delta_2.Firm_Contol_{i,t} + \delta_3.CEO_Control_{i,t} \\ + \varepsilon_{i,t} \end{aligned} \quad (5.3)$$

where the dependent variable, $\text{Log}(TComp)_{i,t+1}$, is the logarithm of the total short-term cash compensation paid by firm i to CEO in year $t+1$, corresponding to the sum of the salary paid and due throughout the year $t+1$ and the bonus paid in year $t+1$ but due in year $t - \text{Log}(Salary_{i,t+1} + Bonus_{i,t})$ ³¹.

Finally, we measure pay-for-performance – the extent to which CEO compensation varies with general firm performance – in order to provide a baseline comparison with pay-for-luck. In this sense, we estimate a regression similar to regression (5.2), except that instead of estimating the effect of luck on CEO compensation, we estimate the effect of general firm performance on CEO compensation.

²⁹ In this regard, we add 1 unit (€ 0,000001 million) to the variables *Salary* and *Bonus* to remove the problem of considering the logarithm of a zero value. In the remaining variables in which we use the logarithm, we do not face this problem.

³⁰ Differences in the level of market competition and regulation across countries and sectors may lead to differences in the extent of pay-for-luck.

³¹ In our baseline specification, we consider the variable $Bonus_{i,t}$ equal to the bonus awarded by the CEO in year t , independent of the moment when it is paid.

$$\begin{aligned}
Log(TComp)_{i,t} = & \\
& \propto + \theta_1.Firm_Perf_{i,t} + \theta_2.Firm_Contol_{i,t} \\
& + \theta_3.CEO_Control_{i,t} + \varepsilon_{i,t}
\end{aligned} \tag{5.4}$$

Before interpreting the results obtained from the regressions estimation, we evaluated the quality of the above models by assessing the models': (i) theory consistency; (ii) goodness of fit; and (iii) statistical robustness. Specifically, we verified that the models are globally significant; each individual explanatory variable is statistically significant; the residuals are normally distributed, non-correlated and with constant variance (homoscedasticity); and there is no model misspecifications and multicollinearity problems.

5.2. Pay-for-luck and Corporate Governance

After testing the general sensitivity of CEO compensation to luck across alternative specifications, we now turn to testing some arguments used in favor of the managerial power view, corresponding to our remaining hypothesis defined in Section 3.

To carry out the hypothesis testing H2 “*CEO compensation is more impacted by luck in poorly-governed firms*”, for each year, we consider poorly-governed firms the ones where: (i) the board size is above the sample annual median; (ii) the percentage of independent board members is below the sample annual median; (iii) the blockholders’ ownership is below the sample annual median; or (iv) the CEO holds simultaneously the position of the chairman of the board.

Following the logic of Bertrand and Mullainathan (2001), in order to allow the effect of luck on firm performance to also depend on governance – firm performance may be more or less responsive to luck depending on the company’s governance quality –, we estimate our 1st stage regression (5.1) separately for each governance measure and subsample. Then, to allow the pay-for-luck sensitivity to depend on governance, we estimate the standard 2nd stage regression (5.2) separately for each governance measure and subsample, with $Luck_{i,t}$ corresponding to the estimated value from the respective 1st stage regression.

The comparison between the luck coefficients obtained from each 2nd stage regression indicates us whether the sensitivity of CEO compensation to luck differs between well-governed and poorly-governed companies. In this concern, under the rent extraction view, we should estimate a statistically higher luck coefficient among the poorly-governed companies, implying that pay-for-luck is stronger among these firms.

Because one could argue that finding more pay-for-luck in poorly-governed firms could be driven by these firms paying stronger forms of pay-for-performance³², we circumvent this problem by estimating how the sensitivity of pay-to-performance varies as well with governance. To achieve that, we estimate the pay-performance regression (5.4) for each governance measure and subsample. If the difference of the coefficients of interest between poorly-governed *vs* strongly-governed firms is higher in pay-for-luck compared to pay-for-performance, we can conclude that poorly-governed show indeed more pay-for-luck (relative to pay-for-performance). Otherwise, pay-for-luck could simply increase as a consequence of these firms paying more pay-for-performance.

5.3. Pay-for-luck Asymmetry

In order to test the hypothesis H3: “*CEO compensation is more impacted by good luck than bad luck*”, we create a dummy variable representing good luck – $GoodLuck_{i,t}$ –, that equals one if the industry performance is rising, that is, if the variation of the industry mean performance for firm i in year t relative to year $t-1$ ($\Delta Ind_Perf_{i,t}$) is positive; and zero otherwise. During our sample period, luck is good 44% of the time with respect to ROA and 60% regarding market value.

Similar to the methodology adopted in the previous hypothesis testing and following Davis and Hausman (2018), to allow the effect of luck on firm performance to also depend on whether the industry performance is rising *versus* failing – firm performance may be more or less responsive to luck depending on that –, we estimate two 1st stage regressions: one for the interaction term $Firm_Perf_{i,t} \times GoodLuck_{i,t}$ and other for the interaction term $Firm_Perf_{i,t} \times (1 - GoodLuck_{i,t})$, where the first is instrumented with the interaction term $Ind_Perf_{i,t} \times GoodLuck_{i,t}$ and the second with the interaction term $Ind_Perf_{i,t} \times (1 - GoodLuck_{i,t})$.

$$Firm_Perf_{i,t} \times GoodLuck_{i,t} = \alpha + \beta. Ind_Perf_{i,t} \times GoodLuck_{i,t} + \varepsilon_{i,t} \quad (5.5)$$

$$Firm_Perf_{i,t} \times (1 - GoodLuck_{i,t}) = \alpha + \gamma. Ind_Perf_{i,t} \times (1 - GoodLuck_{i,t}) + \varepsilon_{i,t} \quad (5.6)$$

³² Better-governance firms are more effective in monitoring CEOs and therefore, there is less need to tie their compensation to firm performance (*vide* Section 2.2).

Secondly, to allow the sensitivity of CEO compensation to luck to be a function of the realized luck, we estimate the standard 2nd stage regression with the interaction terms $Luck_{i,t} \times GoodLuck_{i,t}$ and $Luck_{i,t} \times (1 - GoodLuck_{i,t})$, corresponding to the predicted values from the regressions (5.5) and (5.6), respectively $-Firm_Perf_{i,t} \times GoodLuck_{i,t}$ and $Firm_Perf_{i,t} \times (1 - GoodLuck_{i,t})$.

$$\begin{aligned}
Log(TComp)_{i,t} = & \\
& \propto + \delta_1.Luck_{i,t} \times GoodLuck_{i,t} \\
& + \delta_2.Luck_{i,t} \times (1 - GoodLuck_{i,t}) + \delta_3.Firm_Control_{i,t} \\
& + \delta_4.CEO_Control_{i,t} + \varepsilon_{i,t}
\end{aligned} \tag{5.7}$$

If CEOs can control how their own pay is set, they will seek to receive stronger rewards when luck is good and lower penalties when luck is bad. Hence, under the managerial power view, we should estimate a good luck coefficient (δ_1) that is statistically higher than the bad luck coefficient (δ_2).

In order to provide a baseline comparison, we also test the asymmetry on pay-for-performance, where we create a dummy variable representing good performance $-GoodPerf_{i,t}-$, that equals one if the variation of the performance of firm i in year t relative to year $t-1$ ($\Delta Firm_Perf_{i,t}$) is positive; and zero otherwise. The pay-performance regression (5.4) with the interaction terms $Firm_Perf_{i,t} \times GoodPerf_{i,t}$ and $Firm_Perf_{i,t} \times (1 - GoodPerf_{i,t})$ is then estimated.

$$\begin{aligned}
Log(TComp)_{i,t} = & \\
& \propto + \theta_1.Firm_Perf_{i,t} \times GoodPerf_{i,t} \\
& + \theta_2.Firm_Perf_{i,t} \times (1 - GoodPerf_{i,t}) + \theta_3.Firm_Control_{i,t} \\
& + \theta_4.CEO_Control_{i,t} + \varepsilon_{i,t}
\end{aligned} \tag{5.8}$$

Additionally, we test whether corporate governance plays a role in pay-for-luck asymmetry. Under the managerial power hypothesis, CEOs should be able to better protect themselves from bad luck in firms with weaker corporate governance and hence, pay-for-luck asymmetry should be more prevalent in these firms. Having said this, we estimate the 1st stage regressions (5.5) and (5.6) and the 2nd stage regression (5.7) for each governance measure and subsample. A statistically higher difference between the good luck

and the bad luck coefficients among poorly-governed firms will suggest that pay asymmetry is stronger in these companies, giving support to the rent extraction view.

Finally, for comparison purposes and similar to the procedure being adopted, we also test whether pay-for-performance asymmetry varies with corporate governance, where the regression (5.8) is estimated for each governance measure and subsample.

5.4. Pay-for-luck and CEO Pay Level

To carry out the hypothesis testing H4: “*CEO compensation is more impacted by luck among highly-paid CEOs*”, for each year, we consider highly-paid CEOs the ones in which the total compensation is above the sample annual median. The standard 2nd stage regression (5.2) is then separately estimated for each subsample.

Because relatively well-paid CEOs are likely to have more control over the pay-setting process, under the managerial power view, compensation should be more sensitive to luck among these CEOs. Therefore, a statistically higher luck coefficient among highly-paid CEOs will support the managerial power hypothesis while stressing that pay-for luck is not driven by retention concerns.

In order to provide a baseline comparison, we also test pay-for-performance among poorly-paid *vs* highly-paid CEOs by estimating separately the pay-performance regression (5.4) for each subsample.

Finally, we test whether pay-for-luck asymmetry depends on the labor market conditions the CEO face, *i.e.*, on whether the CEO is paid above the median or not. To achieve that, we estimate the regression (5.7) separately for the *highly-paid* and *poorly-paid* subsamples. A stronger pay asymmetry among better-paid CEOs will support once again the rent extraction view.

5.5. Pay-for-luck and the Financial Crisis of 2007-2008

Finally, to test the hypothesis H5: “*CEO compensation became less impacted by luck after the financial crisis of 2007-2008*”, we estimate the standard 2nd stage regression (5.2) separately for two time periods: (1) during the financial crisis (2008-2012); and (2) after the financial crisis (2013-2018).

Because the financial crisis was followed by an increasing scrutiny of CEOs’ compensation and stricter compensation disclosure rules, under the managerial power view, the pay-for-luck coefficient should be statistically smaller in regression (2), indicating that CEOs became less rewarded by luck after the crisis.

Similar to the methodology being adopted, we also analyse the impact of the crisis on pay-for-performance, estimating the pay-performance regression (5.4) separately for each time period.

6. Results and Discussion

6.1. Preliminary Analysis

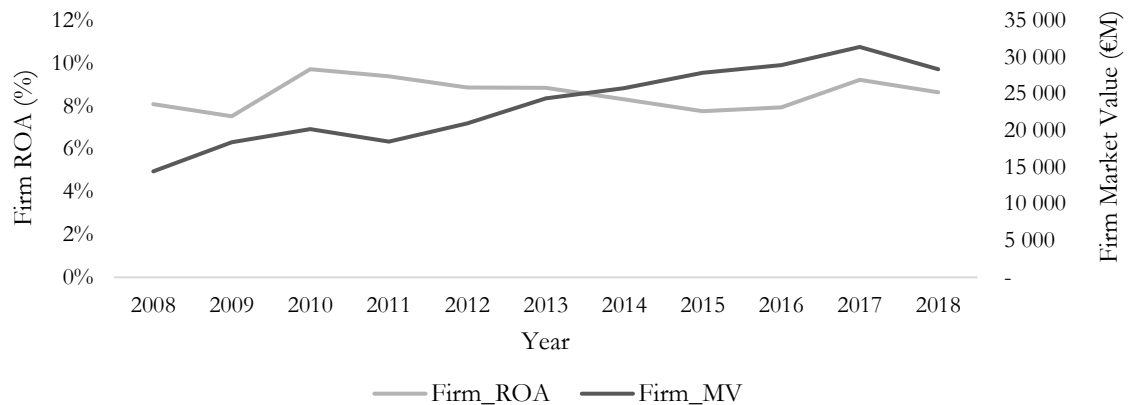
After collecting the necessary data, we start by performing a preliminary data analysis in order to not only have a better understating of the behavior of the variables under study but also to eventually foresee the final results of our empirical analysis. We do not only analyse the behavior of the variables during the full sample period (2008-20018) but we also compare their evolution during the global financial crisis (2008-2012) *vs* after the crisis (2013-2018). Table 8 in the Annexes' Section summarizes the main descriptive statistics of our variables.

Starting with the companies' performance, over the sample period, the ROA is, on average, 8,6% and the market value is € 23.543 million. Comparing these performance measures during and after the financial crisis of 2007-2008, while ROA remains relatively constant (8,7% in 2008-2012 *vs* 8,4% in 2013-2018³³), the market value was more deeply impacted by the financial crisis, increasing from € 18.484 million in 2008-2012 to € 27.758 million in 2013-2018, corresponding to a rise of around 50%.

By observing Figure 1, we can conclude that, on average terms, Firm's ROA and market value present very distinct behaviours over the sample period, which may allow us to expect different results from the regression analysis by using one or another performance measure. In fact, companies' accounting returns are little correlated with market returns, presenting a correlation of only 17% (*vide* Table 9 of the Annexes' Section).

³³ Despite the slightly decrease of ROA in the period after the crisis, by analysing Figure 1, we can observe that there is a significant increase of ROA from 2009 to 2010 of around 30% (2.2 percentage points), reflecting the improvement of the companies' performance after the worst period of the recession.

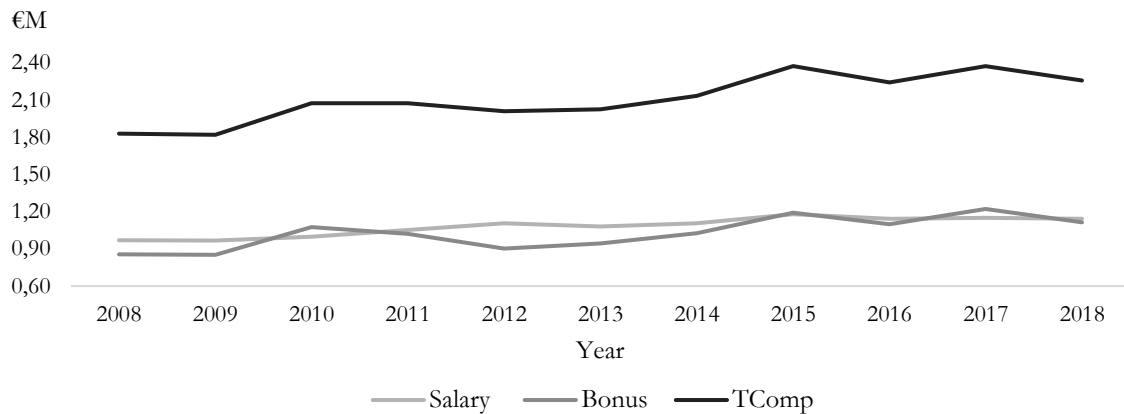
Figure 1 – Average Firm ROA and Market Value



With respect to CEO Compensation, over the sample period, European CEOs earn, on average, € 2,11 million in cash per year, where € 1,08 million (51%) is received through the form of salary and € 1,03 million (49%) in bonus. During this period, the highest-paid CEO receive € 12,50 million in cash compensation (which corresponds also to the CEO who receive the highest bonus during the sample years – € 11,04 million) and, in contrast, the lowest-paid CEO receive € 0,41 million.

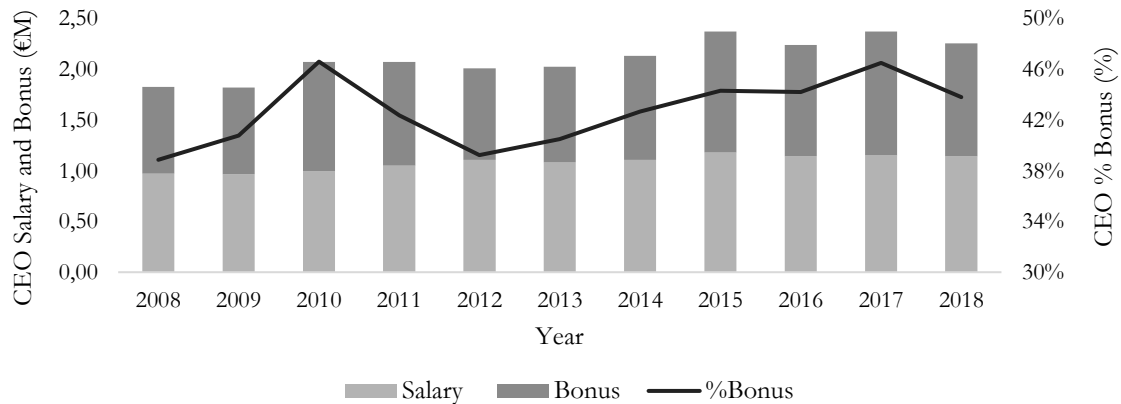
During the period of the financial crisis (2008-2012), European companies rewarded their CEOs with an average cash compensation of € 1,96 million, while after the crisis (2013-2018), European CEOs saw their cash compensation increasing by 14% to € 2,23 million. In fact, since 2008, European CEO mean cash compensation rose by 23%, from € 1,83 million to € 2,26 million, in which salary increased by 18%, from € 0,97 million to € 1,14 million, and bonus increased 30%, from € 0,86 million to € 1,11 million. This strong trend over the years, easily observed through the figure below, is consistent with the improvement of the performance of the companies and the overall economic growth.

Figure 2 – Average CEO Salary, Bonus and Total Compensation



Regarding the structure of CEO compensation, over the sample period, CEOs receive the majority fraction of their compensation in the form of salary, accounting for 57% of the total pay. Nevertheless, by analysing Figure 3, we can observe that the cash bonus has been gradually increasing their relevance throughout the years (39% in 2008 *vs* 44% in 2018), which is also consistent with the improvement of the companies' performance.

Figure 3 – Average CEO Salary, Bonus and %Bonus



Indeed, by focusing on operating performance, two interesting facts emerge from Figure 4. Firstly, on average terms, CEO compensation is highly correlated with firm and industry performance, closely following their patterns. Secondly, CEO compensation tracks upward movements of industry performance more closely than downward movements. In fact, through Figure 5, we can observe that the years in which CEO compensation and industry performance move in opposite directions are the years in which the industry performance declined (2013 to 2015). This is suggestive of asymmetry in pay-for-luck: while CEOs seem to be always rewarded for good luck, they do not seem to be always punished for bad luck.

Figure 4 – Average Firm ROA, Industry ROA and CEO Total Compensation

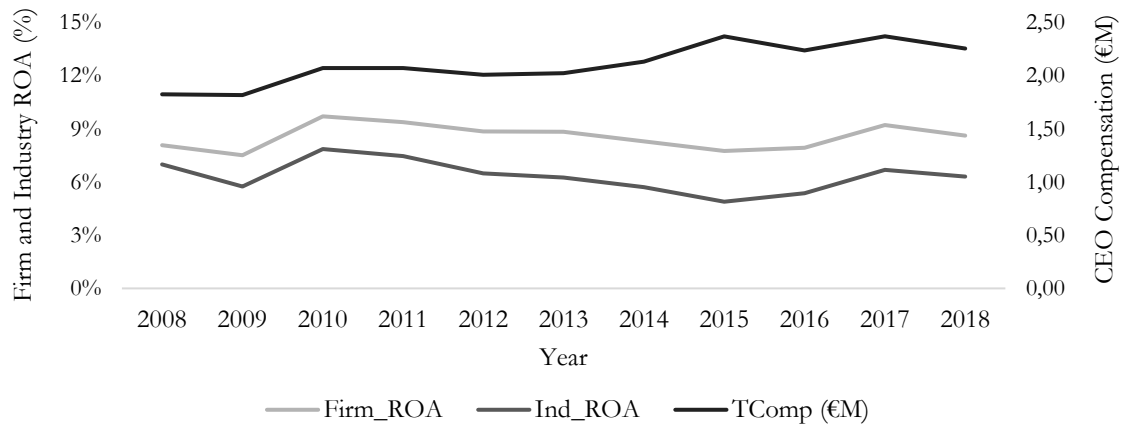
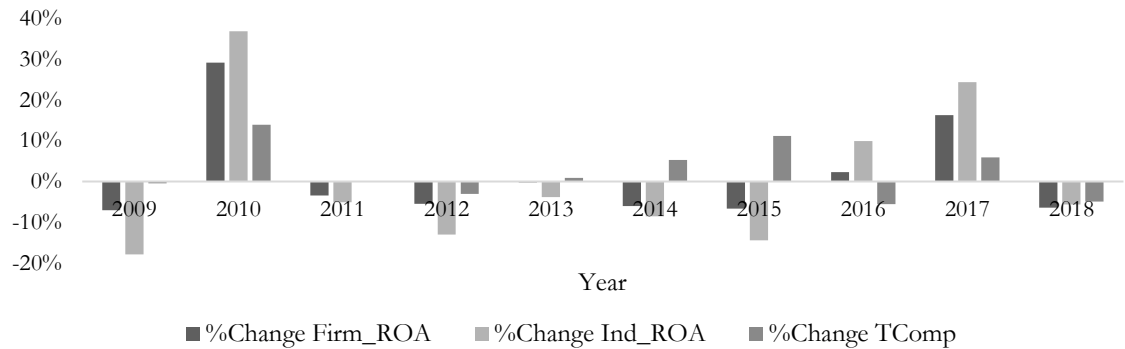


Figure 5 – Average percentage change of Firm ROA, Industry ROA and CEO Total Compensation



On the other hand, when using market value as performance measure, although CEO compensation still follows the patterns of firm and industry performance for most years of analysis (Figure 6), we do not observe any asymmetry in pay (Figure 7).

Figure 6 – Average Firm Market Value, Industry Market Value and CEO Total Compensation

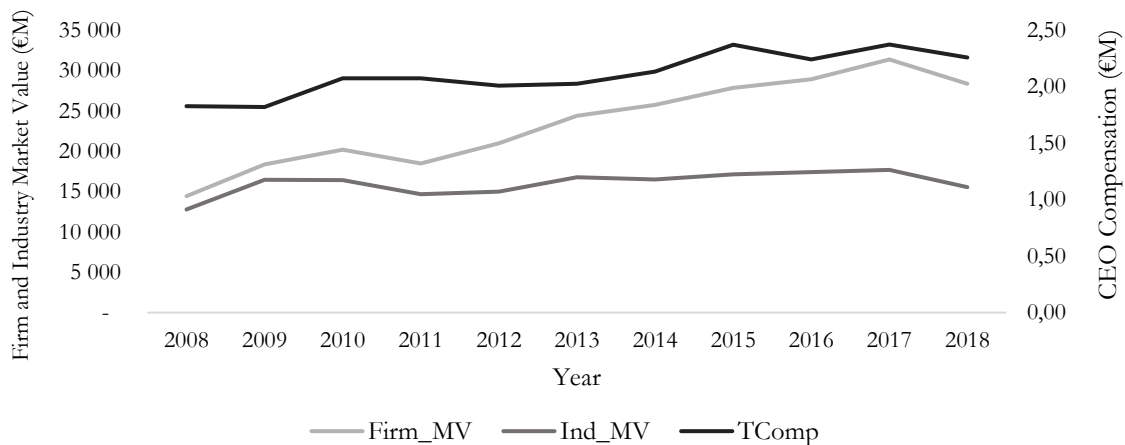
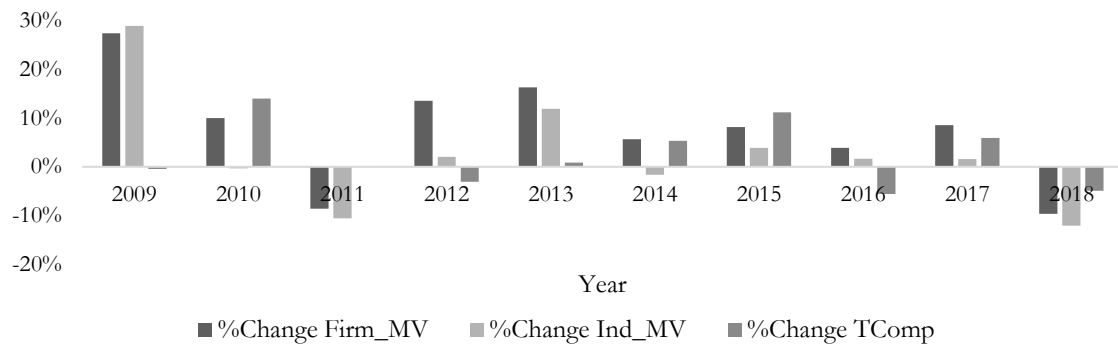


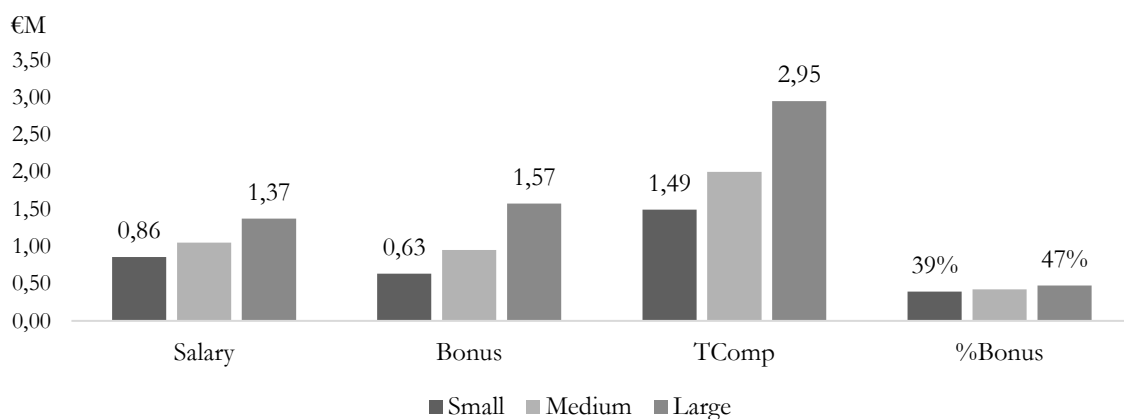
Figure 7 – Average percentage change of Firm Market Value, Industry Market Value and CEO Total Compensation



Even though these results do not provide conclusive evidence of pay-for-luck, it does motivate the regression analysis that follows, showing that CEO compensation is strongly tied to luck.

When analysing CEO compensation according to firm size (*vide* Figure 8), we verify that both the level of total cash compensation and the proportion of bonus increase with firm size. On average, large firms pay their CEOs 98% more than small firms (€ 1,49 million *vs* € 2,95 million). The positive relationship between company size and CEO compensation is not surprising: as the evidence suggests, larger firms demand higher-talented CEOs, putting upward pressure on their compensation level (see Section 4.2.4). Besides, larger firms may face a stronger need to tie CEO compensation to firm performance due to the complexity of their operations.

Figure 8 – Average CEO Salary, Bonus, Total Compensation and %Bonus across different firm size categories



The CEO pay level also varies by region and sector (see Figure 9 and Figure 10, respectively). While CEOs of companies domiciled in Central Europe are the highest-paid ones, with a mean cash compensation of € 2,54 million and a bonus proportion of 49%, CEOs in Northern Europe earn the lowest levels of compensation, with a mean compensation of € 1,85 million (less 27%) and a bonus relevance of 37% (less 12 percentage points). In addition, companies belonging to the Consumer Staples and Health Care's sectors present, on average, the highest levels of cash compensation (€ 2,85 million) and the strongest bonus preponderance (51%), whereas firms on the Utilities' sector reward their CEOs with the lowest compensation levels (€ 1,62 million, less 43%).

Figure 9 – Average CEO Salary, Bonus, Total Compensation and %Bonus across different European Regions

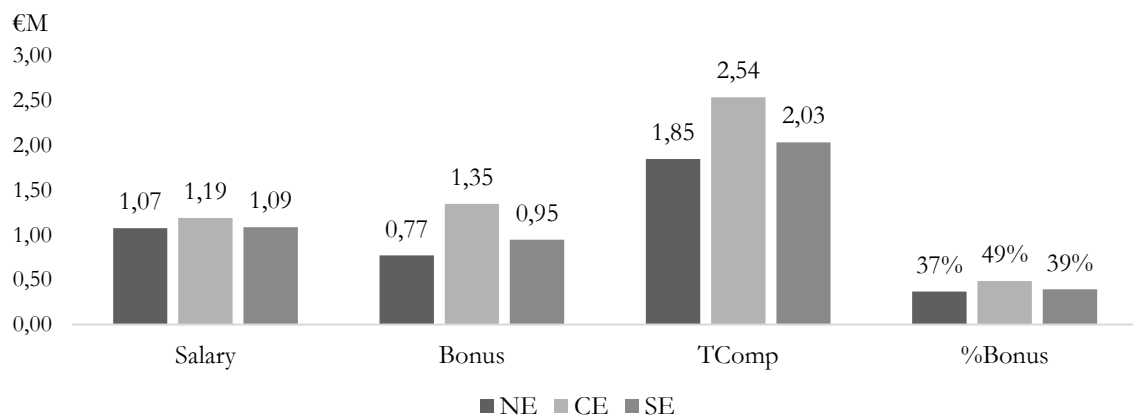
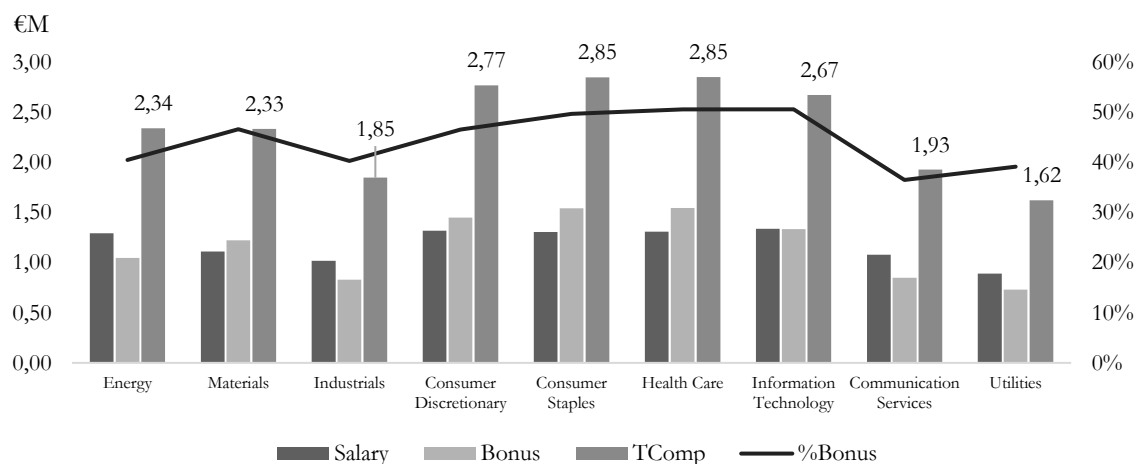


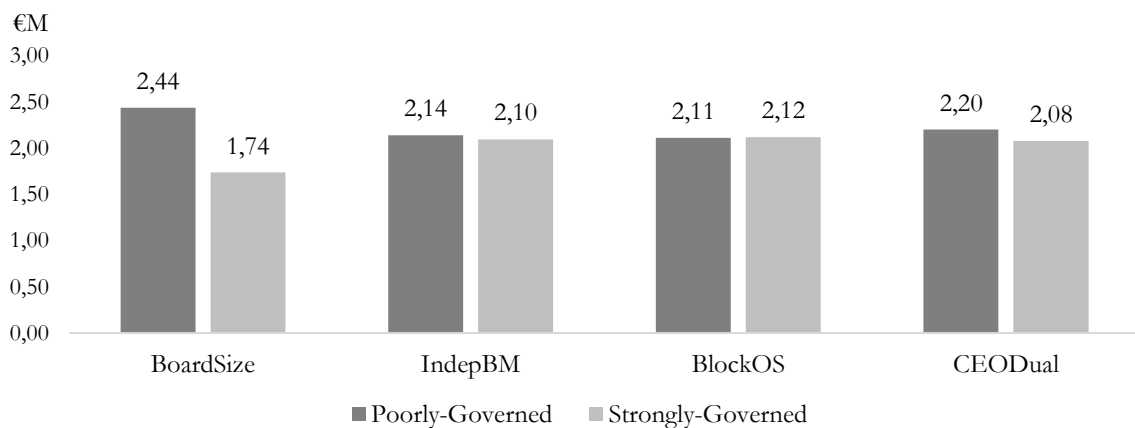
Figure 10 – Average CEO Salary, Bonus, Total Compensation and %Bonus across different sectors



Regarding the corporate governance, during our sample period, the board of European companies is composed, on average, by 12 members (ranging from 5 to 26), out of which 62% are independent members (varying from 0% to 100%). Moreover, in 30% of the companies, the CEO is simultaneously the chairman of the board and 28% of the European companies' shares are strategically hold by blockholders (ranging from 5% to 98%).

In this particular, considering our hypothesis H2: *“CEO compensation is more impacted by luck in poorly-governed firms”* (vide Section 3), it would be interesting to analyse whether CEO compensation significantly differs between strongly-governed *vs* poorly-governed firms. Consistent with the empirical evidence presented in Section 2.2, in 3 of 4 governance measures, CEOs are higher-paid in poorly-governed firms – on average, 16% more –, reflecting their stronger power in these companies (vide Figure 11). Furthermore, after performing a T-student test for the equality of means of CEO compensation across the governance measures in which we obtain results consistent with the empirical evidence, we verify that CEO compensation is statistically different between well-governed and poorly-governed firms in 2 of 3 governance measures with a 95% confidence level .

Figure 11 – Average CEO Total Compensation in poorly-governed *vs* strongly-governed firms



With respect to the firm control variables, the average size of the companies of our sample is € 34.816 million, increasing 42% since 2008, from € 29.024 million to € 41.336 million in 2018; their market value is, on average, 1,8 times the book value, increasing from 1,4 in 2008 to 1,8 in 2018 and ranging from 0,7 to 12,7; and their total debt comprises, on average, 26% of their total assets, decreasing from 29% in 2008 to 26% in 2018 and ranging from 0% to 65%. It should be noted that our sample is composed by firms with substantially different sizes, such that the variable *Size* ranges from € 298 million to € 376.214 million

(1.263 times more). As far as the CEO control variables, European CEOs have, on average, 55 years-old (ranging from 37 to 73 years) and have been CEOs of the firm for 6 years (varying from 0³⁴ to 32 years).

Finally, Table 9 in the Annexes' Section presents the correlation matrix between all the variables of our study. As expected, the firm performance is positively correlated with the industry performance – 25% with respect to ROA and 41% with respect to market value. Relative to CEO compensation, although it is strongly and positively correlated with firm market value (51%), we find, surprisingly, no correlation with firm ROA³⁵. Nevertheless, we find a positive correlation between CEO compensation and industry performance for both performance measures – 14% with respect to ROA and 16% regarding market value. Concerning the governance measures, while CEO compensation is positively correlated with board size (32%) and CEO duality (4%) and negatively correlated with the percentage of independent board members (-4%), consistent with the empirical evidence, we find no correlation with blockholders ownership, against the empirical evidence. Besides, we find a positive correlation between the portion of the bonus and both the board size (13%) and CEO duality (10%), as well as a negative correlation with the percentage of independent board members (-7%) and blockholders ownership (-4%). These findings go along with the argument that firms with weaker corporate governance face a stronger need to link CEO compensation to firm performance. Finally, also not surprising, CEO compensation is strongly positively correlated with firm's size (43%), as well as with CEO's age (19%) and tenure (16%).

Although the results obtained from this statistical analysis are preliminary, the understating of the variables' behavior provides us relevant information for the purpose of our study, allowing us to foresee the potential results of the regression analysis that follows.

³⁴ This applies to the situations where the CEO has been in that position for less than 6 months (0,5 years). In our study, the minimum tenure is 1 month (0,083 years).

³⁵ This lack of correlation with Firm ROA can be explained by the pay asymmetry observed when using ROA as performance measure while no asymmetry is found when using market value as performance measure – *vide* Figure 5 and Figure 7, respectively (we will see further below, in Section 6.2.3, that these are also the conclusions drawn from our regression analysis).

6.2. Regression Analysis

6.2.1. Pay-for-luck

Once the individual variables are understood, we are prepared to perform a multivariate regression analysis. From Table 10 to Table 18 of the Annexes' Section, we present our results across several alternative specifications under our hypothesis testing H1: “*CEO compensation is positively impacted by luck*” and following the methodology presented in Section 5.1.

Our regressions generate a number of interesting results. To begin, we find that the industry performance is an important value driver of European companies – 71% and 63% of the firm' ROA and market value, respectively, are driven by the industry performance, *i.e.*, by luck (Table 10).

Secondly, consistent with prior literature (e.g. Bell & Van Reenen, 2016; Bertrand & Mullainathan, 2001; Davis & Hausman, 2018; and Garvey & Milbourn, 2006), we find that European CEOs are also rewarded by luck (Table 11). When using ROA as performance measure (Panel A of Table 11), we estimate a positive and strong relationship between CEO compensation and luck – our pay-for-luck coefficient is 1,78 (statistically significant at the 1% level), implying that, for every 1 percentage point (p.p.) increase in firm's ROA due to luck, CEO cash compensation rises by almost 2%. Similarly, when tying pay to market performance (Panel B of Table 11), we continue to find evidence of pay-for-luck, although in a smaller extent – the pay-for-luck coefficient is 0,16 (statistically significant at the 1% level), indicating that when firm market value increases by 10% due to luck, CEO cash compensation rises by 1,6%. In this respect, it is worth mentioning that, from 2008 to 2018, the average market value of our sample firms rose by 96%. Thus, according to our empirical findings, 63% of this rise might be due to luck, which in turn implies a rise of almost 10% in CEO compensation. Since CEOs saw their compensation rising by 23% during 2008-2018, we can infer that luck accounted for almost half of their pay level increase.

The above results are consistent with the ones of Bertrand and Mullainathan (2001), who find the strongest evidence of pay-for-luck when using firm operating performance³⁶. Since most companies compensate CEOs based on firm operating performance rather than stock-market performance (Murphy, 1999), we find these results perfectly reasonable³⁷. Moreover, it should be stressed that we are only considering cash pay components and hence, we may be underestimating the true extent of pay-for-luck. We would probably obtain higher magnitudes of pay-for-luck if we have considered in our measure of total compensation the value of stock options awarded by CEOs, which is intrinsically tied to market value.

Thirdly, by estimating the standard 2nd stage regression (5.2) separately for each pay component (Table 12), we find unsurprisingly that pay-for-luck is mainly driven by the responsiveness of bonus to firm performance. Even though we find an unexpected strong relationship between salary and luck, there is a much stronger link between bonus and luck – each percentage point increase in firm’s ROA driven by luck raises salary by 3% and bonus by 16,5% while a 10% increase in firm’s market value due to luck leads to a rise of 3,9% in salary and 15,2% in bonus. Given that the industry performance is easily measured and more sophisticated compensation mechanisms have been emerging over the years, by finding pay-for-luck on the most discretionary pay components we can conclude that companies seem to be rewarding CEOs for industry shocks beyond their control even when they could easily filter these out.

Fourthly, when testing pay-for-luck across different firm sizes (Table 13), we find that our evidence of pay-for-luck might be driven by the largest firms of our sample. Indeed, while CEO compensation in small and medium firms appears to not be sensitive to luck (the luck coefficients are statistically insignificant), CEOs of large firms are strongly rewarded by luck ($\delta_{1_ROA}=3,44$ and $\delta_{1_MV}=0,44$, statically significant at the 1% level). On the other hand, as opposed to pay-for-luck, we do find pay-for-performance in small and medium firms (Table 14), indicating that luck is being completely removed from CEO

³⁶ It should be noted that, while the magnitude of our luck coefficient with respect to market value is similar to the one obtained by Bertrand and Mullainathan (2001) – their coefficient is 0,22 –, when using ROA as performance measure, our estimate is significantly smaller than the one obtained by them – their coefficient is 4.02. This could be explained by the different time-period considered (1984-1991). In fact, we will show in Section 6.2.5 that pay-for-luck has been diminishing over the years.

³⁷ We find that pay-for-performance is also statistically lower when using market value as performance measure ($\theta_{1_ROA}=1,18$ and $\theta_{1_MV}=0,24$).

compensation among these firms. Given that large firms, due to their complexity, may be less effective in monitoring CEOs, these findings provide support to the managerial power as the underlying driver of pay-for-luck³⁸.

Additionally, across the various European regions considered (Table 15), we find no pay-for-luck in Southern Europe – if anything, CEO compensation in firms domiciled in SE seems to be countercyclical, decreasing with the increase of firm performance due to luck ($\delta_{1_ROA}=-5,07$ and $\delta_{1_MV}=-0,84$) – and strong pay-for-luck in Northern and Central Europe, with similar magnitudes³⁹. Likewise, we find that the evidence of pay-for-luck is also not robust across different industries (Table 16), only finding statistically significant pay-for-luck in 3 of 9 sectors⁴⁰. In this regard, for both performance measures, we find that pay-for-luck is strongest in the utilities' sector ($\delta_{1_ROA}=13,25$ and $\delta_{1_MV}=0,94$).

Fifthly, when we consider a lag between CEO compensation and luck (Table 17), we estimate stronger effects of pay-for-luck, particularly when using market performance. Indeed, compared to our baseline specification, the luck coefficients increase by 9% to 1,93 and 45% to 0,23, when tying performance to ROA and market value, respectively. These results reinforce our key evidence of pay-for-luck while suggesting that the salary level may be rather determined based on the prior year firm performance⁴¹.

³⁸ This conclusion is strengthened by the finding of a positive correlation between the proportion of the bonus and the firm size (*vide* Table 9 of the Annexes' Section), as well as the increasing pay-performance sensitivity with the firm size (see Table 14 of the Annexes' Section). These findings reflect the stronger need to tie CEO compensation to firm performance among large firms so that CEOs are motivated to take actions that maximize shareholder value.

³⁹ The absence of pay-for-luck in SE vs the strong pay-for-luck in NE and WE – in this respect, we find pay-for-performance across the three regions – could be explained under the managerial power view. Indeed, the countries of SE present, overall, not only lower economic conditions but they were also the ones most affected by the financial crisis of 2007-2008. Therefore, the public and press attention has been most devoted to them which brings a greater concern from these companies in presenting efficient compensation contracts and, consequently, in completely filtering luck from compensation.

⁴⁰ It should be noted that, although we estimate statistically significant luck coefficients in only 3 of 9 sectors, in 5 of these sectors, the coefficients' magnitudes are suggestive of an economically large effect – with respect to ROA, we estimate coefficients above 3,46 and regarding market value, above 0,17.

⁴¹ These conclusions are bolstered by the finding that pay-for-performance sensitivity also increases when we consider a different compensation window. In particular, the performance coefficient increases 9% to 1,29 and 13% to 0,27, when using operating and market performance, respectively.

Sixthly, analogous to Bertrand and Mullainathan (2001) and Davis and Hausman (2018), considering the large standard errors, we estimate a pay-for-performance coefficient ($\theta_{1_ROA}=1,18$ and $\theta_{1_MV}=0,24$) that is not statistically different from the pay-for-luck coefficient ($\delta_{1_ROA}=1,78$ and $\delta_{1_MV}=0,16$) – Table 11 *vs* Table 18. In terms of economic magnitude, the results imply that, when firm's ROA increases by 1 p.p. or firm's market value increases by 10%, CEO compensation rises by around 1,20% and 2,4%, respectively, regardless of whether that performance improvement is due to CEO's effort or luck. Hence, we cannot reject the hypothesis that companies reward CEOs for luck as much as for general firm performance, indicating that little or no filtering of luck is being done.

One could argue that a potential explanation for this lack of filtering could be due to the lag the companies face in obtaining performance data for its industry peers – accounting data is only available, at best, at quarterly intervals (Murphy, 1999). However, this only explains the absence of filtering when measuring performance with accounting data since the market data is available instantaneously. Moreover, we should estimate the same lack of filtering across all subsets of firms and CEOs. Yet, as we have shown above, small and medium firms appear to completely remove luck from CEO compensation. Besides, in the sections below, we show that the extent of filtering also differs across firms with different governance strengths and across CEOs with different relative pay levels. In particular, we estimate partial filtering of luck among strongly-governed firms (*vide* Section 6.2.2) and complete filtering among highly-paid CEOs (see Section 6.2.4). Thus, there is little evidence to support the idea that filtering out luck contemporaneously is simply not feasible.

Finally, it should be noted that, for both performance measures, not only are the estimates obtained for the coefficients of the control variables of the standard 2nd stage regression (5.2) all statistically significant at the 1% level, but also their signs and magnitudes are consistent with the empirical evidence presented in Section 4.2.4 (*vide* Table 11 of the Annexes' Section). While CEO compensation rises with firm size ($\delta_{ROA}=0,15$ and $\delta_{MV}=0,14$) and to a lower extent with Tobin-Q ($\delta_{ROA}=\delta_{MV}=0,08$), it decreases largely with firm leverage ($\delta_{ROA}=\delta_{MV}=-0,41$). Likewise, CEO pay increases greatly with CEO age ($\delta_{ROA}=0,26$ and $\delta_{MV}=0,25$) and to a lesser degree with CEO tenure ($\delta_{ROA}=\delta_{MV}=0,03$). In addition, it is worth mentioning that 79% of the total variation of CEO cash compensation is explained by our model.

In summary, the conclusion to be drawn from our results is the standard one: the average European company is not making any attempt to remove exogenous factors from firm performance to ensure that CEO compensation only reflects what is under her control. Indeed, CEOs are rewarded by luck as much as by general firm performance. However, as argued in Section 2.3.3, such finding is not enough to support the managerial power view, *i.e.*, the hypothesis that compensation contracts are inefficient with CEOs effectively controlling the pay-setting process. In the sections below, we report our main findings across our attempts in determining whether the CEO power can be the major underlying driver of the pay-for-luck observed.

6.2.2. Pay-for-luck and Corporate Governance

Throughout this section, we report our results under the hypothesis testing H2: “*CEO compensation is more impacted by luck in poorly-governed firms*” and following the methodology presented in Section 5.25.1. In this respect, Table 19 and Table 20 of the Annexes’ Section present the impact of the corporate governance on pay-for-luck and pay-for-performance, respectively.

When using ROA as performance measure, in line with the managerial power view and prior studies (e.g. Bell & Van Reenen, 2016; Bertrand & Mullainathan, 2001; Davis & Hausman, 2018; and Garvey & Milbourn, 2006), we find that, across all governance measures, CEO compensation is more sensitive to luck in firms with weak corporate governance (Panel A of Table 19). On average, when luck causes firm’s ROA to increase by 1 p.p., CEO compensation rises by 1,3% in well-governed firms, whereas in firms with weak corporate governance, the rise has a magnitude of 3,2%. This corresponds to a pay-for-luck effect that is more than 2,5 times stronger in poorly-governed firms. Moreover, in 3 of 4 governance measures, we reject the hypothesis that the luck coefficients are equal across poorly *vs* strongly-governed firms at the 5% significance level. The results are qualitatively similar if we use market value as performance measure, although a lower economic magnitude is observed – on average, the pay-for-luck sensitivity is around 1,7 times greater in poorly-governed firms (Panel B of Table 19). It is worth mentioning that in 1 governance measure with respect to ROA (blockholders ownership) and in 2 governance measures regarding market value (board size and percentage of independent board members), we find

no pay-for-luck in well-governed firms⁴², ruling out the optimal contracting view. If pay-for-luck was consistent with optimal contracting, we should observe this phenomenon preferably in well-governed firms. On the contrary, we find stronger pay-for-luck in poorly-governed firms, where CEOs are more likely to have the power to extract rents from shareholders.

When we compare the extent of pay-for-performance between poorly-governed *vs* strongly-governed firms (Table 20), we find that our results are unlikely to be a consequence of poorly-governed firms paying more intense forms of pay-for-performance⁴³. Despite finding that pay-for-performance is indeed stronger in poorly-governed firms in 2 and 3 of 4 governance measures regarding ROA and market value, respectively⁴⁴, we find that the difference between poorly-governed and strongly-governed firms (row *Weak/Strong* in Table 19 and Table 20) is only statistically higher in pay-for-performance relative to pay-for-luck in one governance measure (CEO duality with respect to ROA and board size regarding market value). Moreover, on average terms, while the link between CEO pay and general firm performance is only 1,4 and 1,6 times greater in poorly-governed firms relative to ROA and market value, respectively (and thereby, pay-performance is roughly the same in weakly *vs* strongly-governed firms), the relationship between CEO pay and luck appears more than 2,6 and 3,0 times stronger in the same group of firms concerning ROA and market value, respectively. Therefore, we can claim that CEO compensation is indeed more sensitive to luck in poorly-governed firms.

In view of above, two conclusions can be drawn from our empirical findings. Firstly, external and internal controls effectively matter in the CEO pay-setting process. A strong corporate governance appears to align incentives and reduce compensation for lucky factors outside the CEO control. Secondly, the finding of a much stronger link between CEO pay and luck in poorly-governed firms goes along with the evidence presented in favor of the rent extraction view, reflecting inefficiencies in compensation contracts driven by CEOs power over the board of directors.

⁴² Although the luck coefficients are positive, they are neither economically nor statistically significant. Moreover, across the same governance measures, we find strong pay-for-performance (Table 20), implying that, if anything, these companies seem to be completely filtering the effect of luck from CEO compensation.

⁴³ If CEO compensation is more tied to general firm performance in poorly-governed firms, pay-for-luck can simply increase as a consequence.

⁴⁴ This challenges the evidence of Bertrand and Mullainathan (2001) that pay-for-performance is independent of governance.

6.2.3. Pay-for-luck Asymmetry

From Table 21 to Table 24 of the Annexes' Section, we report our results under the hypothesis testing H3: “*CEO compensation is more impacted by good luck than bad luck*” and following the methodology presented in Section 5.3.

When using operating performance, in line with the managerial power view and the results of Bertrand and Mullainathan (2001) and Garvey and Milbourn (2006), we find that European CEOs are more rewarded for good luck than penalized for bad luck (Panel A of Table 21). Indeed, when firm's ROA increases by 1 p.p. due to luck, CEOs see their compensation increasing by 1,05%. On the other hand, when firm's ROA decreases by 1 p.p. due to luck, CEOs lose 0,93%, corresponding to a decline of more than 10% in pay-for-luck⁴⁵. Similarly, we find that pay-for-performance is also asymmetric (Panel A of Table 22) – the sensitivity of CEO compensation to firm's ROA is around 10% lower when the firm performs poorly – which runs counter to the findings of Bertrand and Mullainathan (2001) and Garvey and Milbourn (2006), who report no asymmetry in general pay-for-performance⁴⁶.

Moreover, consistent with Garvey and Milbourn (2006), we find that pay-for-luck asymmetry occurs mainly in poorly-governed firms (Panel A of Table 23). On average, while strongly-governed firms show a marginal decline of 6% in pay-for-luck when bad luck impacts the firm performance, in poorly-governed firms, almost 40% of the effects of bad luck are removed from CEO compensation when the firm faces bad luck. In specific, in one governance measure (board size), we estimate a statistically insignificant coefficient on bad luck in weak-governed firms, implying that CEOs receive no pay penalty from negative luck

⁴⁵ In this respect, it is worth mentioning that, although we estimate a statistically significant decline in pay-for-luck when luck is bad, our estimate is somewhat smaller than the one obtained by Garvey and Milbourn (2006) – they estimate a decline of nearly 25%. Our smaller estimate can be explained by the different time period considered – Garvey and Milbourn (2006)'s sample period is 1992-2001. As we will see on Section 6.2.5, pay-for-luck has been declining over the years.

⁴⁶ The finding of pay-performance asymmetry when using operating performance can be explained under the optimal contracting view if punishments for poor operating performance induce CEOs to practice accounting manipulation or fraud (Campbell & Thompson, 2015). This argument is strengthened by the finding of pay-for-performance asymmetry in well-governed firms while no asymmetry is found in poorly-governed firms across 3 of 4 governance measures (*vide* Table 24 of the Annexes' Section).

returns⁴⁷. On the other hand, in 3 of 4 governance measures, better-governed firms appear to reward luck symmetrically, with CEOs not being protected from bad luck as in poorly-governed firms⁴⁸. Therefore, these results highlight the stronger CEO's ability to strategically influence her pay in firms with weaker corporate governance, suggesting that the strength of corporate governance plays a critical role in restraining managerial skimming practices.

On the other hand, when performance is measured by market value, the results obtained are somewhat different. Firstly, we find no evidence of asymmetry in pay-for-luck, that is, CEOs are equally rewarded by luck whether luck is rising or falling (Panel B of Table 21). Likewise, we find no asymmetry in pay-for-performance (Panel B of Table 22). Secondly, across all governance measures, we find that pay-for-luck and pay-for-performance continues to be symmetric, irrespective of the company's governance (Panel B of Table 23 and Panel B of Table 24). These results appear consistent with the ones of Bertrand and Mullainathan (2001) and Garvey and Milbourn (2006), who find the noisiest evidence of pay asymmetry when luck is analysed with market rather than operating performance.

In view of above, while our asymmetry results with respect to operating performance perfectly match the predictions of the managerial power view, in which European CEOs seem to opportunistically benchmark their pay, skimming off the gains from good luck but managing to partially avoid the losses from bad luck, particularly in firms with weak corporate governance⁴⁹; the results from using market value as performance measure are more hard to reconcile with the rent extraction view.

⁴⁷ In the same governance measure, we estimate not only a statistically significant pay-performance sensitivity when performance is bad in poorly-governed firms (Panel A of Table 24), but also similar sensitivity to luck and performance when performance is good (Panel A of Table 23 and Panel A of Table 24). This indicates that bad luck, as opposed to good luck, is completely removed from CEO compensation in poorly-governed firms.

⁴⁸ In this respect, in poorly-governed firms, we reject the hypothesis that the good and bad luck coefficients are equal at the 10% significance level across 2 of 4 governance measures whereas in strongly-governed firms, we do not reject the hypothesis that the coefficients are equal across all 4 governance measures, suggesting that there is no pay asymmetry in firms with strong corporate governance.

⁴⁹ CEOs do not seem able to fully avoid the penalties from bad luck. Although the bad luck coefficient is smaller than the good luck coefficient, it is still positive and highly significant in 3 of 4 governance measures (*vide* Panel A of Table 23).

Finally, one could argue that, given we estimate an equally asymmetry in both pay-for-luck and pay-for-performance when operating performance is used, the minimum pay hypothesis rather than managerial power view could explain our results. That is, CEOs are strongly risk-averse to reductions in their pay (Scharfstein, 1988), which implies that they should be protected from any downturn. Consequently, their compensation should present the same asymmetric response to firm general performance as well as to luck, which is consistent with our results. However, if minimum pay considerations were the driver of the pay-for-luck asymmetry, we should estimate an equally asymmetry in poorly-governed *vs* well-governed firms, counters to our results. Indeed, pay asymmetry appears to be significantly more prominent in firms in which the CEO is likely to have greater influence over the pay-setting process. Thus, there is little evidence to support the minimum pay hypothesis over the rent extraction one.

On the other hand, dismissal is, *a priori*, a possible alternative explanation for our finding that pay-for-luck is asymmetric. That is, when firms are experiencing poor performance, that may lead not only to lower pay levels but also to an increased probability of dismissal (Huson et al., 2001; Jenter & Kannan, 2015). However, our sample only contains CEOs who remain in the company, which implies that we may be underestimating the true consequences of bad luck. Therefore, the dismissal hypothesis may weaken our conclusion of opportunistic benchmarking if CEOs are disproportionately likely to lose their jobs in poorly-governed firms when luck is bad⁵⁰.

6.2.4. Pay-for-luck and CEO Pay Level

From Table 25 to Table 27 of the Annexes' Section, we present our results with respect to the impact of the CEO relative pay level in pay-for-luck and pay-for-performance, under the hypothesis testing H4: “*CEO compensation is more impacted by luck among higher-paid CEOs*” and following the methodology presented in Section 5.4.

Our results show that pay-for-luck depends effectively on the external labor market conditions the CEO faces, *i.e.*, on whether he is paid above or below the median. However, contrary to the predictions of the managerial power view, we find that pay-for-luck is significantly stronger among CEOs who are relatively poorly-paid (Table 25). In fact, regardless of the performance measure, we find that, while highly-paid CEOs appear

⁵⁰ Despite outside the scope of our study, this could be an interesting topic to investigate in future work.

to not be rewarded by luck (the luck coefficients are statistically insignificant), CEOs paid below the median see their compensation rising by 1,3% when firm's operating performance increases 1 p.p. due to luck and 1,6% when firm's market performance improves by 10% due to luck. Besides, we find that, even though compensation of highly-paid CEOs is not tied to luck, is strongly tied to firm performance ($\theta_{1_ROA}=1,19$ and $\theta_{1_MV}=0,21$, statistically significant at the 1% level – Table 26), indicating that companies appear to completely filter out luck among this group of CEOs.

Furthermore, when testing pay-asymmetry across both groups of CEOs (Table 27), besides finding that CEOs paid above the median continue to receive no compensation for luck whether luck is rising or falling, we observe an unfavorable pay asymmetry (from the CEO's perspective) in poorly-paid CEOs when using operating performance. That is, they seem to be more penalized for bad luck than rewarded for good luck – pay is 16% more sensitive to luck when luck is down. On the other hand, when tying compensation to market value, poorly-paid CEOs seem to be symmetrically rewarded. These findings run counter to the ones of Bizjak et al. (2008) and Campbell and Thompson (2015), who provide evidence that pay-for-luck asymmetry is strongest among CEOs paid below the median and thereby, argue that pay-for-luck is driven by retention concerns.

In view of above, while at first sight we could suggest that pay-for-luck looks to be efficiently driven by retention concerns, motivated by the finding that companies reward poorly-paid CEOs more strongly for luck⁵¹, that conclusion is offset when finding that in the same group of CEOs, firms appear to penalize bad luck more harshly than good luck is rewarded. Thereby, companies do not seem to be concerned in protecting lower-paid CEOs from negative returns and increasing consequently their retention. Hence, our findings provide weak support for the retention hypothesis over the skimming one.

⁵¹ Given that CEO pay relative to the peers is indicative of the CEO labor market opportunities and their value may vary positively with industry performance (*i.e.*, with luck), companies by rewarding relatively poorly-paid CEOs more strongly for industry shocks, ensure that their pay does not deviate from the one of their peers, increasing thereby their retention (Himmelberg & Hubbard, 2000; Oyer, 2004).

6.2.5. Pay-for-luck and the Financial Crisis of 2007-2008

Throughout this section, we present our results under the hypothesis testing H5: “*CEO compensation became less impacted by luck after the financial crisis of 2007-2008*” and following the methodology presented in Section 5.5. In this concern, Table 28 and Table 29 of the Annexes’ Section report the impact of the crisis on pay-for-luck and pay-for-performance, respectively.

Regardless of the performance measure, we find that pay-for-luck became weaker after the financial crisis of 2007-2008 (Table 28). While during the crisis, we estimate a luck coefficient of 2,58 and 0,19 regarding operating and market performance, respectively, after this major recession, the pay-for-luck sensitivity decreased 42% to 1,49 and 26% to 0,14, respectively. Similarly, we find that the sensitivity of CEO pay to the general firm performance has also declined after the financial crisis – the pay-for-performance dropped 67% and 5% concerning ROA and market value, respectively (Table 29)⁵². Therefore, it seems that CEO compensation has been moving towards a less performance-based structure, especially regarding accounting performance. Given that tying executives’ compensation to accounting performance metrics may give rise to accounting manipulation and fraud (Murphy, 1999), these results are perfectly understandable. Moreover, governance controls have been narrowing over time which decreases the need to link CEO pay to firm performance. Additionally, it is worth mentioning that, although when tying CEO compensation to operating performance, we can still observe an absence of filtering – the luck coefficient is statistically higher than the performance coefficient (Panel A of Table 28 *vs* Panel A of Table 29) –, we find, with respect to market value, an increasing filtering of luck – the luck coefficient becomes statistically smaller than the performance coefficient (Panel B of Table 28 *vs* Panel B of Table 29).

In summary, despite strong pay-for-luck can still be observed, it has been declining over the years, with an associated increase of luck filtering. Given that a variety of factors may be underlying this fall, we cannot make any direct causal claim regarding these findings. Nevertheless, it seems that the financial crisis of 2007-2008 has contributed to the decrease of pay-for-luck. This may be associated to the increasing public scrutiny the companies are exposed to, as well as the stricter compensation disclosure rules and stronger governance

⁵² For both pay-for-luck and pay-for-performance, when using ROA as performance measure, we reject the hypothesis that the coefficients are equal across the two time periods at the 10% significance level.

controls that resulted from this recession, putting a pressure on companies in moving towards a more efficient compensation structure. In this sense, these results as a whole give strength to the managerial power view.

Below, we present a summary of the empirical results obtained from all hypotheses tests.

Table 2 – Summary of the empirical results

#	Hypothesis	Performance Measure		Consistent with Managerial Power View?	
		ROA	Market Value	ROA	Market Value
H1	CEO compensation is positively impacted by luck	✓	✓	✓	✓
	Pay-for-luck is driven by large firms	✓	✓	✓	✓
	Pay-for-luck is driven by firms domiciled in NE and CE	✓	✓	✓	✓
	Pay-for-luck is driven by firms of the utilities' sector	✓	✓	-	-
	Pay-for-luck matches pay-for-performance	✓	✓	✓	✓
H2	CEO compensation is more impacted by luck in poorly-governed firms	✓	✓	✓	✓
	Pay-performance is only slightly higher in poorly-governed firms	✓	✓	✓	✓
H3	CEO compensation is more impacted by good luck than bad luck	✓	X	✓	X
	Pay-for-luck asymmetry is stronger in poorly-governed firms	✓	X	✓	X
H4	CEO compensation is more impacted by luck among higher-paid CEOs	X	X	X	X
H5	CEO compensation became less impacted by luck after the financial crisis of 2007-2008	✓	✓	✓	✓

7. Conclusion

The agency theory suggests that, in order to induce CEOs to take actions that maximize shareholder wealth, part of their compensation should be tied to firm performance. However, because there are exogenous factors affecting the firm performance that are beyond the CEOs' control, these factors should be removed from performance measures to ensure that CEOs are only rewarded for their true contribution to the firm performance. However, the vast empirical literature on CEO compensation provides evidence of a strictly different prediction than the agency theory, showing that, in practice, CEOs are often rewarded by luck.

In this study, we analyse CEO compensation in European companies over the period between 2008 and 2018. Consistent with prior studies, by isolating the firm performance that is driven by industry shocks as our proxy for luck, we find that European CEOs' compensation is positively and strongly impacted by luck, regardless of whether we use operating or market performance measures. Moreover, we find that CEOs are rewarded for luck as much as for general firm performance. Therefore, despite the arise of more sophisticated compensation mechanisms that could easily remove luck, it seems that filtering out luck that comes from industry performance movements (which is perfectly observable and measurable) is still not a concern among the average European company. In this particular, it is worth mentioning that our evidence of pay-for-luck is not robust across all European firms. In fact, pay-for-luck seems to be driven by the largest firms of our sample, firms domiciled in Northern and Central Europe and companies belonging to the utilities' sector.

Although the literature generally agrees that CEOs are rewarded by luck, the underlying cause for that relationship is still in debate. Hence, after confirming that the robust evidence of pay-for-luck in the U.S. market can be extrapolated to the European market, we attempt to determine whether the pay-for-luck in European companies reflects efficient compensation contracts or is rather the result of the CEO ability to control the pay-setting process, hiding corporate governance issues. We explore this in four ways.

Firstly, we analyse the extent of pay-for-luck across different corporate governance structures. In line with the managerial power view, we find that CEOs are stronger rewarded by luck in poorly-governed firms, where it is easier for the CEO to exert control over the board of directors. Secondly, we look to asymmetric responses in pay-for-luck, finding that,

when using operating performance, CEOs receive stronger rewards for good luck than penalties for bad luck, particularly in those firms with weak corporate governance. Thirdly, we analyse how the sensitivity of CEO compensation to luck varies with the CEO relative pay level. Although our findings point to a strongly increase in pay-for-luck among poorly-paid CEOs, we find simultaneously an unfavorable pay asymmetry among these CEOs, in which they are more penalized for bad luck than rewarded for good luck. This calls into question the retention hypothesis as an explanation for pay-for-luck under optimal contracting. Finally, we investigate the impact of the financial crisis on the pay-for-luck sensitivity, finding that CEOs become less rewarded by luck after this major recession which was accompanied by an increasing scrutiny of CEO compensation and stricter compensation disclosure requirements.

Overall, our results are hard to reconcile with the optimal contracting view and seem more consistent with the managerial power view as the major driver of pay-for-luck. European CEOs appear to have controlled the pay contracting process, skimming the gains of good luck at the expense of shareholders while partially avoiding the losses of bad luck. In this particular, corporate governance looks to have a critical role in restraining managerial skimming pay practices. The less effective the shareholders and the board of directors are in monitoring compensation contracts, the more likely we see pay-for-luck and rent extraction by CEOs, particularly during boom times. Thus, while strongly-governed firms appear to match the predictions of the optimal contracting view, poorly-governed firms seem to rather fit the predictions of the managerial power view.

It is worth mentioning that the above-stated conclusions appear to be sensitive to the performance measure chosen. While operating performance results strongly support the rent extraction view across several subsamples, the market performance results provide the noisiest evidence of skimming. Hence, we would like to underline the importance of considering multiple model specifications when analysing pay-for-luck while stressing that focusing solely on market performance could be disregarding an important part of pay-for-luck and managerial power.

Despite the robust evidence of pay-for-luck among European CEOs, our results are subject to the common caveats of the pay-for-luck literature. First, luck can be generally defined as any exogeneous factor that affects the firm performance, which naturally includes industry shocks. However, the mean industry performance is an imperfect measures of luck and thereby, we cannot assure that we have adequately distinguished between the portion of

the firm performance due to luck and the one driven by the CEO's actions (*i.e.*, skill). We will inevitably misclassify some luck as skill, and vice versa, and such measurement error will tend to drive up the estimated luck coefficient. Moreover, by relying on the mean industry performance to proxy for luck, we were forced to choose a peer comparison group which introduces ambiguity about which companies to include, as well as about how to weight the different observations. Second, not only companies may use many other performance metrics besides ROA and market value to determine CEO compensation, but also the choice of the metrics may be itself endogenous to the compensation committee goals, which can explain empirically why we do not observe much filtering.

Finally, even though our study offers important contributions to the pay-for-luck literature, adding some clarity to the mixed results observed in this field, there are still unanswered questions regarding the managerial power view. As with the rest of the studies, we are unable to rule out all optimal contracting interpretations of pay-for-luck. Our results show that these two views may co-exist in varying degrees across firms and over time, highlighting the two-sided nature of pay-for-luck. Further work is needed to fully distinguish between skimming and efficient compensation practices, as well as the relative importance of each when setting CEO pay. Note that this is a field in which the widespread recognition of the problem can contribute to alleviate it. That is, the extent of the CEO influence on the pay setting-process depends on the extent to which shareholders recognize that. Thus, we hope that future researchers take this opportunity to devote more attention in clarifying the exact factors that induce or restrain rent-extraction in the compensation process. In this particular, it is important to understand, both theoretical and empirically, how exactly a strong governance translates into lower magnitudes of pay-for-luck and apparently more efficient compensation contracts. Finally, determining the mechanisms by which companies can fully remove the luck factor from CEO compensation is left for future research.

8. References

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9. Annexes

9.1. Annex A – Literature Review

Table 3 – Summary of the studies reviewed on pay-for-luck

Authors	Country of study	Period of study	Luck measure	Methodology	Main results
Bertrand and Mullainathan (2001)	United States	• 1977-1994 (oil prices) • 1984-1991 (exchange rates and industry performance)	• Oil prices (oil industry) • Exchange rates (traded goods industry) • Mean industry performance (widespread industries)	Two-stage Regression	Pay-for-luck • CEO pay responds to general firm performance as much as it does to firm performance driven by luck; • Pay-for-luck is widespread across the individual pay components; Pay-for-luck and governance • Pay-for-performance is independent of governance; • Pay-for-luck reduces significantly in the presence of a large shareholder (shareholders who own at least 5% of the firm's common shares); Pay-for-luck asymmetry • CEO pay responds more to positive lucky shocks than to negative ones; • No asymmetry is found in general pay-for-performance.
Garvey and Milbourn (2006)	United States	1992-2001	Mean industry performance	Two-stage Regression	Pay-for-luck • CEO pay is strongly positively related to luck; Pay-for-luck asymmetry • CEOs are rewarded for good luck but heavily insulated from bad luck;

					- The pay asymmetry does not apply equally to the firm-specific performance (skill component of performance); Pay-for-luck and governance - Although in firms with strong corporate governance (measured by the Corporate Governance Index constructed by Gompers, Ishii, and Metrick (2003)), pay-for-luck is smaller than pay-for-skill, in firms with weak corporate governance, pay-for-luck is greater than pay-for-skill; - While pay-for-luck asymmetry is not observed in firms with strong corporate governance, there is significant asymmetry in firms with weak corporate governance.
Bell and Van Reenen (2016)	United Kingdom	1999-2015	Mean industry performance	Two-stage Regression	Pay-for-luck - There is substantial pay-for-luck, even when CEO pay is explicitly condition on firm performance relative to peer firms of the same sector; Pay-for-luck and governance - Pay-for-luck is stronger in firms with weaker corporate governance (measured by institutional ownership).
Davis and Hausman (2018)	United States	1992-2016	Oil prices (oil and gas industry)	Two-stage Regression	Pay-for-luck - Executive compensation responds to changes driven by oil prices as much as it does to generic changes in company value; - Pay-for-luck holds for different components of pay; Pay-for-luck and governance - There is less pay-for-luck in better-governed companies (measured by the proportion of non-board executives; non-insiders board members; and non-insiders remuneration committee members);

			Pay-for-luck asymmetry - Executive compensation increases more with rising oil prices than it decreases with falling oil prices; Pay-for-luck and pay level - Pay-for-luck (and comparable asymmetry) is stronger among higher-paid executives.
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Table 4 – Summary of the explanations for pay-for-luck

Driver of pay-for-luck	Empirical supports	Authors	Contradictory findings
Managerial power	Pay-for-luck is asymmetric	Bertrand and Mullainathan (2001); Garvey and Milbourn (2006); Davis and Hausman (2018)	DeVaro et al. (2017) CEO compensation is not more positively correlated with luck when shareholder rights are weaker;
	Pay-for-luck is strongest among poorly-governed firms	Bertrand and Mullainathan (2001); Davis and Hausman (2018); Bell and Van Reenen (2016)	Campbell and Thompson (2015) Well-governed firms do not have significantly lower pay-for-luck asymmetry.
Retention concerns	The value of the executives' outside opportunities varies positively with industry or market performance and adjusting compensation contracts is costly	Himmelberg and Hubbard (2000); Oyer (2004)	DeVaro et al. (2017) Executive's outside options vary with luck but this effect operates entirely through the base salary, having no effect on performance-pay;
	CEOs have relative wealth concerns	DeMarzo and Kaniel (2017); Liu and Sun (2014)	Bertrand and Mullainathan (2001) Pay-for-luck is less prevalent in industries with higher rates of turnover;
	Pay-for-luck asymmetry is stronger among CEOs paid below the peers	Bizjak et al. (2008); Campbell and Thompson (2015)	There is no asymmetry in general pay-for-performance; Garvey and Milbourn (2006)
	Pay-for-luck disappears when labor market opportunities are considered	Brookman and Thistle (2013)	Pay asymmetry does not apply equally to the firm-specific portion of performance;
	Retention concerns is the primary determinant of pay-for-luck asymmetry while industry sensitivity concerns,	Campbell and Thompson (2015)	Davis and Hausman (2018) Pay-for-luck (and comparable asymmetry) is stronger among higher-paid executives;

	governance quality and CEO power are only weakly related		Cremers and Grinstein (2014) - Retention concerns can only explain pay-for-luck in industries with outsider CEOs and where the overall supply of CEOs is relatively inelastic; Holmlstrom (2004) - CEO's outside options does not fully explain changes in CEO pay.
Board's desire to incentivize CEO to forecast or respond to lucky events	Most of the observed pay-for-luck corresponds to pay-for-action and these responses add value to shareholders	Gopalan et al. (2010); Albuquerque et al. (2019)	Bertrand and Mullainathan (2001) In the oil industry, CEOs who respond to lucky shocks exactly the same way as every other oil CEO are rewarded.

9.2. Annex B – Sample and Variables

Table 5 – Sample distribution by domicile region

Domicile Region	Domicile Country	N° of companies	% Sample
Northern Europe (NE)	Denmark	4	2,3%
	Finland	9	5,1%
	Ireland	4	2,3%
	Sweden	6	3,4%
	Norway	13	7,4%
	United Kingdom	31	17,6%
	Total	67	38,1%
Central Europe (CE)	Austria	1	0,6%
	Belgium	5	2,8%
	France	34	19,3%
	Germany	21	11,9%
	Luxembourg	1	0,6%
	Netherlands	13	7,4%
	Switzerland	18	10,2%
	Total	93	52,8%
Southern Europe (SE)	Italy	8	4,5%
	Portugal	2	1,1%
	Spain	6	3,4%
	Total	16	9,1%
Total		176	100,0%

Table 6 – Sample distribution by sector

GICS Sector Code	GICS Sector Name	Main Sample (#)	%	Industry Sample (#)	%	Industry Sample / Main Sample
10	Energy	8	4,5%	291	5,2%	36,4
15	Materials	25	14,2%	526	9,4%	21,0
20	Industrials	51	29,0%	1.347	24,1%	26,4
25	Consumer Discretionary	19	10,8%	841	15,1%	44,3
30	Consumer Staples	15	8,5%	412	7,4%	27,5
35	Health Care	17	9,7%	680	12,2%	40,0
45	Information Technology	9	5,1%	817	14,6%	90,8
50	Communication Services	16	9,1%	454	8,1%	28,4
55	Utilities	16	9,1%	217	3,9%	13,6
Total		176	100,0%	5.585	100,0%	36,5 <i>(Mean)</i>

Table 7 – Summary of all the regression variables

Variable Group	Variable Name	Meaning	Definition	Measurement Unit	Data Source
Firm Performance (<i>Firm_Perf_{i,t}</i>)	<i>Firm_ROA_{i,t}</i>	Firm ROA	Return on Assets (ROA) of firm <i>i</i> at the end of year <i>t</i> , measured by the ratio of the Earnings Before Interest and Taxes (EBIT) to the book value of total assets.	Percentage	Worldscope (via DataStream)
	<i>Firm_MV_{i,t}</i>	Firm Market Value	Equity market value of firm <i>i</i> at the end of year <i>t</i> , corresponding to the end-year market capitalization.	Million Euros	Worldscope (via DataStream)
Industry Performance (<i>Ind_Perf_{i,t}</i>)	<i>Ind_ROA_{i,t}</i>	Industry ROA	Our proxy for luck, corresponding to the mean industry ROA of firm <i>i</i> at the end of year <i>t</i> , weighted by firms' size (measured by the book value of total assets). The industry corresponds to all European firms listed in Thomson Reuters Eikon with the same fiscal year period (1 st of January to 31 st of December) and GICS Sector Code as firm <i>i</i> .	Percentage	Worldscope (via DataStream)
	<i>Ind_MV_{i,t}</i>	Industry Market Value	Our proxy for luck, corresponding to the mean industry market value of firm <i>i</i> at the end of year <i>t</i> , weighted by firms' size (measured by the book value of total assets). The industry corresponds to all European firms listed in Thomson Reuters Eikon with the same fiscal year period (1 st of January to 31 st of December) and GICS Sector Code as firm <i>i</i> .	Percentage	Worldscope (via DataStream)
CEO Compensation	<i>TComp_{i,t}</i>	Total short-term cash compensation	Total short-term cash compensation earned by CEO of firm <i>i</i> during year <i>t</i> . It corresponds to the sum of the variables <i>Salary_{i,t}</i> and <i>Bonus_{i,t}</i> .	Million Euros	Annual Reports
	<i>Salary_{i,t}</i>	Base salary	Base salary earned by CEO of firm <i>i</i> during year <i>t</i> .	Million Euros	Annual Reports
	<i>Bonus_{i,t}</i>	Annual cash bonus	Annual cash bonus earned by CEO of firm <i>i</i> during year <i>t</i> .	Million Euros	Annual Reports
	<i>%Bonus_{i,t}</i>	Bonus percentage	Portion of the bonus over the total cash compensation awarded by CEO of firm <i>i</i> during year <i>t</i> . It corresponds to the variable <i>Bonus_{i,t}</i> divided by the variable <i>TComp_{i,t}</i> .	Percentage	-
Corporate Governance	<i>BoardSize_{i,t}</i>	Board Size	Total number of board members in firm <i>i</i> at the end of year <i>t</i> .	Unit	Worldscope (via DataStream)
	<i>IndepBM_{i,t}</i>	Independent Board Members	Percentage of independent board members (members that are not employed by the company; are not shareholders with more than 5% of	Percentage	Worldscope (via DataStream)

			holdings; and have no immediate family ties to the company) in firm i at the end of year t .		
	$BlockOS_{i,t}$	Blockholders' Ownership	Percentage of share holdings of at least 5% in firm i at the end of year t .	Percentage	Worldscope (via DataStream)
	$CEODual_{i,t}$	CEO Duality	Variable that equals one if, at the end of year t , the CEO of firm i holds simultaneously the position of the Chairman of the Board, and zero otherwise.	Binary Variable (0; 1)	Worldscope (via DataStream)
Firm Control Variables ($Firm_Control_{i,t}$)	$Size_{i,t}$	Firm Size	Size of firm i at the end of year t , measured by the book value of total assets.	Million Euros	Worldscope (via DataStream)
	$TobinQ_{i,t}$	Tobin's Q	Tobin's Q of firm i at the end of year t , measured by the book value of total assets minus the book value of common equity plus the market value of common equity (market capitalization) divided by the book value of total assets.	Unit	Worldscope (via DataStream)
	$Levarage_{i,t}$	Leverage	Leverage of firm i at the end of year t , measured by the ratio of the book value of total debt to the book value of total assets.	Percentage	Worldscope (via DataStream)
CEO Control Variables ($CEO_Control_{i,t}$)	$CEOAge_{i,t}$	CEO Age	Age of CEO of firm i at the end of year t .	Years	Annual Reports
	$CEOTenure_{i,t}$	CEO Tenure	Number of years the CEO of firm i has been in that position, as of the end of year t .	Years	Annual Reports
Luck	$Luck_{i,t}$	Firm Performance driven by Luck	Portion of the performance of firm i in year t that is driven by the industry performance (our proxy for luck). This corresponds to the variable $\widehat{Firm_Perf}_{i,t}$, the predicted value from the standard 2 nd stage regression (5.2).	Percentage	-
Good Luck	$GoodLuck_{i,t}$	Good Luck dummy	Dummy variable representing good luck that equals one if the variation of the variable $Ind_Perf_{i,t}$ in year t relative to year $t-1$ ($\Delta Ind_Perf_{i,t}$) is positive; and zero otherwise.	Binary Variable (0; 1)	-

9.3. Annex C – Results

9.3.1. Preliminary Results

Table 8 – Descriptive Statistics

Variables	Unit	N	Mean			Minimum			Maximum			Std. Dev.		
			2008-2018	Crisis (2008-2012)	Aft.Crisis (2013-2018)	2008-2018	Crisis (2008-2012)	Aft.Crisis (2013-2018)	2008-2018	Crisis (2008-2012)	Aft.Crisis (2013-2018)	2008-2018	Crisis (2008-2012)	Aft.Crisis (2013-2018)
Firm Performance														
Firm_ROA	%	1.936	8,6%	8,7%	8,4%	-30,1%	-30,1%	-18,5%	39,1%	34,7%	39,1%	6,6%	7,2%	6,1%
Firm_MV	€ M	1.936	23.543	18.484	27.758	375	375	1.471	218.975	157.490	218.975	32.187	25.506	36.319
Industry Performance														
Ind_ROA	%	1.936	6,3%	6,9%	5,9%	1,8%	1,8%	1,8%	15,4%	15,4%	10,5%	2,2%	2,5%	1,8%
Ind_MV	€ M	1.936	16.030	15.061	16.837	2.725	2.725	5.795	62.129	62.129	45.766	9.721	10.985	8.446
CEO Compensation														
Salary	€ M	1.778	1,08	1,02	1,13	0,00	0,00	0,30	3,75	3,32	3,75	0,44	0,42	0,46
Bonus	€ M	1.778	1,03	0,94	1,10	0,91	0,00	0,00	11,04	11,04	6,18	0,91	0,92	0,90
TComp	€ M	1.778	2,11	1,96	2,23	0,41	0,41	0,45	12,50	12,50	9,78	1,18	1,14	1,20
%Bonus	%	1.778	43%	42%	44%	0%	0%	0%	100%	100%	81%	18%	19%	17%
Governance														
BoardSize	Unit	1.936	12	12	12	5	5	5	26	26	24	4	4	4
IndepBM	%	1.858	62%	58%	65%	0%	0%	0%	100%	100%	100%	23%	24%	22%
BlockOS	%	1.698	28%	30%	27%	5%	5%	5%	98%	98%	92%	20%	21%	19%
CEODual	Binary	1.936	0,29	0,29	0,29	0,00	0,00	0,00	1,00	1,00	1,00	0,45	0,45	0,45
Firm Control Variables														
Size	€ M	1.936	34.816	31.550	37.538	298	298	539	376.214	270.060	376.214	51.248	45.217	55.653

TobinQ	Unit	1.936	1,8	1,6	2,0	0,7	0,7	0,8	12,7	7,7	12,7	1,1	0,8	1,3
Leverage	%	1.936	26%	26%	26%	0%	0%	0%	65%	64%	65%	14%	14%	14%
CEO Control Variables														
CEOAge	Years	1.776	55	55	56	37	37	41	73	73	73	6	6	5
CEOTenure	Years	1.778	6	5	6	0	0	0	32	27	32	5	4	5

This table presents the main descriptive statistics for all the variables of our study, which are defined in Table 7. The sample comprises 176 European companies listed in the S&P Europe 350 Index, over the period 2008-2018. The variables *Firm_ROA*, *Firm_MV*, *Size*, *TobinQ* and *Leverage* were winsorized at the 1% level.

Table 9 – Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) Firm_ROA	1,000																
(2) Firm_MV	0,169*	1,000															
(3) Ind_ROA	0,249*	0,202*	1,000														
(4) Ind_MV	0,088*	0,406*	0,499*	1,000													
(5) Salary	-0,016	0,480*	0,095*	0,121*	1,000												
(6) Bonus	0,017	0,427*	0,138*	0,148*	0,470*	1,000											
(7) TComp	0,007	0,507*	0,142*	0,159*	0,733*	0,945*	1,000										
(8) %Bonus	0,090*	0,240*	0,113*	0,094*	0,073*	0,752*	0,606*	1,000									
(9) BoardSize	-0,219*	0,296*	-0,050*	0,151*	0,264*	0,288*	0,320*	0,125*	1,000								
(10) IndepBM	-0,029	0,050*	-0,012	-0,014	0,005	-0,054*	-0,039*	-0,067*	-0,373*	1,000							
(11) BlockOS	0,030	0,093*	0,028	0,165*	0,014	0,022	0,023	-0,040*	0,261*	-0,345*	1,000						
(12) CEODual	-0,068*	0,057*	-0,047*	-0,106*	0,006	0,053*	0,043*	0,104*	0,170*	-0,222*	0,072*	1,000					
(13) Size	-0,206*	0,635*	-0,011	0,319*	0,340*	0,392*	0,428*	0,158*	0,470*	-0,069*	0,183*	0,066*	1,000				
(14) TobinQ	0,669*	0,105*	0,100*	0,004	-0,028	-0,033	-0,036	0,052*	-0,263*	-0,085*	-0,011	-0,003	-0,282*	1,000			
(15) Leverage	-0,238*	0,003	-0,137*	0,038	0,028	0,034	0,037	-0,060*	0,188*	0,039	0,052*	-0,069*	0,168*	-0,311*	1,000		
(16) CEOAge	-0,113*	0,118*	-0,033	0,093*	0,124*	0,181*	0,186*	0,124*	0,178*	-0,067*	0,084*	0,098*	0,259*	-0,094*	-0,054*	1,000	
(17) CEOTenure	0,074*	0,062*	0,028	-0,049*	0,167*	0,126*	0,159*	0,076*	0,024	-0,073*	0,028	0,149*	-0,037	0,077*	-0,030	0,367*	1,000

This table presents the Pearson's correlations between all the variables of our study, which are defined in Table 7.

* Denotes statistical significance at the 10% level.

9.3.2. Regression Results

Table 10 – Impact of Industry Performance on Firm Performance

Dependent Variable:	Firm_ROA (1)	Log(Firm_MV) (2)
Ind_ROA	0,7135*** (0,0689)	
Log(Ind_MV)		0,6270*** (0,0376)
F-Statistic	14,4360	17,5146
Adjusted R ²	0,5636	0,9180
N° Observations	1.936	1.936

This table reports the results of estimating the 1st stage regression (5.1) for each performance measure. Column (1) reports the results of using ROA as performance measure, in which the dependent variable is the Firm ROA; and Column (2) reports the results of using market value, in which the dependent variable is the logarithm of Firm Market Value. *Ind_ROA* is the mean Industry ROA and *Log(Ind_MV)* is the logarithm of the mean Industry Market Value, corresponding to our proxies for luck. A detailed definition of all variables can be found in Table 7. We report the OLS coefficient estimates and the standard errors in parentheses underneath. Both regressions include firm and time fixed-effects.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.

Table 11 – Impact of Luck on CEO Total Compensation

	Panel A: ROA	Panel B: Market Value
Dependent Variable:	Log(TComp) (1)	Log(TComp) (2)
Luck	1,7760*** (0,5525)	0,1565*** (0,0478)
Log(Size)	0,1484*** (0,0272)	0,1378*** (0,0276)
TobinQ	0,0809*** (0,0125)	0,0786*** (0,0126)
Leverage	-0,4089*** (0,1065)	-0,4120*** (0,1064)
Log(CEOAge)	0,2588*** (0,1006)	0,2531*** (0,1005)
Log(CEOTenure)	0,0258*** (0,0093)	0,0264*** (0,0093)
F-Statistic	36,1561	36,1671
Adjusted R ²	0,7909	0,7910
N° Observations	1.776	1.776

This table reports the results of estimating the 2nd stage regression (5.2) for each performance measure. Panel A reports the results of using ROA as performance measure and Panel B of using market value. The dependent variable in both

regressions is the logarithm of CEO Total Compensation. *Luck* is the predicted value from the 1st stage regression (5.1), whose OLS estimates are reported in Table 10. Log(Size), Tobin-Q and Leverage are firm control variables and Log(CEOAge) and Log(CEOTenure) are CEO control variables. A detailed definition of all variables can be found in Table 7. We report the OLS coefficient estimates and the standard errors in parentheses underneath. Both regressions include firm and time fixed-effects.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.

Table 12 – Impact of Luck on CEO Salary and Bonus

	Panel A: ROA		Panel B: Market Value	
Dependent Variable:	Log(Salary)	Log(Bonus)	Log(Salary)	Log(Bonus)
	(1)	(2)	(3)	(4)
Luck	2,9969** (1,2777)	16,4873*** (6,2550)	0,3918*** (0,1103)	1,5230*** (0,5410)
F-Statistic	9,3821	4,6755	9,4613	4,6834
Adjusted R ²	0,5472	0,2834	0,4766	0,2839
N° Observations	1.776	1.776	1.776	1.776

This table reports the results of estimating the 2nd stage regression (5.2) for each performance measure and pay component. Panel A reports the results of using ROA as performance measure and Panel B of using market value. The dependent variable is the logarithm of CEO Salary in Columns (1) and (3); and the logarithm of CEO Bonus in Columns (2) and (4). *Luck* is the predicted value from the 1st stage regression (5.1), whose OLS estimates are reported in Table 10. We report the OLS coefficient estimates and the standard errors in parentheses underneath. All regressions include firm and time fixed-effects, as well as Firm control variables – Log(Size), Tobin-Q and Leverage – and CEO control variables – Log(CEOAge) and Log(CEOTenure). A detailed definition of all variables can be found in Table 7.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.

Table 13 – Impact of Firm's Size on Pay-for-Luck

	Panel A: ROA			Panel B: Market Value		
Size:	Small	Medium	Large	Small	Medium	Large
	(1)	(2)	(3)	(4)	(5)	(6)
Luck	1,5977 (1,1892)	0,2067 (0,8154)	3,4423*** (1,1244)	0,1051 (0,1061)	-0,0499 (0,0718)	0,4421*** (0,1002)
F-Statistic	18,3005	24,2600	20,0605	18,2470	24,2765	20,7271
Adjusted R ²	0,7389	0,7609	0,7495	0,7383	0,7610	0,7559
N° Observations	429	900	447	429	900	447

This table reports the results of estimating the 2nd stage regression (5.2) for each performance measure and size subsample. Panel A reports the results of using ROA as performance measure and Panel B of using market value. Columns (1) and (4) contain the results for the subsample of *Small* firms, whose size is below the annual first quartile; Columns (2) and (5) for the subsample of *Medium* firms, whose size is situated between the annual first and third quartile; and Columns (3) and (6) for the subsample of *Large* firms, whose size is above the annual third quartile. The dependent variable in all regressions is the logarithm of CEO Total Compensation. *Luck* is the predicted value from the 1st stage regression (5.1), whose OLS estimates are reported in Table 10. We report the OLS coefficient estimates and the standard errors in parentheses underneath. All regressions include firm and time fixed-effects, as well as Firm control variables – Log(Size), Tobin-Q and Leverage – and CEO control variables – Log(CEOAge) and Log(CEOTenure). A detailed definition of all variables can be found in Table 7.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.

Table 14 – Impact of Firm’s Size on Pay-for-Performance

	Panel A: ROA			Panel B: Market Value		
Size:	Small	Medium	Large	Small	Medium	Large
	(1)	(2)	(3)	(4)	(5)	(6)
Firm_ROA	0,6405*** (0,2314)	1,5470*** (0,2601)	1,5541*** (0,3756)			
Log(Firm_MV)				0,0024 (0,0521)	0,2180*** (0,0412)	0,4244*** (0,0508)
F-Statistic	18,6816	25,6510	20,5718	18,1832	25,3616	24,0505
Adjusted R ²	0,7431	0,7713	0,7544	0,7376	0,7692	0,7834
N° Observations	429	900	447	429	900	447

This table reports the results of estimating the regression (5.4) for each performance measure and size subsample. Panel A reports the results of using ROA as performance measure and Panel B of using market value. Columns (1) and (4) contain the results for the subsample of *Small* firms, whose size is below the annual first quartile; Columns (2) and (5) for the subsample of *Medium* firms, whose size is situated between the annual first and third quartile; and Columns (3) and (6) for the subsample of *Large* firms, whose size is above the annual third quartile. The dependent variable in both regressions is the logarithm of CEO Total Compensation. *Firm_ROA* is the Firm ROA and *Log(Firm_MV)* is the logarithm of the Firm Market Value. We report the OLS coefficient estimates and the standard errors in parentheses underneath. Both regressions include firm and time fixed-effects, as well as Firm control variables – Log(Size), Tobin-Q and Leverage – and CEO control variables – Log(CEOAge) and Log(CEOTenure). A detailed definition of all variables can be found in Table 7.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.

Table 15 – Impact of Firm’s Domicile Region on Pay-for-Luck

	Panel A: ROA			Panel B: Market Value		
Domicile Region:	NE	CE	SE	NE	CE	SE
	(1)	(2)	(3)	(4)	(5)	(6)
Luck	1,5577* (0,8355)	1,9596*** (0,7741)	-5,0698** (2,1213)	0,1812** (0,0803)	0,1499** (0,0672)	-0,8355*** (0,1642)
F-Statistic	31,0550	31,4728	28,5418	31,1591	31,4069	33,9294
Adjusted R ²	0,7857	0,7751	0,8540	0,7863	0,7747	0,8749
N° Observations	673	956	147	673	956	147

This table reports the results of estimating the 2nd stage regression (5.2) for each performance measure and domicile region. Panel A reports the results of using ROA as performance measure and Panel B of using market value. Columns (1) and (4) contain the results for the subsample of firms domiciled in Northern Europe (*NE*); Columns (2) and (5) for the subsample of firms domiciled in Central Europe (*CE*); and Columns (3) and (6) for the subsample of firms domiciled in Southern Europe (*SE*). The dependent variable in all regressions is the logarithm of CEO Total Compensation. *Luck* is the predicted value from the 1st stage regression (5.1), whose OLS estimates are reported in Table 10. We report the OLS coefficient estimates and the standard errors in parentheses underneath. All regressions include firm and time fixed-effects, as well as Firm control variables – Log(Size), Tobin-Q and Leverage – and CEO control variables – Log(CEOAge) and Log(CEOTenure). A detailed definition of all variables can be found in Table 7.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.

Table 16 – Impact of Firm’s Sector on Pay-for-Luck

GICS Sector Code:	10	15	20	25	30	35	45	50	55
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: ROA									
Luck	0,2259 (1,1750)	1,7646 (1,2706)	3,4572 (3,7064)	3,9427* (2,3367)	3,7499 (5,2221)	-3,1137* (1,6774)	6,3199* (4,0467)	-0,0970 (4,0682)	13,2519*** (4,4041)
F-Statistic	41,7900	32,5362	24,5114	36,0080	18,8118	46,0407	10,6616	12,7334	8,7239
Adjusted R ²	0,7513	0,4318	0,2153	0,5199	0,4097	0,6125	0,3840	0,3110	0,2302
Nº Obs.	82	250	515	195	155	172	94	157	156
Panel B: Market Value									
Luck	0,0177 (0,2493)	0,7180*** (0,1942)	0,1692 (0,1302)	0,2018* (0,1294)	-0,0734 (0,2793)	-0,0897 (0,1750)	0,2609 (0,1837)	0,1339 (0,5523)	0,9361*** (0,3323)
F-Statistic	41,7668	36,0378	24,6871	35,8614	18,6810	44,6511	10,5429	12,7480	8,4864
Adjusted R ²	0,7512	0,4578	0,2166	0,5188	0,4079	0,6050	0,3811	0,3112	0,2247
Nº Obs.	82	250	515	195	155	172	94	157	156

This table reports the results of estimating the 2nd stage regression (5.2) for each performance measure and GICS sector code. Panel A reports the results of using ROA as performance measure and Panel B of using market value. Column (1) contains the results for the subsample of firms belonging to the Energy Sector (GICS Sector Code 10); Column (2) for the subsample of firms belonging to the Material Sector (GICS Sector Code 15); Column (3) for the subsample of firms belonging to the Industrials Sector (GICS Sector Code 20); Column (4) for the subsample of firms belonging to the Consumer Discretionary Sector (GICS Sector Code 25); Column (5) for the subsample of firms belonging to the Consumer Staples Sector (GICS Sector Code 30); Column (6) for the subsample of firms belonging to the Health Care Sector (GICS Sector Code 35); Column (7) for the subsample of firms belonging to the Information Technology Sector (GICS Sector Code 45); Column (8) for the subsample of firms belonging to the Communication Services Sector (GICS Sector Code 50); and Column (9) for the subsample of firms belonging to the Utilities Sector (GICS Sector Code 55). The dependent variable in all regressions is the logarithm of CEO Total Compensation. Luck is the predicted value from the 1st stage regression (5.1), whose OLS estimates are reported in Table 10. We report the OLS coefficient estimates and the standard errors in parentheses underneath. All regressions include Firm control variables – Log(Size), Tobin-Q and Leverage – and CEO control variables – Log(CEOAge) and Log(CEOTenure). A detailed definition of all variables can be found in Table 7.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.

Table 17 – Impact of the following-year Compensation on Pay-for-Luck

	Panel A: ROA	Panel B: Market Value
Dependent Variable:	Log(TComp_{t+1})	Log(TComp_{t+1})
	(1)	(2)
Luck	1,9324*** (0,5822)	0,2269*** (0,0536)
F-Statistic	36,1561	32,9999
Adjusted R ²	0,7909	0,8003
Nº Observations	1.518	1.518

This table reports the results of estimating the 2nd stage regression (5.3) for each performance measure. Panel A reports the results of using ROA as performance measure and Panel B of using market value. The dependent variable in both regressions is the logarithm of the Total Compensation received by the CEO in the following year. *Luck* is the predicted value from the 1st stage regression (5.1), whose OLS estimates are reported in Table 10. We report the OLS coefficient estimates and the standard errors in parentheses underneath. Both regressions include firm and time fixed-effects, as well

as Firm control variables – Log(Size), Tobin-Q and Leverage – and CEO control variables – Log(CEOAge) and Log(CEOTenure). A detailed definition of all variables can be found in Table 7.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.

Table 18 – Impact of Firm Performance on CEO Compensation

	Panel A: ROA	Panel B: Market Value
Dependent Variable:	Log(TComp)	Log(TComp)
	(1)	(2)
Firm_ROA	1,1767*** (0,1564)	
Log(Firm_MV)		0,2356*** (0,0242)
F-Statistic	37,4454	38,5033
Adjusted R ²	0,7968	0,8014
N° Observations	1.776	1.776

This table reports the results of estimating the regression (5.4) for each performance measure. Panel A reports the results of using ROA as performance measure and Panel B of using market value. The dependent variable in both regressions is the logarithm of CEO Total Compensation. *Firm_ROA* is the Firm ROA and *Log(Firm_MV)* is the logarithm of the Firm Market Value. We report the OLS coefficient estimates and the standard errors in parentheses underneath. Both regressions include firm and time fixed-effects, as well as Firm control variables – Log(Size), Tobin-Q and Leverage – and CEO control variables – Log(CEOAge) and Log(CEOTenure). A detailed definition of all variables can be found in Table 7.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.

Table 19 – Impact of Corporate Governance on Pay-for-Luck

Governance Measure:	Board Size		Independent BM		Blockholder Ownership		CEO Duality	
	Weak	Strong	Weak	Strong	Weak	Strong	Weak	Strong
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: ROA								
Luck	1.9312** (0,8075)	1,2833* (0,8006)	4,8490*** (1,8388)	1,0925** (0,5357)	2,7113*** (0,7742)	1,0891 (0,9212)	3,1319*** (1,2177)	1,5377*** (0,6017)
Weak/Strong	1,5049	-	4,4386	-	2,4894	-	2,0368	-
F-Statistic	24,2141	23,4635	21,3738	28,1519	29,4744	24,9517	33,4309	30,7851
Adjusted R ²	0,7749	0,7775	0,7873	0,8233	0,8250	0,7876	0,8405	0,7895
N° Obs.	952	824	865	846	792	763	512	1.264
Panel B: Market Value								
Luck	0,1510** (0,0637)	0,1361 (0,0953)	0,2481*** (0,0726)	0,0305 (0,0830)	0,2409*** (0,0787)	0,1542** (0,0761)	0,2148*** (0,0778)	0,1722*** (0,0597)
Weak/Strong	1,1095	-	8,1404	-	1,5619	-	1,2469	-
F-Statistic	24,2107	23,4417	21,5451	27,9634	29,3258	25,0795	33,5205	30,8460
Adjusted R ²	0,7748	0,7773	0,7887	0,8223	0,8243	0,7885	0,8408	0,7898
N° Obs.	952	824	865	846	792	763	512	1.264

This table reports the results of estimating the 2nd stage regression (5.2) for each performance measure and governance subsample. Panel A reports the results of using ROA as performance measure and Panel B of using market value.

Columns (1), (3), (5) and (7) report the results for the subsamples of weakly-governed firms (*Weak*), in which: the board size is above the sample annual median – Column (1); the percentage of independent board members is below the sample annual median – Column (3); the blockholders' ownership is below the sample annual median – Column (5); and the CEO holds simultaneously the position of the chairman of the board – Column (7). Columns (2), (4), (6) and (8) report the results for the subsamples of strongly-governed firms (*Strong*), corresponding to the remaining companies. The dependent variable in all regressions is the logarithm of CEO Total Compensation. *Luck* is the predicted value from the 1st stage regression (5.1) estimated for each governance subsample. The row *Weak/Strong* provides the ratio of the coefficient estimated for the *Weak* subsample over the one obtained for the *Strong* subsample, indicating whether pay-for-luck sensitivity is stronger among weakly-governed firms. We report the OLS coefficient estimates and the standard errors in parentheses underneath. All regressions include firm and time fixed-effects, as well as Firm control variables – Log(Size), Tobin-Q and Leverage – and CEO control variables – Log(CEOAge) and Log(CEOTenure). A detailed definition of all variables can be found in Table 7.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.

Table 20 – Impact of Corporate Governance on Pay-for-Performance

Governance Measure:	Board Size		Independent BM		Blockholder Ownership		CEO Duality	
	Weak (1)	Strong (2)	Weak (3)	Strong (4)	Weak (5)	Strong (6)	Weak (7)	Strong (8)
Panel A: ROA								
Firm_ROA	1,5850*** (0,2716)	0,9287*** (0,1940)	1,0987*** (0,2726)	1,1347*** (0,2016)	0,7826*** (0,1925)	1,8277*** (0,3293)	2,2769*** (0,3373)	0,9233*** (0,1787)
Weak/Strong	1,7066		0,9683		0,4282		2,4662	
F-Statistic	25,2547	24,3068	21,7105	29,4406	29,6931	26,3381	36,8901	31,4704
Adjusted R ²	0,7824	0,7838	0,7901	0,8299	0,8261	0,7969	0,8536	0,7932
N° Obs.	952	824	865	846	792	763	512	1.264
Panel B: Market Value								
Log(Firm_MV)	0,2991*** (0,0348)	0,1203*** (0,0361)	0,3026*** (0,0383)	0,1688*** (0,0335)	0,1783*** (0,0376)	0,2900** (0,0388)	0,3520*** (0,0451)	0,2142*** (0,0282)
Weak/Strong	2,4864		1,7924		0,6148		1,6432	
F-Statistic	26,7143	23,8181	23,3791	29,1482	29,9973	27,5151	38,2465	32,5225
Adjusted R ²	0,7922	0,7802	0,8026	0,8285	0,8277	0,8042	0,8582	0,7987
N° Obs.	952	824	865	846	792	763	512	1.264

This table reports the results of estimating the regression (5.4) for each performance measure and governance subsample. Panel A reports the results of using ROA as performance measure and Panel B of using market value. Columns (1), (3), (5) and (7) report the results for the subsamples of weakly-governed firms (*Weak*), in which: the board size is above the sample annual median – Column (1); the percentage of independent board members is below the sample annual median – Column (3); the blockholders' ownership is below the sample annual median – Column (5); and the CEO holds simultaneously the position of the chairman of the board – Column (7). Columns (2), (4), (6) and (8) report the results for the subsamples of strongly-governed firms (*Strong*), corresponding to the remaining companies. The dependent variable in all regressions is the logarithm of CEO Total Compensation. *Firm_ROA* is the firm's ROA and *Log(Firm_MV)* is the logarithm of the Firm Market Value. The row *Weak/Strong* provides the ratio of the coefficient estimated for the *Weak* subsample over the one obtained for the *Strong* subsample, indicating whether pay-for-performance sensitivity is stronger among weakly-governed firms. We report the OLS coefficient estimates and the standard errors in parentheses underneath. All regressions include firm and time fixed-effects, as well as Firm control variables – Log(Size), Tobin-Q and Leverage – and CEO control variables – Log(CEOAge) and Log(CEOTenure). A detailed definition of all variables can be found in Table 7.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.

Table 21 – Asymmetry on Pay-for-Luck

	Panel A: ROA	Panel B: Market Value
Dependent Variable:	Log(TComp)	Log(TComp)
	(1)	(2)
Luck x GoodLuck	1,0477*** (0,3360)	0,0856*** (0,0339)
Luck x (1-GoodLuck)	0,9287*** (0,3534)	0,0850*** (0,0343)
Luck change when luck is bad	-11,36%	-0,66%
F-Statistic	36,6764	36,5906
Adjusted R ²	0,8069	0,8065
N° Observations	1.632	1.632

This table reports the results of estimating the 2nd stage regression (5.7) for each performance measure. Panel A reports the results of using ROA as performance measure and Panel B of using market value. The dependent variable in both regressions is the logarithm of CEO Total Compensation. *GoodLuck* is a dummy variable that equals one if the variation of the industry performance (our proxy for luck), is positive; and zero otherwise. *Luck x GoodLuck* is the predicted value from the 1st stage regression (5.5), indicating the pay-for-luck sensitivity when luck is good; and *Luck x (1-GoodLuck)* is the predicted value from the 1st stage regression (5.6), reflecting the pay-for-luck sensitivity when luck is bad. The row *Luck change when luck is bad* provides the percentage change of the coefficient estimated for the interaction term *Luck x (1-GoodLuck)* relative to the one obtained for the interaction term *Luck x GoodLuck*. This indicates whether pay-for-luck sensitivity is weaker when luck is bad. We report the OLS coefficient estimates and the standard errors in parentheses underneath. Both regressions include firm and time fixed-effects, as well as Firm control variables – Log(Size), Tobin-Q and Leverage – and CEO control variables – Log(CEOAge) and Log(CEOTenure). A detailed definition of all variables can be found in Table 7.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.

Table 22 – Asymmetry on Pay-for-Performance

	Panel A: ROA	Panel B: Market Value
Dependent Variable:	Log(TComp)	Log(TComp)
	(1)	(2)
Firm_ROA x GoodPerf	1,0544*** (0,1749)	
Firm_ROA x (1-GoodPerf)	0,9593*** (0,1999)	
Log(Firm_MV) x GoodPerf		0,2173*** (0,0280)
Log(Firm_MV) x (1-GoodPerf)		0,2177*** (0,0284)
Performance change when performance is bad	-9,02%	0,18%
F-Statistic	37,4873	38,2837
Adjusted R ²	0,8104	0,8136
N° Observations	1.632	1.632

This table reports the results of estimating the regression (5.8) for each performance measure. Panel A reports the results of using ROA as performance measure and Panel B of using market value. The dependent variable in both regressions is the logarithm of CEO Total Compensation. *Firm_ROA* is the Firm ROA and *Log(Firm_MV)* is the logarithm of the Firm Market Value. *GoodPerf* is a dummy variable that equals one if the variation of the firm performance is positive; and zero otherwise. The row *Performance change when performance is bad* provides the percentage change of the coefficient estimated for the interaction term *Firm_ROA* $\times$ (1-*GoodPerf*) – in Panel A – or *Log(Firm_MV)* $\times$ (1-*GoodPerf*) – in Panel B – relative to the one obtained for the interaction term *Firm_ROA* $\times$ *GoodPerf* – in Panel A – or *Log(Firm_MV)* $\times$ *GoodPerf* – in Panel B. This indicates whether pay-for-performance sensitivity is weaker when performance is bad. We report the OLS coefficient estimates and the standard errors in parentheses underneath. Both regressions include firm and time fixed-effects, as well as Firm control variables – Log(Size), Tobin-Q and Leverage – and CEO control variables – Log(CEOAge) and Log(CEOTenure). A detailed definition of all variables can be found in Table 7.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.

Table 23 – Impact of the Corporate Governance on Pay-for-Luck Asymmetry

Governance Measure:	Board Size		Independent BM		Blockholder Ownership		CEO Duality	
	Weak (1)	Strong (2)	Weak (3)	Strong (4)	Weak (5)	Strong (6)	Weak (7)	Strong (8)
Panel A: ROA								
Luck x GoodLuck	1,0493* (0,5651)	0,7816* (0,4192)	1,2560** (0,6171)	0,9027** (0,4400)	1,5243*** (0,4710)	0,4265 (0,5822)	1,8657*** (0,6846)	0,9442** (0,3884)
Luck x (1-GoodLuck)	0,9081 (0,5910)	0,7467* (0,4423)	1,1691* (0,6341)	0,8580* (0,4592)	1,1886*** (0,5092)	0,3705 (0,6030)	1,5416** (0,7087)	0,7963** (0,4048)
Luck change when luck is bad	-100%	-4,46%	-6,92%	-4,95%	-22,02%	-	-17,37%	-15,66%
F-Statistic	24,7158	22,9625	22,1986	26,8069	28,9504	26,8918	33,5516	31,1680
Adjusted R ²	0,7924	0,7872	0,8018	0,8239	0,8305	0,8088	0,8497	0,8015
N° Observations	871	761	808	790	731	705	473	1.159
Panel A: Market Value								
Luck x GoodLuck	0,0650 (0,0498)	0,0907* (0,0508)	0,1630*** (0,0598)	0,0156 (0,0476)	0,0966* (0,0527)	0,0813 (0,0543)	0,1723*** (0,0598)	0,0713* (0,0422)
Luck x (1-GoodLuck)	0,0665 (0,0502)	0,0878* (0,0513)	0,1639*** (0,0603)	0,0137 (0,0481)	0,0929* (0,0531)	0,0836 (0,0550)	0,1759*** (0,0604)	0,0691* (0,0426)
Luck change when luck is bad	-	-3,22%	0,58%	-	-3,76%	-	2,09%	-2,99%
F-Statistic	24,6493	23,0552	22,3310	26,6578	28,6694	26,9986	33,6434	31,1274
Adjusted R ²	0,7919	0,7879	0,8028	0,8230	0,8291	0,8094	0,8501	0,8013
N° Observations	871	761	808	790	731	705	473	1.159

This table reports the results of estimating the 2nd stage regression (5.7) for each performance measure and governance subsample. Panel A reports the results of using ROA as performance measure and Panel B of using market value. Columns (1), (3), (5) and (7) report the results for the subsamples of weakly-governed firms (*Weak*), in which: the board size is above the sample annual median – Column (1); the percentage of independent board members is below the sample annual median – Column (3); the blockholders' ownership is below the sample annual median – Column (5); and the CEO holds simultaneously the position of the chairman of the board – Column (7). Columns (2), (4), (6) and (8) report the results for the subsamples of strongly-governed firms (*Strong*), corresponding to the remaining companies. The dependent variable in all regressions is the logarithm of CEO Total Compensation. *GoodLuck* is a dummy variable that equals one if the variation of the industry performance (our proxy for luck), is positive; and zero otherwise. *Luck* $\times$ *GoodLuck* is the predicted value from the 1st stage regression (5.5) estimated for each governance subsample, indicating the pay-for-luck sensitivity when

luck is good; and $Luck \times (1-GoodLuck)$ is the predicted value from the 1st stage regression (5.6) estimated for each governance subsample, reflecting the pay-for-luck sensitivity when luck is bad. The row *Luck change when luck is bad* provides the percentage change of the coefficient estimated for the interaction term $Luck \times (1-GoodLuck)$ relative to the one obtained for the interaction term $Luck \times GoodLuck$. This indicates whether the pay-for-luck sensitivity is weaker when luck is bad. We report the OLS coefficient estimates and the standard errors in parentheses underneath. All regressions include firm and time fixed-effects, as well as Firm control variables – Log(Size), Tobin-Q and Leverage – and CEO control variables – Log(CEOAge) and Log(CEOTenure). A detailed definition of all variables can be found in Table 7.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.

Table 24 – Impact of the Corporate Governance on Pay-for-Performance Asymmetry

Governance Measure:	Board Size		Independent BM		Blockholder Ownership		CEO Duality	
	Weak (1)	Strong (2)	Weak (3)	Strong (4)	Weak (5)	Strong (6)	Weak (7)	Strong (8)
Panel A: ROA								
Firm_ROA x GoodPerf	1,3935*** (0,3006)	0,7565*** (0,2180)	1,2086*** (0,3206)	1,0721*** (0,2225)	0,6518*** (0,2291)	1,4406*** (0,3399)	2,8353*** (0,4520)	0,8500*** (0,1910)
Firm_ROA x (1-GoodPerf)	1,3058*** (0,3521)	0,6899*** (0,2461)	1,2643*** (0,3647)	0,7463*** (0,2519)	0,4482* (0,2644)	1,5258*** (0,3872)	2,8215*** (0,5014)	0,7026*** (0,2193)
Performance change when performance is bad	-6,30%	-8,79%	4,61%	-30,39%	-31,24%	5,91%	-0,49%	-17,34%
F-Statistic	25,4490	23,3390	22,6079	27,8033	28,8026	27,8573	36,5848	31,6944
Adjusted R ²	0,7973	0,7900	0,8048	0,8293	0,8298	0,8144	0,8608	0,8042
N° Obs.	871	761	808	790	731	705	473	1.159
Panel B: Market Value								
Log(Firm_MV) x GoodPerf	0,3007*** (0,0407)	0,0935** (0,0426)	0,2972*** (0,0431)	0,1292*** (0,0393)	0,1454*** (0,0441)	0,2696*** (0,0430)	0,3497*** (0,0502)	0,1915*** (0,0333)
Log(Firm_MV) x (1-GoodPerf)	0,3037*** (0,0412)	0,0900** (0,0431)	0,3002*** (0,0437)	0,1273*** (0,0398)	0,1407*** (0,0446)	0,2760*** (0,0436)	0,3547*** (0,0507)	0,1897*** (0,0338)
Performance change when performance is bad	0,99%	-3,71%	1,02%	-1,46%	-3,22%	2,35%	1,43%	-0,93%
F-Statistic	26,8055	23,1955	23,9482	27,2782	29,3971	29,0816	37,5124	32,4132
Adjusted R ²	0,8059	0,7889	0,8141	0,8265	0,8328	0,8210	0,8638	0,8079
N° Obs.	871	761	808	790	731	705	473	1.159

This table reports the results of estimating the regression (5.8) for each performance measure and governance subsample. Panel A reports the results of using ROA as performance measure and Panel B of using market value. Columns (1), (3), (5) and (7) report the results for the subsamples of weakly-governed firms (*Weak*), in which: the board size is above the sample annual median – Column (1); the percentage of independent board members is below the sample annual median – Column (3); the blockholders' ownership is below the sample annual median – Column (5); and the CEO holds simultaneously the position of the chairman of the board – Column (7). Columns (2), (4), (6) and (8) report the results for the subsamples of strongly-governed firms (*Strong*), corresponding to the remaining companies. The dependent variable in all regressions is the logarithm of CEO Total Compensation. *Firm_ROA* is the firm's ROA and *Log(Firm_MV)* is the logarithm of the Firm Market Value. *GoodPerf* is a dummy variable that equals one if the variation of the firm performance is positive; and zero otherwise. The row *Performance change when performance is bad* provides the percentage change of the coefficient estimated for the interaction term $Firm_ROA \times (1-GoodPerf)$ – in Panel A – or $Log(Firm_MV) \times (1-GoodPerf)$ – in Panel B – relative to the one obtained for the interaction term $Firm_ROA \times GoodPerf$ – in Panel A – or $Log(Firm_MV) \times GoodPerf$ – in Panel B. This indicates whether pay-for-performance sensitivity is weaker when performance is bad. We report the OLS coefficient estimates and the standard errors in parentheses underneath. All regressions include firm

and time fixed-effects, as well as Firm control variables – Log(Size), Tobin-Q and Leverage – and CEO control variables – Log(CEOAge) and Log(CEOTenure). A detailed definition of all variables can be found in Table 7.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.

Table 25 – Impact of the CEO’s Pay Level on Pay-for-Luck

	Panel A: ROA		Panel B: Market Value	
	Poorly-Paid (1)	Highly-Paid (2)	Poorly-Paid (3)	Highly-Paid (4)
Luck	1,2690* (0,6853)	0,9411 (0,6134)	0,1565*** (0,0589)	0,0847 (0,0541)
F-Statistic	12,6571	14,5826	12,7437	14,5851
Adjusted R ²	0,6587	0,6791	0,6603	0,6792
N° Observations	883	893	883	893

This table reports the results of estimating the 2nd stage regression (5.2) for each performance measure and CEO relative pay level subsample. Panel A reports the results of using ROA as performance measure and Panel B of using market value. Columns (1) and (3) contain the results for the subsample of *Highly-Paid* CEOs, in which Total Compensation is above the sample annual median; and Columns (2) and (4) contain the results for the subsample of *Poorly-Paid* CEOs, in which Total Compensation is equal or below the sample annual median. The dependent variable in all regressions is the logarithm of CEO Total Compensation. *Luck* is the predicted value from the 1st stage regression (5.1), whose OLS estimates are reported in Table 10. We report the OLS coefficient estimates and the standard errors in parentheses underneath. All regressions include firm and time fixed-effects, as well as Firm control variables – Log(Size), Tobin-Q and Leverage – and CEO control variables – Log(CEOAge) and Log(CEOTenure). A detailed definition of all variables can be found in Table 7.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.

Table 26 – Impact of the CEO’s Pay Level on Pay-for-Performance

	Panel A: ROA		Panel B: Market Value	
	Poorly-Paid (1)	Highly-Paid (2)	Poorly-Paid (3)	Highly-Paid (4)
Firm_ROA	0,5800*** (0,1607)	1,1896*** (0,2315)		
Log(Firm_MV)			0,1372*** (0,0294)	0,2128*** (0,0310)
F-Statistic	12,8866	15,2196	13,0972	15,7665
Adjusted R ²	0,6630	0,6890	0,6669	0,6971
N° Observations	883	893	883	893

The table below reports the results of estimating the regression (5.4) for each performance measure and CEO relative pay level subsample. Panel A reports the results of using ROA as performance measure and Panel B of using market value. Columns (1) and (3) contain the results for the subsample of *Highly-Paid* CEOs, in which Total Compensation is above the sample annual median; and Columns (2) and (4) contain the results for the subsample of *Poorly-Paid* CEOs, in which Total Compensation is equal or below the sample annual median. The dependent variable in all regressions is the logarithm of CEO Total Compensation. *Firm_ROA* is the Firm ROA and *Log(Firm_MV)* is the logarithm of the Firm Market Value. We report the OLS coefficient estimates and the standard errors in parentheses underneath. All regressions include firm and time fixed-effects, as well as Firm control variables – Log(Size), Tobin-Q and Leverage – and CEO control variables – Log(CEOAge) and Log(CEOTenure). A detailed definition of all variables can be found in Table 7.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.

Table 27 – Impact of the CEO’s Pay Level on Pay-for-Luck Asymmetry

	Panel A: ROA		Panel B: Market Value	
	Poorly-Paid (1)	Highly-Paid (2)	Poorly-Paid (3)	Highly-Paid (4)
Luck x GoodLuck	0,7090* (0,4305)	0,4844 (0,3737)	0,1113*** (0,0449)	0,0286 (0,0373)
Luck x (1-GoodLuck)	0,8209* (0,4506)	0,4406 (0,3911)	0,1113*** (0,0454)	0,0297 (0,0376)
Luck change when luck is bad	15,80%	-	-0,02%	-
F-Statistic	12,1652	14,7066	12,2419	14,6817
Adjusted R ²	0,6650	0,6976	0,6665	0,6972
N° Observations	811	821	811	821

This table reports the results of estimating the 2nd stage regression (5.7) for each performance measure and CEO relative pay level subsample. Panel A reports the results of using ROA as performance measure and Panel B of using market value. Columns (1) and (3) contain the results for the subsample of *Highly-Paid* CEOs, in which Total Compensation is above the sample annual median; and Columns (2) and (4) contain the results for the subsample of *Poorly-Paid* CEOs, in which Total Compensation is equal or below the sample annual median. The dependent variable in all regressions is the logarithm of CEO Total Compensation. *GoodLuck* is a dummy variable that equals one if the variation of the industry performance (our proxy for luck), is positive; and zero otherwise. *Luck* × *GoodLuck* is the predicted value from the 1st stage regression (5.5), indicating the pay-for-luck sensitivity when luck is good; and *Luck* × (1-*GoodLuck*) is the predicted value from the 1st stage regression (5.6), reflecting the pay-for-luck sensitivity when luck is bad. The row *Luck change when luck is bad* provides the percentage change of the coefficient estimated for the interaction term *Luck* × (1-*GoodLuck*) relative to the one obtained for the interaction term *Luck* × *GoodLuck*. This indicates whether the pay-for-luck sensitivity is weaker when luck is bad. We report the OLS coefficient estimates and the standard errors in parentheses underneath. All regressions include firm and time fixed-effects, as well as Firm control variables – Log(Size), Tobin-Q and Leverage – and CEO control variables – Log(CEOAge) and Log(CEOTenure). A detailed definition of all variables can be found in Table 7.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.

Table 28 – Impact of the Financial Crisis of 2007-2008 on Pay-for-Luck

	Panel A: ROA		Panel B: Market Value	
	During Crisis (1)	After Crisis (2)	During Crisis (3)	After Crisis (4)
Luck	2,5838*** (0,9536)	1,4860** (0,6971)	0,1853* (0,0997)	0,1377* (0,0782)
F-Statistic	21,1518	38,3556	20,9952	38,2787
Adjusted R ²	0,8240	0,8762	0,8229	0,8759
N° Observations	793	983	793	983

This table reports the results of estimating the 2nd stage regression (5.2) for each performance measure and time-period. Panel A reports the results of using ROA as performance measure and Panel B of using market value. Columns (1) and (3) contain the results for the time period 2008-2012, corresponding to the period during the Financial Crisis of 2007-2008 (*During Crisis*); and Columns (2) and (4) contain the results for the time period 2013-2018, corresponding to the period after the Crisis (*After Crisis*). The dependent variable in all regressions is the logarithm of CEO Total Compensation. *Luck* is the predicted value from the 1st stage regression (5.1), whose OLS estimates are reported in Table 10. We report the OLS coefficient estimates and the standard errors in parentheses underneath. All regressions include firm and time fixed-effects,

as well as Firm control variables – Log(Size), Tobin-Q and Leverage – and CEO control variables – Log(CEOAge) and Log(CEOTenure). A detailed definition of all variables can be found in Table 7.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.

Table 29 – Impact of the Financial Crisis of 2007-2008 on Pay-for-Performance

	Panel A: ROA		Panel B: Market Value	
	During Crisis	After Crisis	During Crisis	After Crisis
	(1)	(2)	(3)	(4)
Firm_ROA	1,6718*** (0,2182)	0,5535*** (0,2187)		
Log(Firm_MV)			0,3046*** (0,0368)	0,2890*** (0,0371)
F-Statistic	23,1919	38,4548	23,5821	41,3416
Adjusted R ²	0,8375	0,8765	0,8399	0,8843
N° Observations	793	983	793	983

This table reports the results of estimating the regression (5.4) for each performance measure and time-period. Panel A reports the results of using ROA as performance measure and Panel B of using market value. Columns (1) and (3) contain the results for the time period 2008-2012, corresponding to the period during the Financial Crisis of 2007-2008 (*During Crisis*); and Columns (2) and (4) contain the results for the time period 2013-2018, corresponding to the period after the Crisis (*After Crisis*). The dependent variable in all regressions is the logarithm of CEO Total Compensation. *Firm_ROA* is the Firm ROA and *Log(Firm_MV)* is the logarithm of the Firm Market Value. We report the OLS coefficient estimates and the standard errors in parentheses underneath. All regressions include firm and time fixed-effects, as well as Firm control variables – Log(Size), Tobin-Q and Leverage – and CEO control variables – Log(CEOAge) and Log(CEOTenure). A detailed definition of all variables can be found in Table 7.

*** Indicates statistical significance at the 1% level; ** 5% level; * 10% level.