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The theory of board's compensations, agency problems and firm performance How did COVID-19 affect board's compensation?

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1. Abstract

CEOs play a crucial role in the administration of a company. In the past decades, their remuneration packages have received an increased amount of attention. On the one hand, overpaid but inefficient CEOs have been one of the main reasons behind different bankruptcies. On the other hand, several authors proposed compensation as the main tool to align the interest of shareholders and CEOs and incentivize better performance. As the growth of modern corporations is leading to a higher degree of separation between ownership and control of the company, the conflict of interest between shareholders and managers is only supposed to increase as well in the future.

This paper aims to identify the main determinants behind CEOs’ remuneration in the United States. In doing that, the paper will empirically investigate if the remuneration of CEOs is supported by an effective performance or by more complex tasks performed. The paper refers to mixed-effect regression models to account for intrinsic differences between companies, years, and industrial sectors. Findings suggest that the remuneration of CEOs is aligned with a positive market or accounting performance. However, while remuneration increased during COVID-19, the sensibility to the performance of CEOs decreased, hinting at higher remuneration with lower results during the crisis. Furthermore, results highlight that the complexity of a firm in terms of size or growth opportunities justifies higher CEO remuneration. However, geographical diversification and risk associated with the firms are less related.

This study contributes to the literature in several ways. First, this paper empirically investigates the validity of theory related to the principle-agent framework in a modern sample of United States firms. Second, the study comprehensively analyzed different types of compensation to understand their specific relation with different variables. Finally, this analysis advances the current literature investigating the impact of the COVID-19 crisis on CEO compensation. In doing that, results will be useful for future consideration on endogeneity problems between compensation and performance.

2. Introduction

Over the last century, companies have grown exponentially by joining international realities. As a consequence of this evolution, the separation of firms' management and firms' ownership gained higher relevance in several corporate structures. However, the higher divergence between these two main elements of a company has increased the principal-agent issues as well (Jensen & Meckling, 1976).

Defining principals as the group of people that trust agents with the power to manage a firm, principal-agent issues include a cluster of limitations deriving from this contract. The main reasons behind consequent problems are explained by economic theories as the natural trend of rational subjects to maximize their utility. The literature highlighted two main problems related to the separation of management and ownership. The agency problem of Type I refers to conflicts due to distinct goals between shareholders and executives (Eisenhardt, 1989). The agency problem of Type II accounts for issues related to the different degrees of influence of bigger and smaller shareholders concerning executives (Morck et al., 1988). While both types of problems are still relevant today, the cultural context and the background of the country in which a company operates tend to emphasize one over the other. For instance, public companies operating in the United States have a fragmentation of ownership so relevant that the main problems are related to the different goals between shareholders and executives. By contrast, several listed companies operating in China are spin-offs of state-owned enterprises (i.e., SOEs) for which the State is a majority shareholder (Tong, 2003).

Monitoring can be a solution to this recognized conflict of interest. However, agents in charge of the management of the company have access to more information than principals. Furthermore, firms with a higher fragmentation of ownership will be more prone to have shareholders with low resources eligible for the monitoring of the firm. As a consequence of this disequilibrium, different scholars have studied possible incentives to align the interest of principals and agents. Since executives legally work for the firm, the first logical tool to affect their goals has been remuneration packages.

Pay-for-performance schemes or incentive-based remunerations should be able to align the interests of shareholders and executives. However, companies continue to fail due to the decisions of their management. The first decade of the 21st century has seen one of the greatest financial crises of modern history due to executives' misbehaviors while the COVID-19 crisis brought other firms to the verge of bankruptcy a few years later.

Managers are relevant figures for modern corporations which are in turn important entities for the welfare of a country. While theories related to corporate governance can restrain negative consequences for bad management, it is important to notice how policies should evolve to account for the new context in which a company is operating. Hence, while different scholars already started to analyze agency problems and compensation packages as possible solutions in the twentieth century, it is worth analyzing current remuneration schemes to have a better understanding of modern trends in this field of corporate governance.

This paper will analyze the main determinants of CEO compensation. In doing so, fixed, stock, option, and total compensation will be analyzed over their relationship with different variables. Since performance is one of the main metrics related to employees, this paper will account both for accounting and market performance. Accomplishing that, this study will also refer to the impact of the COVID-19 crisis on CEO remuneration. Furthermore, other variables will be used as a proxy for complexity. Since more intricated corporations should reward executives with a better compensation package to avoid executives' leaks towards less challenging firms with the same base remuneration scheme.

This research is organized as follows. Section 3 examines the current state of the literature related to agency problems and the United States corporate context. Section 4 focuses on assumed determinants of CEO remuneration. Section 5 presents the data, their descriptive statistics, and the methodology needed due to their structure. Section 6 describes the results of the analysis. Finally, section 7 offers a conclusion to this study.

3. Literature Review

3.1 Principal-agent theory

The traditional agency theory underpins the classical view of executive compensation by defining the relationship between the principal (owner) and the firm's agent (executive). Jensen and Meckling's depiction of this relationship (1976) expresses that shareholders delegate authority to the executive as their representative. As a result, a type of agreement arises between the shareholders and the executive, forming a contract between the two. The direct consequence of this relationship is asymmetric information arising due to the shareholders' failure to adequately monitor the executive. Literature refers to this condition as an agency problem of type I (Grossman & Hart, 1983; Holmstrom, 1979; Jensen & Meckling, 1976).

Assuming that both executives and shareholders aim to maximize utility, managers will presumably operate to favor their interests. With that being said, Jensen and Meckling (1976) argued that the shareholders will take precautionary measures to limit the potential harm that the executives' choices could induce. These precautions lead to costs that are commonly referred to as agency costs by the literature. Among these measures, the authors suggested that compensation schemes could be tools for mitigating this agency problem. As executives have the duty and authority to lead the company, literature studies suggest that their pay should be related to the firm performance (Grossman & Hart, 1983; Holmstrom, 1979; Jensen & Murphy, 1990). The said linkage would validate the contract between the principal and the agent. While not completely correlated, the additional information supplied by the firm's performance can provide a more accurate picture of the agents' achievements (Holmstrom, 1979). Only later other authors added new variables such as size (Conyon & Murphy, 2000) or risk (Bloom & Milkovich, 1998) in this model to determine executives' compensation determinants. As a broader prospect to this problem, Doucouliagos et al. (2007) suggest that compensation schemes should reward agents with compensation schemes that would align their interests to those of principals.

The design of compensation contracts for company executives in an agency context has been a major topic in the microeconomic literature as well. Crespi-Cladera and Gispert (2003) tried to determine an optimal compensation scheme that motivates managers to exercise maximum effort while cognizant of the fact that managers are risk averse and that a contract is made in

asymmetric information circumstances. More specifically, the agent's degree of effort is personal information, which is a sufficient prerequisite for feasibly opportunistic behavior.
Crespi-Cladera and Gispert (2003) interpret the output of a firm (y) as a function of the effective effort carried out by executives I and a group of variables randomly distributed which are outside of the executive's control (ε). This model can be expressed as the following formula:

$$y = f(e, \varepsilon)$$

A contract where the executive's remuneration is dependent on observable achievements can be a tool to incentive the executives' best course of action and be detrimental for those who fail to achieve so. Hence, different authors justify a contract that ties executive compensation I to the observable output of the firm (Hart, 1995; Rosen, 1992; Tirole, 1988). This can be conceptualized using the following formula:

$$c = f(y)$$

Assuming that the executive's level of effort and the results of the company are correlated, Crespi-Cladera & Gispert (2003) suggest that through the observability of the company's outcome it would be possible to complete executives to a higher degree of effort. The direct consequence would be that executives denoted by a degree of risk aversion select contracts that remunerate for the born risk. Hence, the risk of underperforming and receiving a lower remuneration would explain an external remuneration premium. This assumption is also supported by the empirical findings of different authors (Conyon,1997; Conyon & Peck, 1998; Gregg et al., 1993; Jensen & Murphy, 1990; Main et al., 1996, Murphy, 1985).

3.2 Corporate Governance Model in the United States

The social environment in which a company operates affects individual corporate governance practices.
The literature highlighted the state of financial markets, the labor market for executives, the impact of banks as external monitors, the legal rules protecting the shareholders' investments, and the role of institutional investors as variables that can affect executives' remuneration (Crespi-Cladera & Gispert, 2003). More precisely, three elements can affect the governance practices of the company: the ownership structure, the board composition, and the impact of creditors. For instance, as new monitors can supervise the behavior of executives, the higher will be the understanding of agents' efforts.

The starting point of these new studies on various forms of corporate governance can be traced down to the early 1990s. During these years, the US economic system's downfall and the reduction of competitiveness discredited the shareholder value paradigm. Meanwhile, the activity of designing and implementing homogeneous legal standards across different European countries and regions, on the one hand, and the growing influence of institutional investors among public companies, on the other hand, incentivized new studies across the ocean. In light of the following studies that empirically denoted heterogeneity of corporate governance practices across advanced capitalist economies, the authors also pointed out how precise groups of countries present common governance features (Aguilera & Jackson, 2003).

The broader division presented by the literature is the one between the outsider and insider systems. The outsider system is historically linked to the United Kingdom and the United States. In this system, institutional investors usually detain the effective control of companies. Meanwhile, the insider system is related to countries where the ownership is determined by interlocking shareholdings such as France and Germany. As a consequence of this structure, an insider system of firms' control by which families or other companies are the actual owners arises (Franks & Mayer, 1997). As this study will focus on U.S. executives, only the first system will be presented in more in-depth.

Companies operating in the Anglo-Saxon outsider system have historically focused on shareholder value maximization. The ownership structure of the firms is usually dispersed and for this reason, the control is mainly transferred to executives (Airoldi, 1993). While literature denoted a decreasing rate of retail investors' participation, this class of shareholders is significant when compared to other economies. More precisely, families own a relatively high percentage of shares even if on average institutional investors have effective control of firms. This can be explained because retail investors own shares for diversification strategy while institutional investors can exploit their relevance to appoint trusted managers (Kaen, 2003).

The dispersion of ownership due to the highly fragmented shareholders' structure is the main determinant of rules or practices related to the board of directors in the outsider system's firms. As a consequence of the dispersion, a great percentage of companies lack a controlling shareholder that could have a particular ascendancy over the board of directors. This implies that top executives can potentially influence board strategies or goals through the election of new members (Parrino & Starks, 2001). This common feature of outsider system companies leads to different problems. First, CEOs have relatively higher power, and, in many instances, they cover this role and the role of the Chairman for the same company (i.e., Chairman-CEO duality). As the chairman has usually the duty to organize meetings, this figure is considered to exercise a disproportionate influence on this board's practice. Hence, the power of an executive that would cover both the role of Chairman and CEO would be particularly significant for the board's decisions (Tirole, 2010). Second, defining independence as not being employed by the company, not supplying goods or services to the company, or not having conflicts of interest in the fulfillment of the oversight goal, non-executive directors can still be dependent. This is the case when executives must select non-executives, as it happens for systems where this class of managers has excessive power. Furthermore, another historical consequence is the excessive presence of executive directors when compared to non-executive in outsider systems. While as above-mentioned non-executives can be not independent as well, executives are by definition not independent.

The growing presence of institutional investors seems to have attenuated problems deriving from the excessive power of the firm's top managers. As retail investors have more incentives to monitor the board and ensure its well-functioning, this class of shareholders appears to nudge toward adjustments in cases of suboptimal performance. Furthermore, corporate governance practices changed for the development of new rules by regulators or governance codes by committees. In particular, new practices lead to a majority of independent directors compared to non-independent and to the creation of a new role denoted as "Lead Independent Directors" that organizes the interaction of independent across the board and with the CEO (Fiori, 2016).

Outsider systems historically presented a one-tier board. Concerning this type of board, shareholders directly nominate board members that will form a single structure with both managing and controlling functions. Moreover, the board members can form various sub-committees with different functions. This structure is historically opposed to the one usually adopted by insider system companies which prefer two-tier boards. The existing literature tends to divide the two-tier board into vertical and horizontal two-tier boards. In vertical two-tier boards, shareholders appoint a supervisory board of non-executive and independent directors that can form within its structure committees and has to elect a management board of executives. In horizontal two-tier boards, shareholders appoint both the supervisory board and the management board. In both cases, the main duty of the supervisory board is to monitor executives inside the management board (Fiori, 2016).

The participation in financial markets related to outsider system countries seems to be relatively higher than the one in insider system countries. When compared to other countries, the United States and the United Kingdom (i.e., outsider system countries) denoted a higher market capitalization to GDP ratio. This implies that stock investment represented a higher form of savings in the United States and the United Kingdom over the considered horizon when compared to other countries. In other words, financial markets in the United States and the United Kingdom tend to have a higher activity than other countries which may be oriented more toward bonds. As a direct consequence of this, markets are higher regulated and monitored by the government which tends to offer various protections for investors to incentivize and boost investments. Given a higher amount of regulation on companies, shareholders are less prone to monitor the governance of the company (Van Den Bergh & Drews, 2019).

Among outsider system companies, the market for corporate control is the main mechanism to deal with sub-performing executives that do not match expectations. Among these practices, there are two more common in use. First, as executives are underperforming, shares of the company will decrease in value. Hence, external investors can buy more shares of the company than the ones that would have been available if they would have not been discounted by the market. Finally, with more shares at their disposal, external buyers would encounter fewer difficulties to replace current executives (i.e., hostile takeover). The potential for hostile takeovers incentivizes the current management to properly perform. Second, shareholders have the right to present an alternative list of board candidates. Then, it is possible to interact with other shareholders to bring them to vote for the alternative list. In the case of the majority, current executives will be replaced (i.e., proxy fight).

4. Theoretical Framework & Hypotheses

The focus of this section will be to introduce the main determinants of CEO remuneration. In doing that, this section will start by proposing a theoretical framework regarding the modern literature on this issue.

Over the years, different authors have studied the link between corporate characteristics and executive compensation, but this topic remains controversial. Among the different theories regarding corporate governance, the most commonly referred to concerning the determinants of executive remuneration is the agency theory. Under the assumption that the alignment of interest between executives and owners may solve the problem derived from asymmetric information, Jensen and Murphy (1990) implied that the problem is not on the total compensation of managers but instead on the composition of remuneration packages.

Through the years, compensation committees divided the overall manager compensation into four main components: a standard salary, a variable bonus, stock options, and long-term incentives (Murphy, 1999). Studies regarding the different compositions of executive pay packages and relative determinants have led to mixed findings across time. A first explanation related to this problem can be tracked down to the complications deriving from picking explanatory determinants when compared to the company's needs.

Compensation is a remuneration related to an executed performance. Hence, the first set of variables should be linked to the performer. Thus, executive characteristics will collect variables strictly related to executives, their relative labor market, and their performance. At the same time, prior literature implies that corporate governance mechanisms affect the functional compensation attributed to executives (Ozkan, 2007). Hence, relational characteristics will regroup variables that will define the relationship between adopted governance structures and executive compensations. Another important set of variables that describe individual firm features should be accounted for as a proxy for managing complexity. Following Lippert and Moore (1994), this study will consider two main groups of determinants. Rational determinants will account for characteristics strictly related to the value of CEOs such as their performance, their tenure, and whether they were operating during the COVID-19 crisis or not. Operating determinants will consider characteristics mainly related to the firm in which CEOs were working such as its size, complexity, growth opportunities, and risk.

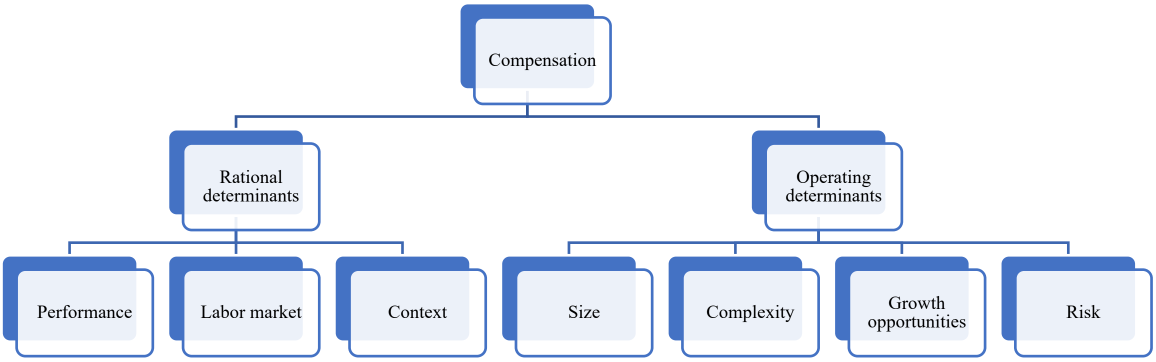

Figure 1: Compensation determinants

4.1 Rational characteristics

4.1.1 Company performance

Since executives' main responsibility is to generate value from company resources (Shaw, 2012), compensation should account for the performance of managers. Since the role of optimal contracting theory regarding performance regained importance among scholars in light of the 2008 global financial crisis and executives' poor performance, several authors have studied the relationship between remuneration and firm performance (Bussin & Ncube, 2017). In particular, since 1993, compensation packages in the United States have been contingent on the fulfillment of predetermined performance results settled by the compensation committee. This new compensation designing practice derived from the Internal Revenue Service regulations to implement the Act (Section 162(m)) and the Omnibus Budget Reconciliation Act of 1993 which limited the deductibility of the five highest-paid officers' remuneration exceeding $1 million. While this was generally true for cash compensation, compensation based upon the attainment of pre-established performance metrics approved by the stockholders of the company was excluded from the limit of $1 million (Bussin & Ncube, 2017). While the theory is intuitively appealing, several authors have empirically found evidence of a relationship between remuneration and performance in the Anglo-American setting as well (Bouteska & Mefteh-Wali, 2021). In line with the above-mentioned theories and pieces of evidence, is therefore hypothesized;

HP1: Performance will be positively related to CEO remuneration.

4.1.2 Labor market for executives and Tenure

An analysis of tenure as a variable of executive compensation has different advantages. On average, the different aim of a shareholder and a manager leads to a shorter time horizon approached by the latter (Narayanan, 1985). Thus, executives can adopt a myopic approach to investments which would lead to a decrease in shareholder value in the long term (Dechow & Sloan 1994). For instance, empirical studies report that most managers would avoid a project with a net present value higher than zero if the adoption is prospected to decrease the current quarter consensus forecast. (Graham & Rajgopal, 2005). Murphy and Zabojnik (2007) showed that this can be explained by the tendency to link a higher compensation to executives who are perceived as more able to perform their tasks. Thus, newly appointed managers are more prone to accept short-term projects over long-term investments if this choice will be able to increase their perceived ability. In particular, besides higher compensation in the current company, managers would earn a better reputation which would lead to an increase in their market value. On the other hand, the long-run value of the company will suffer from these short-term investments, which would be detrimental for executives who will sacrifice a higher basic compensation for a larger proportion of stock remuneration (e.g., stock options). Building on this, executive compensation should be analyzed over a time horizon over a multiple years horizon (Devers et al., 2007).

Furthermore, tenure is related to the competency of the executive. The ex-post settling-up problem is related to the possibility that managers will be compensated for ex-ante forecasted positive cash flows that will not be realized in the future (Leone et al., 2006). This case is used as an example of sub-optimal decisions by executives which would represent a comparatively lower degree of competence (Gong, 2011). However, given that executive contracts can be not renovated, a longer tenure can be seen as an above-average ability to realize the ex-ante forecasted cash flows for which compensation should be higher. Furthermore, tenure is perceived to be strictly correlated to perceived ability since more years in the position would give the possibility to acquire experience, skills, and knowledge (Lippert & Moore, 1994). Thus, tenure should be positively related to the value of executives in the labor market and their required compensation.

On the other hand, the incentive system represented by the managerial labor market loses part of its power to motivate managers. Since a higher tenure means by definition a higher number of years served in the company, this implies a shorter period before retirement. Following this assumption, Gibbons and Murphy (1992) showed that compensation packages remunerate executives in a manner that decreases their incentive to invest as they approach retirement. Furthermore, near-retirement management has a lower interest to account for ex-post settling up a problem in their decision. Thus, executives would be more prone to pursue their interests instead of increasing the value for stockholders (Hill & Phan, 1991) which would lead to a less profitable incentive-based remuneration.

Assuming that a longer period serving as an executive in a company will lead to a higher value given a higher amount of experience, is therefore hypothesized;

HP2: Tenure will be positively related to CEO remuneration.

4.1.2 COVID-19 crisis

Literature concerning executive compensations denoted that crises could affect pay-performance sensitivity. For instance, Van Essen et al. (2013) pointed out how corporate governance practices may differ between the periods preceding and succeeding crises. In particular, Van Essen et al. (2013) denoted that CEO duality could positively affect firm performance. In contrast to this finding, Grove et al. (2011) argued that CEO duality negatively affected performance metrics for companies operating in the financial sector. While both papers were sustained by previous studies on similar situations, the difference in the findings highlights how crises could lead to predictions diverging from theory.

Different studies examined the consequences of crises on executives' compensation. For example, a relevant number of papers explored the financial crisis of 2008. On the one hand, the instability derived from this crisis can be compared to the one reached during the pandemic period. On the other hand, the financial crisis of 2008 and COVID-19 differ for several reasons. Li et al. (2022) pointed out that the COVID-19 crisis had a bigger impact on the US economy since the financial crisis of 2008 was announced by structural problems. Hence, hypotheses will be based on general theories on executive compensation.

Companies operating during crises require executives that can properly manage the firm through the adverse period. If several companies are operating in the same context, the offered remuneration will increase to attract or retain executives with higher competencies. Murphy and Zabojnik (2007) denoted that executives are proportionally paid to the degree of their tasks. Furthermore, the COVID-19 crisis impact will be different by the time horizon considered. On the one hand, Li et al. (2022) suggested that the crisis will have a particular relevance on the geopolitical risk of Unites States in the long run. On the other hand, the same authors denoted COVID-19 crisis had a relevant negative economic impact in the short term. Economic crises can involve a decrease in the market value of firms as a consequence of their share prices. Van Den Bergh and Drews (2019) already denoted the importance of market metrics for U.S. firms and their management. With that being said, it would be logical to assume that compensation committees would try to solve this problem.

Assuming that the COVID-19 crisis added new stability tasks, is therefore hypothesized;

HP3.a: CEOs operating during the COVID-19 crisis will have a higher remuneration when compared to the pre-pandemic period.

Finally, higher remuneration during a crisis will attract or retain executives with higher competencies. One possible reason behind this policy is to guarantee that managers will properly perform. While this goal is intuitive, it has acquired particular relevance after the financial crisis of 2008 (Bussin & Ncube, 2017). Hence, is therefore hypothesized that;

HP3.b: As CEOs operate during the COVID-19 crisis, the positive relationship between performance and executive remuneration will increase.

4.2 Operating characteristics

4.2.1 Firm size

Literature denotes the importance of firm size in different practices of corporate finance. In the sector of corporate governance, authors studied the determinants of executive compensation in light of the development of the theory of large firms (Agarwal, 1981). While this theory can be tracked down to Berle and Means (1933), authors such as Baumol (1959), Monsen and Downs (1965), and Williamson (1964) elaborated on it suggesting that managers prefer to increase the size of a firm rather than its profitability. Since the separation of ownership and control characterizes modern corporations, a bigger size would lead to less constrained executives who would have higher discretionary power in guiding the company. To explain this, Baumol (1959) suggested size is a bigger determinant of executive compensation than performance. A possible explanation for this is given by Roberts (1956) who suggests that the marginal productivity of a manager is positively related to the size of the managed company. Hence, executives in larger firms should have higher compensation than those in relatively smaller companies.

The importance of size as an executive compensation determinant can be partially explained also on a sociological level. Simon (1957) argued this thesis following three premises. First, the governance structure of a firm is comprised of different management levels roughly shaped in a pyramidal form. Second, compensation packages follow the norm of appropriately differentiating between the remunerations of managers and the ones of their hierarchical subordinates. Third, given the competitive nature of the labor market for executives, managers at the lowest level tend to have similar compensation packages. Given these three premises, if a company follows a pyramidal structure, the difference in compensation between executives should be proportional to the levels that divide them in the pyramid. Overall, given that larger companies tend to have more levels in their hierarchy, top executives in these companies would have higher compensations than those of smaller firms.

Furthermore, Rosen (1992) underlined how a bigger firm requires more tasks which will increase the degree of complexity and responsibility. Hence, since the cost of wrong managerial decisions is higher, the same should hold for the benefits deriving from fitting administrative decisions.

While these theories are intuitively appealing, their thesis was based on a more qualitative rather than quantitative analysis. However, Lambert et al. (1993) empirically demonstrated that in their study there is a positive association between the size of a group, division, or plant, and the related level of executive compensation. In line with this finding, it is therefore hypothesized;

HP4: Size will be positively related to CEO remuneration.

4.2.2 Firm complexity and diversification

Another possible element that affects executives' remuneration is the degree of diversification of the company for which they are working. As empirical findings suggest that the compensation of executives is directly related to the complexity of their tasks, Duru and Reeb (2002) hypothesized that the presence of different executives' tasks managing a diversified firm could affect their remuneration.

Another reason to assume that a relationship between the degree of diversification and executive remunerations exists is the impact on the human capital risk of managing a diversified firm instead of a non-diversified one. As literature suggested that the executive's human capital risk can be proxied using the born risk from the firm (Core et al., 1999), the effect of diversification on firm risk can affect both executives' decisions and remuneration. Hence, the agency theory highlights the potential consequences of situations in which executives are bearing disproportionate human capital risk. For instance, principal-agent models predict that executives will require higher remuneration as a consequence of different risk preferences between undiversified executives and diversified investors. Thus, executives that decide to adopt diversification investments that align with their risk aversion but are overall value-decreasing are supposed to receive a discounted remuneration (Holmström, 1979). Since the relationship between diversification and executive remuneration depends on the ability of the former to increase value for investors, it is necessary to highlight different types of diversification.

An underlying theme of literature is the distinction between geographical and industrial corporate diversification. The first type of diversification, geographical, defines the extent to which a company is active in different regions or countries. Authors consider multinational companies as the decision-making environment with the highest degree of complexity (Finkelstein & Hambrick, 1989). In particular, companies that operate in different geographic locations will be characterized by a strong dependence on several foreign markets (Bodnar et al., 1998). For instance, a diversified network will generate frictions derived from cultural and legal divergences that mainly affect clients, suppliers, regulations, and labor markets (Gomez-

Mejia & Palich, 1997). Furthermore, the authors denoted a positive relationship between company risk and the degree of diversification for a given firm. The excess risk appeared to derive from higher exchange rate risk, country risk, and political risk. This is accentuated for contemporary investments in markets that are self-correlated (He & Ng, 1998).

Geographical diversification can affect the structure of manager remuneration due to a more challenging effort to monitor executives. Effective monitoring requires an understanding of legal, cultural, and corporate characteristics. However, as the degree of geographical diversification increases, more information and language barriers accentuate monitoring frictions (Reeb et al., 1998). The logical consequence of this disequilibrium is a greater level of information asymmetry between executives and investors. With that being said, principal-agent models would predict a greater weight of incentive remuneration for executives managing diversified firms to make up for the lower degree of monitoring (Gaver & Gaver, 1993).

The second type of diversification, industrial, defines the extent to which a company is active in different industries. As argued for geographical diversification, principal-agent models suggest that shareholders would reward only industrial diversification that can match their interests and not the risk preferences of managers. Based on this premise, the same hypotheses and considerations stated for geographic diversification could be considered valid for industrial diversification (Duru & Reeb, 2002).

Substantial researches on executive compensation suggest that inferences on industrial diversification can diverge from the ones related to geographic diversification for two reasons. The first difference is that studies on diversification that rely on performance metrics can be affected by the extent to which an executive can manipulate earnings. For instance, authors suggest relying more on accounting-based measures and less on market-based measures if accounting returns have higher explanatory power concerning executives' decisions (Baber et al., 1996; Bryan et al., 2000).

Defining a greater complexity to understanding accounting earnings manipulation as noisiness, some arguments sustain a higher amount of noise in the context of geographically diversified firms. The first reason is that executives operating in different countries have a higher degree of freedom in adopting determinate accounting and reporting standards (Rosen, 1982). In particular, the presence of incentives to increase the value for shareholders implies greater discretion for managers to arbitrage among accessible accounting and tax regimes (Scholes et al., 1992). A second argument behind higher noisiness is related to exchange risk. Companies operating in different countries adopting various currencies will have a higher potential for imperfect hedging (i.e., a situation where the hedge does not guarantee that gain and loss fully offset each other). Thus, the final values presented in the balance sheet or the income statement will not match the true performance of a firm. In conclusion, a geographically diversified firm would have a higher tendency than a non-geographic diversified one to present noises.

The second intuitive difference between implications for geographic diversification compared to industrial diversification is related to the effect on shareholder value. Empirical findings denoted that a higher degree of industrial diversification leads to a lower shareholder value (Duru & Reeb, 2002). The main argument behind this finding suggests that industrial diversification is pursued to decrease executives' human capital risk. Managers tend to accept a discount on their compensation as insurance against the born risk. This effect seems less common in geographically diversified firms (Amihud & Lev, 1981).

As the implications of leading a geographically diversified company appear to be more unintelligible, this study will mainly focus on this type of diversification. Executives that have the skills required to manage a geographically diversified company are supposed to receive a premium on compensation. Furthermore, since operating in different countries increase the difficulty to monitor executives' performance, remuneration packages should account for higher incentives to align the interest of shareholders and managers. In line with the above-mentioned literature, is therefore hypothesized;

HP5: CEOs operating for a geographically diversified firm will have higher remuneration.

4.2.3 Firm opportunities

The number of growth opportunities related to a firm can affect the structure of executive compensation. Applying the same logic used for risk, the authors suggested that the presence of available growth opportunities increases the difficulty for which it would be possible to design a correct value-maximizing strategy (Smith & Watts, 1992). Hence, due to the presence of ineffective monitoring, it would be suggested to tie the compensation of executives operating in an environment with growth opportunities to incentives (Conyon, 2006). Building on this, Guay et al. (2002) empirically denoted that equity incentive packages are more predominant in firms with greater growth opportunities.

On the other hand, the literature suggests that also the opposite can be true. Since companies that are operating in an environment with several growth opportunities use to set their goals on the long-term horizon, short-term remuneration based on the stock could be detrimental. A yearly compensation based on stocks could tie the compensation of the executive only to its short-term performance which will not match available growth opportunities (Lippert & Moore, 1999). Thus, Bizjak, Brickley, and Coles (1992) denoted how managers are used to accepting investment projects to merely manipulate the inferences of the market about their firms if they are operating under excessive concern over the current stock price. Hence, it would be possible that executive contracts will focus both on short-run and long-run stock returns implying that direct alignment or bonding could not be the preferred choice behind a compensation package. Building on these theories, this study suggests that executives will have a higher total remuneration if they are operating in an environment believed to have higher growth opportunities. This can be explained by the need to have more capable executives that will be more required but will have the ability to lead the firm in its growth. In line with the above-mentioned theories, it is therefore hypothesized;

HP6: CEOs operating in an environment rich in growth opportunities will have to be compensated with higher remuneration.

4.2.4 Risk

Literature developed two theories on how risk is related to executive compensation packages. The first theory implies that risk is a driving factor for remuneration. The second theory suggests that executive remuneration may affect the risk behavior of the firm (Abrokwah et al., 2018; White, 2018). Both theories have been developed due to the hypothesis that fitting corporate governance structures increases the performance of firms while lowering the related risk (Brezeanu et al., 2011; Cheung et al., 2010). On the other hand, literature has not achieved a consensus on the matter. For instance, authors have supposed that the relationship between executive compensation and firm risk could theoretically be negative, positive, or U-shaped (Petacchi, 2013).

Compensation packages can have different sensitivity to risk.

A reason to suppose that risk can at least be positively correlated to executive compensation is related to its impact on the complexity of the firm. Intuitively, a riskier firm would require more qualified executives to operate. Due to the existence of a labor market for executives, an executive with higher qualifications should be paid more than one with lower qualifications (Chalmers et al., 2006).

Different managers can adopt different choices related to their risk aversion. For instance, executives may accept investments with additional non-efficient risk. Hence, the structure of compensation should be adapted to link a larger part of the total remuneration to shares, options, or other incentive-based remuneration. By doing so, executives would be more prone to increase performance by disregarding unnecessary risk (Brezeanu et al., 2011; Cheung et al., 2010). Specifically, a study on incentive systems denoted that the risk that a company bears is positively associated with option remuneration packages and negatively associated with share remuneration packages (Chalmers et al., 2006). Furthermore, findings from Chalmers et al. (2006) suggest a higher percentage of compensation in shares would align the interest of executives in long-term performance. Hence, the opposite should hold still.

The instability that characterizes the firm's operating environment directly affects the difficulty with which executive choices can be monitored. For instance, an operating environment denoted by higher volatility of product prices or production technology would imply a lower degree to which an executive's performance could be compared to other executives or past performances (Demsetz & Lehn, 1985). Thus, the literature suggests adopting the above-mentioned incentive system when monitoring is inefficient, and vice versa. In line with the above-mentioned literature, it is therefore hypothesized;

HP7: Executives operating for a riskier firm will have to be compensated with higher remuneration.

5. Data and Descriptive Statistics

5.1 Sample description

Data were retrieved from Execucomp, CRSP, and Compustat databases. Since different databases had variables of interest for the study, they have been merged using the unique ticker symbol for the firm and the specific year as key variables.

The sample time horizon ranges from the year 2013 to 2021. The first year of the sample (i.e., 2013) was chosen to account only for firms that implemented different compensation policies after the financial crisis of 2008. The last year of the sample (i.e., 2021) was chosen since it was the last one that had all the variables of interest from the three databases that have been used. Furthermore, for the given time horizon, Execucomp followed the same standards required by Financial Accounting Standards Board (FASB) and the required compensation discloser mandated by the Securities and Exchanges Commission (SEC).

Among the different directors available, the sample excluded non-executive directors and non-CEO executives. Hence, the final sample included firms inlcuded in S&P 500, S&P 400 MidCap, and S&P SmallCap 600 indexes during the time horizon. For every CEO, were retrieved six types of remuneration: fixed, variable, pension, options, stocks, and residual compensation. Then, variables used to control for possible determinants of CEO compensation were included. All these variables were controlled to drop illogical values given their definition retrieved from the respective database's manual. For instance, negative values for fixed compensation were eliminated. Then, duplicates for the same firm in the same year were treated by sorting different values to their mean as a single value.

Following Cieślak (2018) for similar research on executives' compensation, extreme outliers passed through the Winsorizing procedure at the 1st and 99th percentiles where the closest observation replaces the largest and smallest values. Winsorizing process for the 2.5th and 97.5th percentiles or 5th and 95th percentiles did not significantly affect the final findings.

The final sample consists of 2237 firms. The only reported currency for this study was the dollar.

5.2 Sample statistics

Table 1 displays means, standard deviations, and correlations with confidence intervals between the variables exploited in the regression analysis.

Table 1 indicates that the average total compensation is equal to $ 6.692.450. Furthermore, it shows that the average fixed compensation is $ 898.070, the average bonus compensation is $ 154.290, the average stock compensation is $ 3.774.880, and the average option compensation is $ 1.261.870. Results suggest a higher weight related to stock remuneration than other types of compensation when compared to the total compensation. On the other hand, different values of standard deviations suggest a lower spread of the data when taking into account fixed compensation. This result would imply that CEOs operate in a system predominated by incentives which would show a higher standard deviation. This table denotes that the average tenure is 7.33 years, the average stock return is positive and equal to 0.01, the average EBITDA margin is 0.22, and the average Tobin's Q is 1.02.

A relevant correlation holds between market value and fixed compensation (.25) or stock compensation (.25). Furthermore, relevant correlations can be registered between the total value of assets and fixed compensation (.20) or the market value (.36). Overall, the low degree of correlation between explanatory variables would suggest low collinearity problems in the construction of the model.

Table 1: *Means, standard deviations, and correlations with confidence intervals*

Variable	*M*	*SD*	*Min*	MAX	1	2	3	4	5	6	7	8	9	10
1. Total Compensation	6692.45	21410.73	0	2284045										
2. Fixed Compensation	898.07	453.47	0	20000	.15** [.13, .16]									
3. Bonus Compensation	154.29	826.35	0	32000	.08** [.07, .10]	.13** [.12, .15]								
4. Stock Compensation	3774.88	6567.72	0	280200	.34** [.33, .36]	.29** [.27, .30]	.10** [.08, .12]							
5. Option Compensation	1261.87	19944.93	0	2283989	.94** [.94, .94]	.02 [-.00, .03]	.01 [-.01, .03]	.02* [.00, .04]						
6. Market Value	16569790	64930710	3870	2324390000	.12** [.10, .13]	.25** [.23, .26]	.07** [.05, .09]	.25** [.23, .26]	.02** [.01, .04]					
7. Stock Returns	0.01	1.41	-6.86	7.92	.08** [.06, .09]	.14** [.13, .16]	.02* [.00, .04]	.12** [.10, .13]	.03** [.02, .05]	.16** [.15, .18]				
8. EBITDA Margin	0.22	0.16	0.00003	0.98	.02* [.00, .04]	.02* [.00, .04]	.05** [.04, .07]	.06** [.04, .07]	-.00 [-.02, .01]	.11** [.09, .13]	.07** [.05, .08]			
9. Tenure	7.33	7.62	1	56	-.01 [-.03, .01]	.01 [-.00, .03]	.02 [-.00, .03]	-.05** [-.07, -.03]	.01 [-.01, .02]	-.00 [-.02, .01]	.06** [.04, .07]	.01 [-.01, .02]		
10. Total Assets	22394.21	122930.88	14125	3743567000	.08** [.06, .10]	.20** [.18, .21]	.19** [.18, .21]	.17** [.16, .19]	.01 [-.01, .03]	.36** [.34, .37]	.04** [.02, .05]	.14** [.12, .15]	-.01 [-.02, .01]	
11. Tobin's Q	1.02	1.26	0.0001	22.9	.02* [.00, .03]	-.13** [-.14, -.11]	-.02* [-.04, -.00]	.03** [.01, .04]	.02* [.00, .03]	.11** [.10, .13]	.24** [.23, .26]	-.02* [-.04, -.00]	.10** [.09, .12]	-.08** [-.10, -.06]

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). * indicates $p < .05$. ** indicates $p < .01$. Monetary values refer to thousands of dollars as unit.

5.3 Research design and variable description

Before showing empirical results, this study will introduce the theory behind the specific model adopted. Since lower-level data units that follow this type of structure can be nested in one higher-level unit, the dataset can be analyzed as a hierarchical structure. For instance, lower-level units can be nested within industries or repeated observations over time on the same firm. Firms nested in the same group or cluster are expected to show more similarities among each other than when compared to firms from different groups or clusters. Authors refer to models based on this data structure as mixed-effect models, random-effect models, hierarchical linear models, variance components-based models, or mixed models (Cameron & Trivedi, 2005).
Hamilton (2013) defines a mixed-effect model as a special type of regression analysis that accounts for two categories of effects. The first allowed effect is the fixed one and it refers to intercepts (i.e., the point where the regression line crosses the y-axis at x = 0) and slopes (the acclivity of the regression line) as a tool to explain the population as a whole similarly to an OLS regression. The second allowed effect is the random one and it refers to individual intercepts and slopes that differ among distinct groups or clusters of the sample. For example, if the random-effect model describes firms, a mixed-effect model would have different intercepts and/or slopes for each firm. Lastly, mixed-effect models can handle missing data if a random subject effect is included. The random subject effect combined with fixed model effects leads to a prediction of missing values.

Mixed-effect models account for fixed and random effects. Random effects define a higher group variable under which observations could be nested. Thus, random effects should be categorical or nominal while fixed effects can be continuous or categorical (Winter, 2019). On the one hand, random effects convey a selection of a non-finite number of potential levels. For example, firms, years, or sectors represent a possible infinite collection of levels from which many different observations can be drawn. Therefore, random effects represent a random sample. On the other hand, fixed effects represent a fixed set of variable levels like domestic or non-domestic firms. Another key distinction is that the effect drawn among different samples should be consistent if fixed and non-consistent if random (Winter, 2019). For instance, the effect of geographical diversification on executives' compensation can be tested using different samples of directors. The effect of geographical diversification can be qualified as fixed since the literature suggests a predictable and non-idiosyncratic influence of this factor on the response that could be tested with a different sample of directors.

Model-based on regressions should account for the structure of the data. For example, pooled OLS model combines the data from different clusters. Among the assumptions behind pooled OLS, there is the assumption of independence. Thus, it is assumed a lack of correlation between estimated residuals from the model. However, the assumption of independence holds only if the observations are nested in or more hierarchical groups and are checked for possible hierarchical levels effects on the model.

On behalf of OLS models, authors suggest that the correlation of the residuals leads to invalid conventional estimators of standard errors even if the coefficients estimated for the fixed effect inside the OLS models are consistent and not biased. Moreover, if there is a correlation between residuals, OLS models will not lead to asymptotically efficient coefficients (Rabe-Hesketh & Skrondal, 2012). Additionally, OLS models can reject the null hypothesis of zero slopes since the estimated confidence intervals might be too short. Thus, models based on the OLS estimate may suggest that predictors influence the outcome even if this result could be ascribed randomly. In particular, given the same higher level in the hierarchical structure, an increase in the lower-level observations is positively correlated to the degree of underestimation related to the effective standard errors among regression coefficients (Goldstein, 2011). On the contrary, mixed-effect requires data sets with higher observations to avoid cases of β-errors (Johnson, 2009).

Having exposed the need for this specific type of regression, the design of the model can be exhibited according to mixed-effect regressions' features. As introduced in previous chapters, the main determinants of remuneration can be divided into two groups. Each group contains several variables that can theoretically affect compensation. All these main sub-determinants will be included in the mixed-effect model as fixed effects. However, the model adopted will also account for the specific company, year, and operating sector as a random factor. The final regression equation including all the factors will therefore be;

$$
\begin{aligned}
Ln(Compensation) = {} & \alpha + \beta_1 Tenure + \beta_2 DummyCovid + \beta_3 StockReturn + \\
& \beta_4 EBITDAMargin + \beta_5 (DummyCovid * StockReturn) + \\
& \beta_6 (DummyCovid * EBITDAMargin) + \\
& \beta_7 DummyInternational + \beta_8 LnTotalAssets + \beta_9 Tobin'sQ + \\
& \beta_{10} StandardDeviation + (1|Company) + (1|Year) + \\
& (1|Sector) + \varepsilon
\end{aligned}
$$

5.3.1 Explanatory variables for determinants of CEO remuneration packages

This subsection will analyze the assumed determinants of CEO remuneration packages for companies listed in the United States stock market. The structure of this subsection will follow the structure used to review different theories on possible remuneration determinants. Hence, the subsection will start with an analysis of Rational characteristic variables to move on Operating characteristic after.

A. Rational characteristic

A.1 Company performance

Over the years, literature has referred to different metrics to estimate executives' performance. However, the authors denoted how computing the performance of executives can be a difficult task. In particular, researchers and managers agree that analysis of the performance of the company managed by executives can be affected by various factors. For instance, Porter's analysis suggests accounting for barriers to new entry, rivalry among existing competitors, bargaining power of suppliers and buyers, and substitute products (Porter, 1979).

On the other hand, the literature also suggests that measuring the performance of companies using accounting of financial metrics could still lead to valid outcomes. However, it is worth noticing that the same company performance measure could lead to different outcomes concerning executives' compensation analysis (Crespi-Cladera & Gispert, 2003). One frequently used argument behind this reasoning is that investors are mainly interested in the return on their investment. Thus, measuring the performance of the company could be a valid proxy to determine how effective the executives were (Doucouliagos et al., 2007).

One intuitive practice to adopt before measuring performances would be to compare them against a common benchmark. In practice, researchers have denoted that investors tend to choose between investments in the same industry or among firms with similar attributes (Dogan and Smyth, 2002). However, while it would be possible to assume that firms outperforming other companies should lead to higher executives' remuneration, this is not always the case. Alshimmiri (2004) denoted a negative relationship between company performance and relative executives' compensations. While this may be due to the precise kind of remuneration to which the study was referring (i.e., cash remuneration), results could have been biased by the performance measure used as well.

Previous authors have based their research on two types of performance measures: accounting-based measures and market-oriented measures. Accounting-based performance measures are usually indicators constructed starting from financial statements. While accounting-based measures are intuitively appealing, literature has denoted how measures derived from financial statements can be affected by manipulation by the firms' management (Alshimmiri, 2004). Furthermore, accounting-based measures tend to diverge from the economic market value of a company since they have a low or zero correlation to systematic risk (Benston, 1985). Lastly, compensation packages that refer to market-based metrics do not curb all earning management problems (Bergstresser & Philippon., 2006). On the other hand, market-based performance measures are usually determined collectively by market participants. While market-based measures are more robust to manipulation since they are mainly affected by market participants' considerations, studies can only refer to them if companies are quoted in financial markets (Alshimmiri, 2004).

Accounting for overall industrial performance using random effect, this study will take into consideration both an accounting-based measure and a market-based measure. As a proxy for accounting performance, this paper will refer to the EBITDA margin. The literature considers the EBITDA margin an efficient tool to measure a firm's profitability unbiased by the capital structure. Furthermore, since this measure refers to EBITDA, it reports the firm's operating ability unbiasedly by depreciation and amortization policies (Hampton & Stratopoulos, 2015). While Bussin and Ncube (2017) denoted an existing relationship between EBITDA and executives' compensation, this paper will still focus on the EBITDA margin for two reasons. First, Bussin and Ncube (2017) refer to state-owned entities whose purpose may diverge from profit or shareholder value maximization. Second, EBITDA without a common base figure would lead to an EBITDA representative of size as well while this study will already account for this variable following the logic explained in the section Size. Finally, literature based on data available before 2005' had less availability of EBITDA information while Bouwens, De Kok, and Verriest (2019) denoted a positive trend of EBITDA information disclosure since 2005.

As a proxy for market performance, this paper will refer to the stock's return. The literature already indicated significant relations between companies' stock returns as a market-based performance indicator and executive compensation (e.g., Ozkan, 2006). While other authors adopted Tobin's q or other similar ratios as market-based performance, (Alshimmiri, 2004), this study will already refer to them as possible growth opportunities proxy in the section

Growth Opportunities. Thus, this study will only account for stock returns that are not considered by the reviewed literature as a growth opportunities proxy.

A.2 Labor market for executives and Tenure

The nature of the labor market for executives brings up difficulties in valuing the fair value of a manager. The complexity of this market suggests that several variables affect the value of an executive (Abowd, 1990). Approaching this problem, results derived by Gong (2011) pointed out that tenure is positively related to the value of an executive in terms of higher change in aggregate market value and cumulative abnormal stock returns.

Tenure will be used as a proxy for the perceived value of the executive in the labor market to determine its impact on remuneration. Thus, the variable tenure will be regressed against the components of compensation.

A.3 COVID-19 crisis

Different papers analyzed the effect of crises on executive compensation using time-based dummy variables in their models. Gilson & Vetsuypens (1993) analyzed the effect of financial distress on executives' compensation operating for firms in the United States. In doing that, the authors used a dummy variable to differentiate between the time period before and after the crisis. Similarly, a dummy variable will be used in this study to differentiate the pre-pandemic period (i.e. 2013-2019) and the post-pandemic period (i.e. 2010-2021).

Models can account for the different effects related to performance derived from the differences in the two periods including interactions with EBITDA Margin and Stock Returns. Hence, it will be possible to account for the moderation in compensation values during the pandemic period.

B. Rational characteristic

B.1 Firm size

Several authors studied the impact of firm size in analyzing executive remuneration. Although empirical studies agree that firm size matters, no study has determined a universally valid proxy for this variable. Concerning executive remuneration, authors have used sales turnover (Main et al., 1996), the logarithm of sales turnover (Crespi-Cladera & Gispert, 2003), total assets (Mishra & James, 2000), or both employment and revenue (Graziano et al., 2001).

While these studies account for firm size, the usage of different proxies leads to the impossibility of preferring one proxy over the others. Starting from this problem, Hashmi et al. (2020) checked for the coefficient of determination sensitivity, the beta coefficient sensitivity, and the significance level sensitivity of different proxies of firm size within different areas of corporate finance. According to this study, total assets are denoted by a relatively high explanatory power in the sector of executive remuneration. Hence, the variable total asset will be used as a proxy for firm size and will be regressed against the components of compensation.

B.2 Firm complexity and diversification

Almost all of the existing studies on the impact of diversification across executives' remuneration packages focus on geographic and industrial diversification. For reasons of feasibility and due to their more unintelligible implications, this study will mainly focus on geographic diversification.

As the sample of the study was retrieved by COMPUSTAT, it provides information from the CBI Geographic Segment files. The requirement of these files is mandatory due to the Statement of Financial Accounting Standards No. 14 (Financial Accounting Standards Board 1976). In particular, the COMPUSTAT Geographic Segment database (hereinafter referred to as the CGS database) presents geographic segment data for COMPUSTAT firms for up to the full horizon of this study. Companies that have less than 90 percent of their total assets, income, or sales from operations inside of the United States are required to disclose information on not affiliated balance statements or net income metrics.

This study will refer to CGS database tapes to differentiate between geographically and non-geographically diversified firms. This differentiation will be repeated every year in the sample. In particular, companies that do not disclose non-U.S. segment data will be tagged as domestic firms while companies that disclose non-U.S. segment data will be classified as geographically diversified firms.

This research design requires two assumptions. First, domestic firms potentially could have up to 10% of their operations outside of their country or be exporting their domestic products. However, this problem was analyzed by Bodnar et al. (1998) that concluded that the impact of diversification on firm value was considered not too impactful for the study. As mentioned in the theory paragraph, since the implication of diversification on shareholders' value (i.e., the value of the company for which they own shares) is the main determinant of executives' compensation packages, this goes under the same research design assumptions made by Bodnar et al. (1998) for their study.

Second, different studies highlighted how determining the marginal impact of diversification may be too dependent on the used methodology (Kim & Mathur, 2008). Hence, this study will only focus on the mean value impact of diversification. In doing that, geographic diversification will be treated as a dummy variable.

B.3 Firm opportunities

Literature usually refers to several measures of growth opportunities. Since outsiders may encounter friction to analyze growth opportunities available to firms, literature usually relies on proxy variables (Adam & Goyal, 2008). This paper will focus on four proxy variables for growth opportunities and will pick the most fitting to the purpose accordingly to other literature findings. Therefore, this paragraph will analyze the market-to-book assets ratio (hereinafter referred to as MBA ratio), the market-to-book equity ratio (hereinafter referred to as MBE ratio), the earnings–price ratio (hereinafter referred to as EP ratio), and the ratio of capital expenditures over the net book value of plant, property, and equipment (hereinafter referred to as CAPX/PPE ratio).

The MBA ratio is based on the book and market value of assets. While both measures are a proxy for assets in place, market value accounts for investment opportunities, too. Hence, the literature suggests that a higher MBA ratio is indicative of a firm with higher growth opportunities given its assets in place than firms with a lower MBA ratio (Adam & Goyal, 2008). The closely related measure to the MBA ratio is Tobin's q which can be defined as the ratio of the market value of assets over the replacement value of assets. Since it has been demonstrated that the correlation coefficient between the MBA ratio and Tobin's q is almost equal to 1 (Adam & Goyal, 2008; Perfect & Wiles, 1994), this study will not distinguish between the MBA ratio and Tobin's q. Even if this measure has several advantages, it presents three shortcomings as well. First, the authors use this measure as a proxy for different other variables as well. Hence, literature has problems denoting its fair potential as a growth opportunity proxy. Second, since only a partial number of traders buy or sell debt, the market value of debt needed to retrieve the market value of assets would be hard to estimate. Third, it is assumed that the replacement value of assets is equal to the book value of assets. However, this is not always empirically true (Adam & Goyal, 2008).

MBE ratio is based on the market and book value of equity. While the book value of equity accounts for the generated value derived by present assets only, the market value of equity represents the discounted value of all future cash flows to equity holders. Hence, the literature suggests that a higher MBE ratio is indicative of a firm with more opportunity to grow in the future given the actual assets in place (Adam & Goyal, 2008). While the MBE ratio is not affected by the replacement values of assets or the market value of debt, it presents two shortcomings. First, the authors use this measure as a proxy for different other variables as well, leading to the same problematic standing for MBA. Second, if total assets are lower than total liabilities, the shareholders' equity of a firm will be negative. In this case, the firms cannot be accounted for in the analysis since they would have a negative MBE ratio which would not be relevant to measuring growth opportunities. Third, leverage can affect the affordability of the MBE ratio as a growth opportunity proxy. For instance, a firm operating in an environment with poor growth opportunities would have the same MBE ratio as a high-growth firm if the first carries a capital structure with a higher proportion of debt (Frank & Goyal, 2005).

EP ratio is based on the earnings and price per share. While earnings are assumed to be a proxy for cash flows generated from assets in place, the firm's market value of equity is assumed to account for the discounted value of future cash flows generated by not only assets in place but also from future growth opportunities (Chung & Charoenwong, 1991). While the EP ratio is not based on the market value of debt estimation, it is not reliable for growth opportunities analysis if earnings are zero or negative. Furthermore, the authors use the PE ratio as a proxy for other variables as well. In addition, this measure is affected by leverage as the MBE ratio is. Finally, current earnings may depart from the long-term expected value on abnormal scenarios implying that it would not be always reliable as a proxy for growth opportunities (Penman, 1996)

CAPX/PPE ratio is based on capital expenditure and property, plant, and equipment. This measure is used as a proxy for growth opportunities as capital expenditure is discretionary and stands for the new available investments. In particular, a higher amount of investment leads to a new possibility to extract value from their new existing assets. Alternatively, the ratio between R&D expenditures divided by sales or total assets is considered to be a related measure to

CAPX/PPE ratio by literature (Adam & Goyal, 2008). Finally, it is important to highlight that capital or R&D expenditures do not always generate new growth opportunities.

While all the above-mentioned measures have advantages and shortcomings, this study will refer to Tobin's q as a proxy for a growth opportunity for two reasons. First, other authors used Tobin's q for similar studies in the field of executive compensation (Lippert & Moore, 1994). Second, empirical findings denoted that Tobin's contained more insights on investment opportunities compared to the other mentioned measures.

B.4 Risk

Literature offered several definitions of risk. This paper will define risk as the uncertainty related to future outcomes (Bloom & Milkovich, 1998). Building upon the capital asset pricing model, risk can be divided into the component Beta and the component Sigma. Beta can be defined as the systematic (i.e., non diversifiable) and exogenous risk that proper diversification cannot eliminate. On the other hand, Sigma can be defined as the unsystematic (i.e., diversifiable) and firm-specific risk that proper diversification can eliminate. Following Lippert and Moore (1994), risk will be denoted as the standard deviation of stock returns on equity. Hence, the variable risk will be regressed against total, stock, and option remuneration.

6. Empirical Specifications and Results

This chapter introduces the retrieved from the mixed-effect regression. The study will present hypothesis discussion and empirical results following the order used for hypotheses in section 4. In doing that, section 6 will be divided in a discussion on the assumptions behind the model and in a discussion related to results.

6.1 Mixed-effect model assumptions

Statistical models generally rely on assumptions. Specifically, mixed-effect models need assumptions on fixed effects and random effects to be validated (Winter, 2019). These are:
(1) Linearity;
(2) Absence of collinearity;
(3) Homoskedasticity or "absence of heteroskedasticity";
(4) Normality of residuals;
(5) Independence.

The first assumption that must be tested is linearity. This assumption states that there is a linear relationship between dependent and independent variables inside the model.
Linearity plots can show the relation between a dependent variable against another independent variable. In this kind of plot, it is possible to include both a linear and quadratic line. The convergence of the linear and quadratic lines would suggest a higher degree of the linear relationship between variables. Furthermore, a symmetric distribution of observations around the lines would indicate a good linear relationship.
Violations of the linearity assumption can be solved by adding fixed effects that can interact with effects already present in the model. Furthermore, log transformation can decrease linearity problems.

The second assumption that has to be tested is the absence of collinearity. This assumption states that there is no correlation between fixed effects (i.e. predictors) inside the model. If the assumption is not satisfied, the rendition of the model becomes unstable. For instance, a correlation between two fixed effects can make one of the two significant or not significant

when this would not be truthful. Furthermore, the significance of a collinear fixed effect is biased since it could pinch explanatory power from other fixed effects.
The variance inflation factor (hereinafter referred to as the VIF) is the quotient of the variance of estimating some parameter in a model that includes different other parameters by the variance of a model constructed using only one parameter. The value of the VIF suggests different degrees of collinearity. In particular, a VIF equal to 1 indicates that variables are not correlated while a VIF higher than 10 suggests a significant multicollinearity that needs correction. More generally, a higher VIF value would indicate higher collinearity problems.
Collinearity problems can be solved by changing analyzed fixed effects. However, this would be detrimental to the design of the model. Thus, the degree of correlation between fixed effects will be accounted for when dealing with the mixed-effect model.

The third assumption that has to be tested is homoskedasticity. This assumption states that the variance of observations is roughly equal across the spectrum values predicted by the model. If this is not true, the model would imply unequal variances across the range of values for an independent variable (i.e., presence of heteroskedasticity).
Graphic plots can be used to check for homoskedasticity. Again, log transformations can decrease the degree of heteroskedasticity.

The fourth assumption that has to be tested is the normality of residuals. In particular, it is assumed that the error term relates to the residuals of the model. If the assumption is satisfied, the residuals of the model are approximately normally distributed.
The Kolmogorov–Smirnov test is a nonparametric test used to check the equality of continuous or discontinuous one-dimensional probability distributions. This test compares a set of observations with a reference probability distribution. Thus, it can be adjusted as a goodness of fit test. For this assumption, the sample is standardized and compared with a standard normal distribution.
According to the Kolmogorov–Smirnov test, dependent variables (i.e., different components of total compensations) do not show a normal distribution. For this reason, outliers have been eliminated from the sample. Furthermore, a nonlinear transformation of each data point of dependent variables has been adopted to achieve a normal distribution without further altering the set of observations. Hence, the logarithm of the different components of total compensations

will be used as a dependent variable. Figure 2 shows a comparison between the actual distribution of the data and the distribution of the log-transformed data for total compensation.

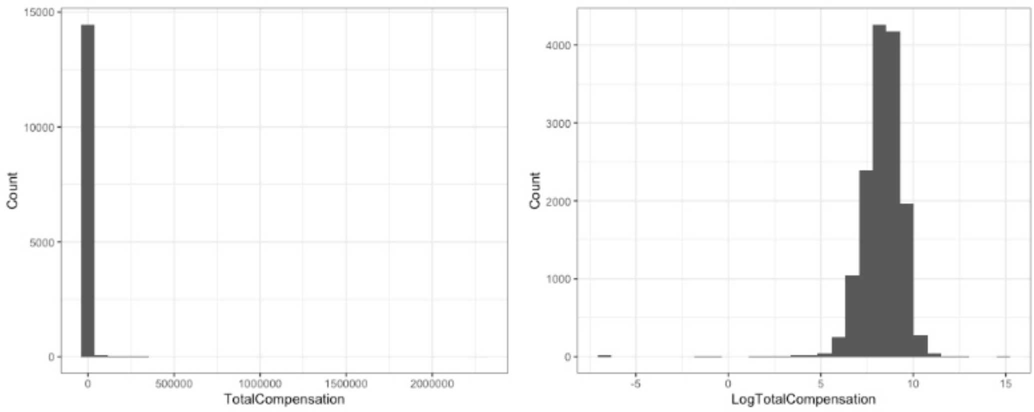

Figure 2: A comparison between the actual distribution of the data (figure on the left) and the distribution of the transformed data (figure on the right).

The fifth assumption that has to be tested is independence. This assumption states that observations are independent of each other. To account for the dependence among variables is possible to include random effects. For example, the second observation of a precise firm would be probably correlated to the first observation from the same firm.

In mixed-effect models, independence can be adjusted by adding the proper random effect. In this case, different observations through the time horizon would not negatively bias the validity of the model. Hence, random effects will be used to solve dependence problems inside the model.

6.2 Mixed-effects models and empirical results

After testing for the assumptions behind mixed-effect regressions, this study will now illustrate the construction of effective models. This study will take into account fixed, stock, option, and total compensation. For each one of these four types of compensation, three models have been constructed: the first one account for rational characteristics, the second one for operating characteristics, and the third one will account for both. Finally, the following independent variable proxies will be used between the three different models for each type of compensation:

Table 2: *proxies used for independent variables*

Proxy	***Independent Variable***
Stock performance	Market performance
Accounting performance	EBITDA margin
Labor market	Tenure
COVID-19 Dummy	COVID-19
Geographical diversification dummy	Complexity
Ln (Total assets)	Size
Tobin's Q	Growth opportunities
Standard deviation	Risk

With regards to compensation, it is now worth mentioning the effective definition of the four different types of compensation used. Fixed compensation is the dollar value of the base salary earned by the named CEO during the year. Stock compensation is the dollar value of stocks at the time of issuance. Option compensation is the dollar value of options at the time of issuance computed using the Black and Scholes method a reference. Total compensation is the sum of fixed, stock, option, bonus, and pension compensation. Referring to the database manual, bonus compensation is defined as the dollar value of bonuses earned by the CEO during the year. Furthermore, pension was defined as the dollar value of pension paid by the firm to the CEO.

6.2a.I Fixed compensation, Stock compensation, Option compensation, and Total compensation

The following tables will include Fixed compensation (i.e., table 3.1), Stock compensation (i.e., table 3.2), Option compensation (i.e., table 3.3), and Total compensation (i.e., table 3.4).

Table 3.1: *Regression model for fixed compensation*

	LogFIXED			LogFIXED			LogFIXED		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	6.73	6.62 – 6.83	**<0.001**	5.38	5.11 – 5.65	**<0.001**	5.48	5.05 – 5.91	**<0.001**
Tenure	-0.01	-0.01 – -0.00	**<0.001**				-0.00	-0.01 – 0.00	0.144
Dummy Covid [1]	0.07	-0.02 – 0.15	0.146				0.02	-0.09 – 0.13	0.729
Stock Return	-0.01	-0.03 – 0.01	0.527				-0.01	-0.04 – 0.01	0.359
EBITDA Margin	0.12	-0.17 – 0.41	0.403				-0.38	-0.78 – 0.01	0.056
Dummy Covid [1] * Stock Return	0.04	0.00 – 0.08	**0.026**				0.01	-0.04 – 0.06	0.579
Dummy Covid [1] * EBITDA Margin	0.19	-0.08 – 0.46	0.169				0.00	-0.42 – 0.42	0.994
Dummy International [1]				-0.06	-0.19 – 0.08	0.419	-0.06	-0.23 – 0.12	0.516
Log Total Assets				0.16	0.13 – 0.19	**<0.001**	0.16	0.12 – 0.21	**<0.001**
Tobin's Q				0.04	0.02 – 0.06	**<0.001**	0.05	0.02 – 0.08	**<0.001**
Standard Deviation				-0.00	-0.00 – 0.00	0.142	-0.00	-0.01 – 0.00	0.248
Random Effects									
σ^2	0.40			0.37			0.36		
τ_{00}	1.21 Company			0.79 Company			0.88 Company		
	0.07 Sector			0.04 Sector			0.05 Sector		
	0.00 Year			0.00 Year			0.00 Year		
ICC	0.76			0.69					
N	9 Year			9 Year			9 Year		
	309 Sector			314 Sector			267 Sector		
	1405 Company			1445 Company			913 Company		
Observations	7172			7286			3884		
Marginal R^2 / Conditional R^2	0.004 / 0.761			0.054 / 0.710			0.141 / NA		

Table 3.2: *Regression model for stock compensation*

	LogSTOCK			**LogSTOCK**			**LogSTOCK**		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	7.69	7.55 – 7.84	**<0.001**	4.20	3.92 – 4.47	**<0.001**	4.58	4.22 – 4.95	**<0.001**
Tenure	0.01	0.00 – 0.01	**<0.001**				0.01	0.00 – 0.01	**<0.001**
Dummy Covid [1]	0.40	0.14 – 0.65	**0.002**				0.24	0.06 – 0.41	**0.010**
Stock Return	0.03	0.01 – 0.04	**0.002**				0.02	-0.01 – 0.04	0.131
EBITDA Margin	0.57	0.33 – 0.82	**<0.001**				-0.26	-0.59 – 0.08	0.136
Dummy Covid [1] * Stock Return	-0.00	-0.03 – 0.03	0.806				-0.06	-0.10 – -0.02	**0.006**
Dummy Covid [1] * EBITDA Margin	-0.03	-0.24 – 0.18	0.770				-0.05	-0.41 – 0.31	0.787
Dummy International [1]				0.03	-0.08 – 0.13	0.623	0.05	-0.08 – 0.17	0.474
Log Total Assets				0.43	0.40 – 0.45	**<0.001**	0.39	0.35 – 0.42	**<0.001**
Tobin's Q				0.05	0.03 – 0.08	**<0.001**	0.04	0.01 – 0.06	**0.002**
Standard Deviation				-0.00	-0.00 – 0.00	0.342	-0.00	-0.01 – 0.00	0.061
Random Effects									
σ^2	0.22			0.29			0.22		
τ_{00}	0.76 Company			0.35 Company			0.33 Company		
	0.14 Sector			0.11 Sector			0.15 Sector		
	0.03 Year			0.02 Year			0.01 Year		
ICC	0.81			0.63			0.69		
N	9 Year			9 Year			9 Year		
	301 Sector			306 Sector			256 Sector		
	1332 Company			1340 Company			839 Company		
Observations	6370			6150			3314		
Marginal R^2 / Conditional R^2	0.030 / 0.812			0.388 / 0.774			0.355 / 0.799		

Table 3.3: *Regression model for option compensation*

	LogOPTION			LogOPTION			LogOPTION		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	7.12	7.00 – 7.25	**<0.001**	3.71	3.44 – 3.98	**<0.001**	4.04	3.65 – 4.44	**<0.001**
Tenure	0.01	0.01 – 0.02	**<0.001**				0.01	0.01 – 0.02	**<0.001**
Dummy Covid [1]	0.25	0.13 – 0.37	**<0.001**				0.08	-0.02 – 0.18	0.117
Stock Return	0.05	0.03 – 0.07	**<0.001**				0.03	0.01 – 0.06	**0.006**
EBITDA Margin	0.39	0.02 – 0.75	**0.036**				-0.23	-0.59 – 0.13	0.208
Dummy Covid [1] * Stock Return	-0.01	-0.05 – 0.04	0.685				-0.02	-0.06 – 0.03	0.503
Dummy Covid [1] * EBITDA Margin	-0.32	-0.69 – 0.04	0.080				-0.39	-0.77 – -0.01	**0.046**
Dummy International [1]				0.01	-0.11 – 0.13	0.879	0.07	-0.08 – 0.23	0.341
Log Total Assets				0.39	0.36 – 0.42	**<0.001**	0.36	0.32 – 0.40	**<0.001**
Tobin's Q				0.11	0.09 – 0.13	**<0.001**	0.09	0.06 – 0.11	**<0.001**
Standard Deviation				0.00	0.00 – 0.00	**0.010**	0.00	-0.00 – 0.01	0.149
Random Effects									
σ^2	0.23			0.26			0.22		
τ_{00}	0.85 Company			0.51 Company			0.51 Company		
	0.14 Sector			0.17 Sector			0.17 Sector		
	0.00 Year			0.00 Year			0.00 Year		
ICC	0.81			0.72					
N	9 Year			9 Year			9 Year		
	259 Sector			300 Sector			253 Sector		
	828 Company			1245 Company			787 Company		
Observations	3445			5788			3181		
Marginal R^2 / Conditional R^2	0.016 / 0.816			0.286 / 0.801			0.574 / NA		

Table 3.4: *Regression model for total compensation*

	LogTOTAL			LogTOTAL			LogTOTAL		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	8.41	8.29 – 8.54	**<0.001**	5.14	4.91 – 5.37	**<0.001**	5.41	5.05 – 5.76	**<0.001**
Tenure	-0.01	-0.01 – -0.00	**0.008**				0.00	-0.00 – 0.01	0.085
Dummy Covid [1]	0.23	0.03 – 0.44	**0.022**				0.15	0.02 – 0.29	**0.030**
Stock Return	0.02	0.00 – 0.04	**0.045**				0.01	-0.01 – 0.04	0.263
EBITDA Margin	0.30	0.03 – 0.58	**0.031**				-0.26	-0.59 – 0.07	0.124
Dummy Covid [1] * Stock Return	0.05	0.01 – 0.09	**0.008**				-0.01	-0.06 – 0.04	0.578
Dummy Covid [1] * EBITDA Margin	0.23	-0.06 – 0.51	0.122				-0.26	-0.68 – 0.15	0.213
Dummy International [1]				-0.02	-0.11 – 0.07	0.667	0.01	-0.11 – 0.12	0.934
Log Total Assets				0.39	0.37 – 0.42	**<0.001**	0.37	0.34 – 0.41	**<0.001**
Tobin's Q				0.06	0.05 – 0.08	**<0.001**	0.05	0.03 – 0.07	**<0.001**
Standard Deviation				-0.00	-0.00 – 0.00	0.868	-0.00	-0.00 – 0.00	0.609
Random Effects									
σ^2	0.47			0.35			0.38		
τ_{00}	0.78 Company			0.27 Company			0.32 Company		
	0.04 Sector			0.05 Sector			0.05 Sector		
	0.01 Year			0.01 Year			0.00 Year		
ICC	0.64			0.48			0.49		
N	9 Year			9 Year			9 Year		
	309 Sector			314 Sector			267 Sector		
	1416 Company			1451 Company			916 Company		
Observations	7228			7322			3900		
Marginal R^2 / Conditional R^2	0.014 / 0.646			0.378 / 0.679			0.308 / 0.648		

The mixed model comprises in the fixed part a random portion that allows to account for not observed heterogeneity through the presence of three levels of residuals: the first one due to differences between companies (level 3), the second one due to differences between sectors (level 2) and the third one due to differences between years (level 1) once we account for the observed and not observed differences between companies and between sectors. Referring to the variance of these random effects conditions it is possible to achieve individual predictions that consider unobserved heterogeneity.

The model includes a composite error term whose variance is divided into a between-company variance element (i.e., the variance of the level 3 residuals), a between-sector variance element (the variance of the level 2 residuals), and a between-year variance component (the variance of the level 1 residuals). Hence, the estimation of the three-level model needs to refer to the maximum likelihood techniques (or by Bayes methods). In particular, this study concerns three models that account for different variables. Model (1) only considers rational variables, model (2) only accounts for operating variables, and model (3) explores both rational and operating variables. The likelihood ratio χ 2 tests for the hypothesis of no distinction in fit among nested models permits the non-acceptance of that hypothesis for models (2) and (3) implying a better fit for complex model (3). This suggests an improvement in the likelihood of the third model when compared with the two other models. The result is valid for all four types of compensation considered.

The study will now account for ICC (intraclass correlation coefficient) estimation to study the random portion of the models. ICC is a descriptive statistic exploited to outline the degree to which the values of a variable are characterized by the grouping of individual observations into clusters (Flora, 2017). A low ICC indicates a low degree of differences between clusters while the opposite is true for high values of ICC. Hence, this descriptive statistic illustrates the degree to which members of a cluster are more comparable to one another than to members of another cluster. Furthermore, a higher value for ICC suggests that the proper sample size would be lower than the actual one implying less precise standard errors as well. Looking at the four tables, ICC related to the model controlling for rational characteristics is always higher than the ICC from the other two models. This would suggest that the random portion of the models has a higher degree of variability when controlling for basic factors influencing CEO compensation schemes. The opposite is true for firm-specific factors and it is possibly explained by the presence of trends in compensation schemes between industries.

This part of the study will now analyze the results from the variable performance. Hypothesis 1 predicted a positive relationship between executive compensation and the performance of the company. Tables 3.1, 3.2, 3.3, and 3.4 indicate diverging results related to EBITDA margin and Stock performance. Table 3.1 shows no significant relation between fixed compensation and performance metrics. This result is logical since fixed compensation act as a buffer for the executive. Hence, it should be granted without taking into account the performance of the CEO. Results stay coherent even for the third model of Table 3.1 which controls for operating characteristics as well.

Table 3.2 exhibits a positive and significant relation between executive compensation in stock with Stock performance and EBITDA margin. In particular, model 1 in table 3.2 shows a beta among stock compensation and independent variable Stock performance equal to 0.03 ($p = 0.002$) while the beta related to EBITDA margin has a value of 0.57 ($p < 0.001$). On the one hand, model 3 in table 3.2 shows that the estimate for betas related to Stock performance and EBITDA margin cease to be significant. On the other hand, the beta between Stock remuneration and executive compensation in stock is equal to 0.02 and similar to the estimate from model 1 in table 3.2.

Estimates included in Table 3.3 denote a positive and significant relation between executive compensation in options with Stock performance and EBITDA margin. Specifically, model 1 in table 3.3 shows a positive beta related to Stock performance equal to 0.05 ($p < 0.001$). Furthermore, the beta associated with EBITDA margin and option remuneration has a positive value equal to 0.39 ($p = 0.036$). Remarkably, model 3 in table 3.3 shows a positive and significant beta between Stock performance and remuneration in option which is equal to 0.03 ($p = 0.006$). However, the beta between the EBITDA margin and option remuneration became negative and insignificant when controlling for operating characteristics.

Table 3.4 displays a positive and significant relationship between total executive compensation with Stock performance and EBITDA margin. Again, the beta related to Stock performance has a positive and significant value of 0.02 ($p = 0.045$). The beta estimated related to EBITDA Margin is positive and significant as well with a value of 0.30 ($p = 0.031$). Similarly, to table 3.2, the estimates turn insignificant when the model accounts for operating characteristics. In particular, the beta related to Stock performance drops to 0.01 (n.s.) while the beta associated with EBITDA Margin turns negative.

Results suggest that there is no relationship between fixed compensation and CEO's performance. However, it is possible to conclude that stock performance is always positively correlated to option compensation. Generally, models indicate a positive relation between stock performance with stock and total compensation which is less significant when controlling for operating characteristics. The impact of EBITDA margin on stock, option, and total remuneration is ambiguous. Finally, the hypothesis suggesting a positive relationship between the performance of the firm and the remuneration of the CEO can be rejected for fixed compensation models. However, this hypothesis can be partially rejected for the rest of the models only concerning accounting performance. This would suggest that remuneration committees value market performance over accounting performance. The finding is coherent with the specifics of firms operating in Anglo-Saxon systems and theories sustaining a better valuation of CEOs' performance mediated by market valuation.

The study will now examine findings related to the value of the CEO in the labor market. Following Gong (2011) and the assumption that tenure can be used as a proxy for CEOs' value, Hypothesis 2 predicted a positive relation between CEOs' tenure and their compensation.

Table 3.1 shows a negative and significant beta for Tenure related to fixed compensation equal to -0.01 ($p < 0.001$). While the coefficient is relatively small, the reviewed literature does not suggest that the period served as CEO would negatively affect the fixed compensation. Notably, model 3 in table 3.1 exhibits a similar but different value for the beta. A model that accounts for operating characteristics leads to a beta equal to -0.00 (n.s.) which would suggest that Tenure is not a determinant of fixed compensation.

Similar to fixed compensation, a model that accounts for total remuneration leads to analogous findings. Table 3.4 indicates a beta of -0.01 ($p = 0.008$) that would imply a lower total compensation as the length of time the CEO occupied this position increases. However, model 3 of table 3.4 shows a neutral beta equal to 0.00 (n.s.). Hence, the first negative relation seems to attenuate when controlling for operating characteristics.

Table 3.2 and table 3.3 show opposite results. The beta in the first models related to Tenure has a value of 0.01 ($p < 0.001$) when the independent variable is stock or option compensation. Furthermore, model 3 of table 3.2 and table 3.3 exhibits the same value and significance for the beta related to Tenure.

Results suggest that the hypothesis stating a positive relationship between pay and tenure can be partially rejected. This hypothesis can be accepted concerning stock and option compensation. According to Dechow and Sloan (1994), managers can adopt a myopic approach when investing preferring results in the short term over the ones in the long term. Furthermore, Hill & Phan (1991) denoted the detrimental effect of a higher tenure. For a definition, as tenure increases, the horizon between the current period and the retirement period gets shorter. Hence, executives will be less motivated to pursue profitable investments to maintain a proper reputation. With these premises, a positive relation between incentive-based remuneration (i.e. stocks and options) and tenure could be a tool to guarantee that CEOs will maintain a long-term vision while performing their task.

COVID-19 crisis impacted on different economies. Findings on the effect of this emergency on corporate governance practices are still ambiguous due to the particular nature of this situation. Hypothesis 3.a predicted that CEOs operating during the COVID-19 crisis will have a higher remuneration with regards to the pre pandemic period. However, estimates from the study seem to lead to different relationship.

Table 3.1 shows no significant relation between fixed compensation and COVID-19 dummy. Since fixed compensation can act as a buffer for managers impacted by the instability derived by the crisis, results seem to be reasonable. In particular, the beta is equal to 0.07 (n.s.) for model 1 and it drops to 0.02 (n.s.) in model 3 (i.e., the model that controls both for rational and operating characteristics).

With respect to stock compensation, table 3.2 exhibits a positive and significant relation between executive compensation COVID-19 dummy. Above all, model 1 in table 3.2 shows a beta among stock compensation and independent variable COVID-19 dummy equal to 0.40 ($p = 0.002$) which decreases to 0.24 ($p = 0.010$). Notably, both the models would suggest the presence of a positive and significant relation between stock compensation and COVID-19 dummy.

Additionally, table 3.3 presents similar estimations. Model 1 in table 3.3 shows a positive beta related to COVID-19 dummy equal to 0.25 ($p < 0.001$). However, beta drops to 0.08 (n.s.) for the model that accounts for operating characteristics.

In conclusion, table 3.4 displays a positive and significant relationship between total executive compensation with COVID-19 dummy. Likewise, the beta related to COVID-19 dummy has a positive and significant value of 0.23 ($p = 0.022$). In a similar trend to table 3.2, the value of beta decreases but stay positive and significant for a model that controls for operating characteristics. In particular, the beta related to COVID-19 dummy drops to 0.15 ($p = 0.030$).

Hypothesis 3.a can be partially rejected. Apparently, the pandemic period did not affect the fixed amount of compensation. However, considering stock and total compensation, results are significant and support the hypothesis that CEOs received a higher remuneration. Apparently, the main drivers of this growth are stocks and options. Notably, the findings related to options compensation are significant until operating characteristics are considered.

Hypothesis 3.b implied that CEOs operating through the COVID-19 crisis would receive a premium for their performance when compared to the pre-pandemic period. Findings related to this hypothesis are ambiguous. Table 3.1 indicates a positive and significant beta equal to 0.04 ($p = 0.026$) related to fixed compensation with respect to Stock performance. While this beta is significative, the value drops to 0.01 (n.s.) when controlling for operating characteristics. Moving to stock compensation, model 3 in table 3.2 shows a negative beta equal to -0.06 ($p = 0.006$). However, the beta from model 1 in table 3.2 is different and non-significant. Moving to option compensation, the only significant beta is equivalent to -0.39 ($p = 0.046$) and it is linked to the relation between COVID-19's dummy and EBITDA margin. Moving to final compensation, the only significant beta is related to the interaction between COVID-19's dummy and Stock Performance. While the value is equal to 0.05 ($p = 0.008$) in model 1, it loses significatively after controlling for operating characteristics.

Apparently, hypothesis 3.b can be partially rejected. On the one hand, findings suggest an increase of fixed and total compensation with respect to performance metrics through the pandemic period. However, the findings are not significant after controlling for operating characteristics. On the other hand, results related to stock and option compensation imply a negative beta related to performance metrics during the pandemic time. Again, results are significant only for a model (i.e., model 3) but not for both of them.

Findings would suggest that through the COVID-19 crisis compensation packages were less prone to reward with stock and option compensation performance's goal. However, it appears that performance metrics positively affected the overall total compensation.

Next, this study will consider the factor size. Hypothesis 4 envisioned a positive relationship between the size of the firm and the CEO's remuneration. Tables 3.1, 3.2, 3.3, and 3.4 indicate similar results related to the variable size.

Each table denoted a positive and significant relation between the logarithm of total assets (i.e. the proxy used for size) and compensation. Table 3.1 exhibits a beta for size equal to 0.16 ($p <$

0.001) with respect to fixed compensation. Beta does not change in magnitude or p-value for the third model that accounts for rational characteristics. Taking into consideration models related to stock compensation, table 3.2 points out a value for beta equal to 0.43 ($p < 0.001$) in model 2 which decrease to 0.39 ($p < 0.001$) for a model accounts for rational characteristics (i.e., model 3). Again, table 3.3 shows that the value for beta is 0.39 ($p < 0.001$) in model 2 and 0.36 ($p < 0.001$) in model 3 with regard to option compensation. Finally, results from table 3.4 estimate a value of 0.39 ($p < 0.001$) which drops to 0.37 ($p < 0.001$) if controlling for rational characteristics.

Findings imply that hypothesis 4 cannot be rejected. Each model suggests that CEOs' remuneration is positively correlated to the size of the firm for which they are working. Results match predictions derived by other authors. Simon (1957) argued that remuneration should be hierarchical. As bigger companies are usually formed by different layers represented by subsidiaries, executives operating in a larger firm should gain more than managers working for smaller firms. Another theory presented by Rosen (1992) suggested that executives working in bigger firms perform more tasks. Hence, their remuneration should contain a premium for this additional effort.

Hypothesis 5 sustained that CEOs operating in a more complex environment would earn higher remuneration. As expressed in the relative paragraph, complexity can be proxied by the degree of diversification. Hence, this study accounted for the difference between geographically diversified and non-geographically diversified firms as a tool to analyze the degree of complexity.

Tables 3.1, 3.2, 3.3, and 3.4 indicate diverging results related to geographic diversification. Concerning fixed compensation, models 2 and 3 from table 3.1 estimate a beta equal to -0.06 (n.s.) that does not change in its magnitude or significance when controlling for rational characteristics. Looking at tables 3.2 and 3.3 it is possible to denote two similar results. The beta related to stock compensation has a value of 0.03 (n.s.) in model 2 which increases to 0.05 (n.s.) in model 3. Similarly, table 3.3 concerning option remuneration exhibits a beta in model 2 equivalent to 0.01 (n.s.) that rises to 0.07 (n.s.) when controlling for rational characteristics. Table 4 shows ambiguous results related to total compensation. In particular, the beta from model 2 is negative and equates to -0.02 (n.s.) while the coefficient retrieved by model 3 is positive and equal to 0.01 (n.s.).

Results would suggest that hypothesis 5 can be rejected due to the lack of significance among retrieved estimations. This could indicate that there is not a major trend among remuneration committees in rewarding a higher remuneration to CEOs. However, Graham et al. (2012) reported that observable time-invariant features of a firm can be absorbed by random effects such as manager or firm. Since one of the random effects used in the model was firm and it is unlikely that a relevant number of firms changes to geographically diversified in a short time horizon, the rejection of the hypothesis could be a consequence of the adopted design.

Based on previous analyses performed in different geographical region than the United States, hypothesis 6 expected that CEOs working for firms operating in the United States will receive higher pay if their company have higher growth potential. This study used Tobin's Q as a proxy for growth potential.

Models from tables 3.1, 3.2, 3.3, and 3.4 exhibits similar findings regarding the growth potential of the firm.

Table 3.1 exhibits a beta for size equivalent to 0.04 ($p < 0.001$) which increases to 0.05 ($p < 0.001$) for the third model that accounts for rational characteristics. Bringing into reference models connected to stock compensation, table 3.2 shows a beta equal to 0.05 ($p < 0.001$) in model 2 which decreases to 0.04 ($p < 0.001$) in model 3. Similarly, table 3.3 point out that the value for beta is 0.11 ($p < 0.001$) in model 2 and 0.09 ($p < 0.001$) in model 3 concerning option compensation. Again, taking into account the estimates related to total compensation, beta is positive and significant with a value of 0.06 ($p < 0.001$) in model 2 which declines to 0.05 ($p < 0.001$) in model 3.

Findings imply that hypothesis 6 cannot be rejected. There is reason to acknowledge the existence of a positive relationship between growth opportunities as measured by Tobin's Q and fixed, stock, option, and total remuneration. While theories related to growth potential and remuneration had polar implications, findings from this study would suggest that there is a positive relationship between growth opportunities and remuneration. This can be explained as the existence of a need to attract managers skilled enough to sustain the growth of the company. Furthermore, the findings would be also in line with the need for a compensation package that accounts for the monitoring complexity in an environment rich in growth opportunities (Conyon, 2006).

Hypothesis 7 argued that CEOs operating for a riskier firm would receive a higher remuneration as a premium for the bear additional risk.

On this matter, tables 3.1, 3.2, 3.3, and 3.4 show similar findings. Every model associated with the risk does not lead to significant results. For that, betas related to fixed, stock, and total compensation would suggest a negative slope close to 0. Estimations do not mute when controlling for rational characteristics. On the contrary, table 3.3 points out a positive slope whose value is still proximate to 0.

Estimates on risk would indicate that hypothesis 7 can be rejected. Each model does not show any significant relationship between risk and compensation. While this could be a result of the design of this study, it is important to highlight that the authors had different findings regarding risk and executive compensation. In particular, Petacchi (2013) pointed out that the relationship between executive compensation and firm risk could theoretically be negative, positive, or U-shaped.

Finally, the presence of a positive beta between the Covid Dummy and stock/option/total compensation is instrumental in addressing endogeneity issues and reverse causality. For instance, the literature has debated whether performance is a driver of compensation or whether compensation is a driver of performance. In other words, the correlation between performance-based remuneration and performance renders it challenging to understand which driver acts first in the relationship. However, during the COVID-19 crisis, several studies showed an average decline in performance. Comparing these results to the study findings suggesting an increase in compensation during the pandemic, it can be assumed that compensation is not a driver stronger enough to influence performance.

7. Conclusion

This section of the study will present considerations related to the main findings. In doing that, the first part of this section will focus on the main contributions and results of this study. Then, the second part of this section will highlight the contradictory results and limitations of this analysis.

7.1 Main research contributions and results

CEOs play a crucial role in the administration of a company. As a consequence of this, several authors have studied the implications and problems arising from the need for executives in companies. However, although several scholars have proposed theories and practices to diminish the problems associated with these figures, the various cases of business failure show that a comprehensive solution is still an ambitious goal.
Several authors propose compensation as the main tool to curb agency problems of type I. Although the underlying logical concept is shared among several scholars, their results are often contradictory to each other and the actual reality. One of the main explanations behind this failure is the continuous evolution of corporate needs according to the context in which a company is operating. This study aimed to examine the main modern drivers of compensation packages.
This paper grows the current field of literature by empirically examining the compensation practices of United Stated firms after the COVID-19 crisis. The sample time horizon ranged from the year 2013 to 2021 and included firms incorporated in S&P 500, S&P 400 MidCap, and S&P SmallCap 600 indexes. Four different types of remuneration have been revised. Furthermore, the study included both performance metrics and complexity proxies. Hence, this paper contributes not only to research on CEOs' results but also to the study of the context in which they have managed to achieve them.
The study also differs from many similar works in its methodology. Several authors have used basic regressions to study the main components influencing CEOs' remuneration. In doing so, these studies have simplified by treating the base years and sectors in which the companies operate as dummy variables. On the contrary, this study adopted a regression by treating year, industry, and individual companies as random effects. The results of this more complex model are results with higher explanatory power. Furthermore, the model could work under the

assumption of independence between the various results and capture the intrinsic differences between the individual random effects.

The study shows some extent of similarities between theories related to agency problems concerning remuneration and modern policies adopted by firms. First of all, the paper included four main models related to four distinct types of remuneration. As the same independent variables showed diverging results in terms of beta and significatively, it is possible to assume that different types of compensation required separate analyses.

The study first explored determinants related to performance. Significative results from this study would indicate a positive relationship between market performance and accounting performance with respect to stock, option, and total compensation. While the results seem to be less significant for more comprehensive models, it would appear that the extraordinary remunerations of CEOs are justified by a related positive performance.

Findings imply that COVID–19 crisis increased stock, options, and total compensation. This might suggest that compensation committees tried to retain more expert CEOs with incentive-based remuneration in order to deal with the pandemic crisis. However, results indicate that during the COVID–19 crisis the relationship between market performance with stock/total remuneration and accounting performance with option remuneration decreased. This would hint that CEOs' compensation was less based on their performance. Hence, CEOs had lower incentives to provide better results. Finally, the presence of higher CEOs' compensation during a period of generally poor performance would suggest that performance is more significant in driving compensation than remuneration is in driving performance.

The study highlighted a trend to offer higher remunerations to more sophisticated firms. Size seems the main and most cohesive driver of remuneration among proxies related to complexity. All four types of remuneration are positively and significantly correlated with company size in every model examined. Results suggest that CEOs working for firms with higher growth opportunities are paid more. Hence, it can be assumed that companies requiring goals that can sustain long-term growth are more willing to pay CEOs with skills useful to achieve these objectives. Again, results related to opportunities are similar in all the models.

7.2 Main contradictory findings and limitations

The study shows contradictory results concerning some hypotheses. For instance, there is no significant and positive relation between fixed compensation and performance. On one hand, this result would indicate that part of the remuneration of CEOs is not justified by their effective performance. On the other hand, it is important to notice that fixed compensation usually acts as a buffer for employees. Hence, fixed compensation can be no incentive-based.

The study showed unexpected results in relation to tenure as well. While stock and option remuneration are positively correlated with tenure, the opposite holds for fixed and total remuneration. No reviewed literature seems to anticipate this finding. However, the nature of betas in the four different remuneration schemes suggests that as tenure increases, remuneration is more based on incentive-based compensation packages. This could be partially anticipated by the concept that CEOs approaching retirement would be less interested in the future of the company.

The other two unexpected results are related to risk and geographical diversification. Findings suggest that these two variables do not significantly affect the compensation schemes of CEOs operating for United States companies. With respect to that, the lack of a specific and homogenous relation between compensation and risk was already denoted by the reviewed literature. Furthermore, the absence of a significative relationship between compensation and geographical diversification could be a limitation of the model. Mixed-effect regressions have problems explaining the influence of variables that stays constant over the time horizon. Since it is unlikely for a firm to turn from geographically diversified to non-geographically diversified over a short time horizon, the lack of significant findings can be a consequence of the model.

Other limitations of this paper can be new topics for additional research on CEO compensation. For instance, the body of literature related to corporate social responsibility (i.e; CSR) increased in the last decade. Hence, trying to study the relationship between remuneration and CSR performance could be a new topic of interest. However, data related to this new sector of interest are shrouded. For instance, CSR performance metrics would be complex to synthesize. Further possible new studies can involve different metrics of geographic and activity diversification. Again, proxies for these two variables seem to require complex assumptions. Finally, a possible topic of interest could be the impact of the random effect sector on CEOs' compensation.

The nature of this study implies that the main results are interesting for CEOs operating in the United States. Furthermore, since corporate governance practices change with the context in which a company is operating, new crises could induct new remuneration strategies to align the interest of principals and agents. Finally, the study analyzed multicollinearity and the correlations between possible determinants of remuneration. The analysis suggested no significant problem on this behalf as a consequence of proper independent variables' scrutiny. However, it is safe to assume that the minimum degree of correlations between similar variables could still affect some results.

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9. Appendixes

Appendix I Compensation Components

Compensation	***Description***
Fixed Compensation	Dollar value of the base salary earned by the named CEO during the year
Stock compensation	Dollar value of stocks at the time of issuance
Option compensation	Dollar value of options at the time of issuance computed using the Black and Scholes method a reference
Total compensation	Sum of fixed, stock, option, bonus, and pension compensation

Appendix II Variables List

Proxy	***Independent Variable***
Stock performance	Market performance
Accounting performance	EBITDA margin
Labor market	Tenure
COVID-19 Dummy	COVID-19
Geographical diversification dummy	Complexity
Ln (Total assets)	Size
Tobin's Q	Growth opportunities
Standard deviation	Risk

Appendix III Standard Industrial Classification

Standard Industrial Classification can be retrieved by the SEC page on the following link; https://www.sec.gov/corpfin/division-of-corporation-finance-standard-industrial-classification-sic-code-list

The appendix will not host the full list due to its length.

SIC Code	Office	Industry Title
100	Industrial Applications and Services	AGRICULTURAL PRODUCTION-CROPS
200	Industrial Applications and Services	AGRICULTURAL PROD-LIVESTOCK & ANIMAL SPECIALTIES
700	Industrial Applications and Services	AGRICULTURAL SERVICES
800	Industrial Applications and Services	FORESTRY
900	Industrial Applications and Services	FISHING, HUNTING AND TRAPPING
1000	Office of Energy & Transportation	METAL MINING
1040	Office of Energy & Transportation	GOLD AND SILVER ORES
1090	Office of Energy & Transportation	MISCELLANEOUS METAL ORES
1220	Office of Energy & Transportation	BITUMINOUS COAL & LIGNITE MINING
1221	Office of Energy & Transportation	BITUMINOUS COAL & LIGNITE SURFACE MINING
1311	Office of Energy & Transportation	CRUDE PETROLEUM & NATURAL GAS
1381	Office of Energy & Transportation	DRILLING OIL & GAS WELLS
1382	Office of Energy & Transportation	OIL & GAS FIELD EXPLORATION SERVICES
1389	Office of Energy & Transportation	OIL & GAS FIELD SERVICES, NEC
1400	Office of Energy & Transportation	MINING & QUARRYING OF NONMETALLIC MINERALS (NO FUELS)
1520	Office of Real Estate & Construction	GENERAL BLDG CONTRACTORS – RESIDENTIAL BLDGS
1531	Office of Real Estate & Construction	OPERATIVE BUILDERS
1540	Office of Real Estate & Construction	GENERAL BLDG CONTRACTORS – NONRESIDENTIAL BLDGS
1600	Office of Real Estate & Construction	HEAVY CONSTRUCTION OTHER THAN BLDG CONST – CONTRACTORS
…	…	…

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SUMMARY

Over the last century, companies have grown exponentially by joining international realities. As a consequence of this evolution, the separation of firms' management and firms' ownership gained higher relevance in several corporate structures. However, the higher divergence between these two main elements of a company has increased the principal-agent issues as well (Jensen & Meckling, 1976).

Defining principals as the group of people that trust agents with the power to manage a firm, principal-agent issues include a cluster of limitations deriving from this contract. The main reasons behind consequent problems are explained by economic theories as the natural trend of rational subjects to maximize their utility. The literature highlighted two main problems related to the separation of management and ownership. The agency problem of Type I refers to conflicts due to distinct goals between shareholders and executives (Eisenhardt, 1989). The agency problem of Type II accounts for issues related to the different degrees of influence of bigger and smaller shareholders concerning executives (Morck et al., 1988). While both types of problems are still relevant today, the cultural context and the background of the country in which a company operates tend to emphasize one over the other. For instance, public companies operating in the United States have a fragmentation of ownership so relevant that the main problems are related to the different goals between shareholders and executives. By contrast, several listed companies operating in China are spin-offs of state-owned enterprises (i.e., SOEs) for which the State is a majority shareholder (Tong, 2003).

Monitoring can be a solution to this recognized conflict of interest. However, agents in charge of the management of the company have access to more information than principals. Furthermore, firms with a higher fragmentation of ownership will be more prone to have shareholders with low resources eligible for the monitoring of the firm. As a consequence of this disequilibrium, different scholars have studied possible incentives to align the interest of principals and agents. Since executives legally work for the firm, the first logical tool to affect their goals has been remuneration packages.

Pay-for-performance schemes or incentive-based remunerations should be able to align the interests of shareholders and executives. However, companies continue to fail due to the decisions of their management. The first decade of the 21st century has seen one of the greatest financial crises of modern history due to executives' misbehaviors while the COVID-19 crisis brought other firms to the verge of bankruptcy a few years later.

Managers are relevant figures for modern corporations which are in turn important entities for the welfare of a country. While theories related to corporate governance can restrain negative consequences for bad management, it is important to notice how policies should evolve to account for the new context in which a company is operating. Hence, while different scholars already started to analyze agency problems and compensation packages as possible solutions in the twentieth century, it is worth analyzing current remuneration schemes to have a better understanding of modern trends in this field of corporate governance.

This paper will analyze the main determinants of CEO compensation. In doing so, fixed, stock, option, and total compensation will be analyzed over their relationship with different variables. Since performance is one of the main metrics related to employees, this paper will account both for accounting and market performance. Accomplishing that, this study will also refer to the impact of the COVID-19 crisis on CEO remuneration. Furthermore, other variables will be used as a proxy for complexity. Since more intricated corporations should reward executives with a better compensation package to avoid executives' leaks towards less challenging firms with the same base remuneration scheme.

Through the years, compensation committees divided the overall manager compensation into four main components: a standard salary, a variable bonus, stock options, and long-term incentives (Murphy, 1999). Studies regarding the different compositions of executive pay packages and relative determinants have led to mixed findings across time. A first explanation related to this problem can be tracked down to the complications deriving from picking explanatory determinants when compared to the company's needs.

Compensation is a remuneration related to an executed performance. Hence, the first set of variables should be linked to the performer. Thus, executive characteristics will collect variables strictly related to executives, their relative labor market, and their performance. At the same time, prior literature implies that corporate governance mechanisms affect the functional compensation attributed to executives (Ozkan, 2007). Hence, relational characteristics will regroup variables that will define the relationship between adopted governance structures and executive compensations. Another important set of variables that describe individual firm features should be accounted for as a proxy for managing complexity. Following Lippert and Moore (1994), this study will consider two main groups of determinants. Rational determinants will account for characteristics strictly related to the value of CEOs such as their performance, their tenure, and whether they were operating during the COVID-19 crisis or not. Operating determinants will consider characteristics mainly related to the firm in which CEOs were working such as its size, complexity, growth opportunities, and risk.

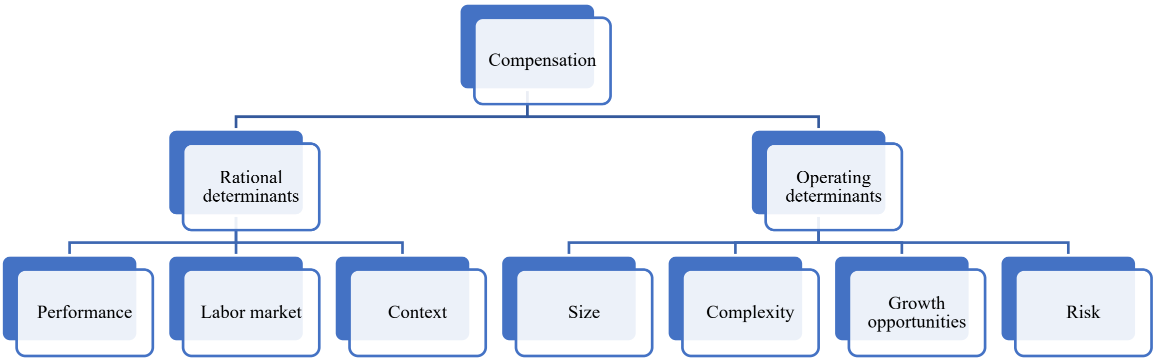

Figure 3: Compensation determinants

Data were retrieved from Execucomp, CRSP, and Compustat databases. Since different databases had variables of interest for the study, they have been merged using the unique ticker symbol for the firm and the specific year as key variables.

The sample time horizon ranges from the year 2013 to 2021. The first year of the sample (i.e., 2013) was chosen to account only for firms that implemented different compensation policies after the financial crisis of 2008. The last year of the sample (i.e., 2021) was chosen since it was the last one that had all the variables of interest from the three databases that have been used. Furthermore, for the given time horizon, Execucomp followed the same standards required by Financial Accounting Standards Board (FASB) and the required compensation discloser mandated by the Securities and Exchanges Commission (SEC).

For every CEO, were retrieved six types of remuneration: fixed, variable, pension, options, stocks, and residual compensation. Then, variables used to control for possible determinants of CEO compensation were included. All these variables were controlled to drop illogical values given their definition retrieved from the respective database's manual. For instance, negative values for fixed compensation were eliminated. Then, duplicates for the same firm in the same year were treated by sorting different values to their mean as a single value.

Following Cieślak (2018) for similar research on executives' compensation, extreme outliers passed through the Winsorizing procedure at the 1st and 99th percentiles where the closest observation replaces the largest and smallest values. Winsorizing process for the 2.5th and 97.5th percentiles or 5th and 95th percentiles did not significantly affect the final findings.

The final sample consists of 2237 firms. The only reported currency for this study was the dollar.

After testing for the assumptions behind mixed-effect regressions, this study will now illustrate the construction of effective models. This study will take into account fixed, stock, option, and total compensation. For each one of these four types of compensation, three models have been constructed: the first one account for rational characteristics, the second one for operating characteristics, and the third one will account for both. Finally, the following independent variable proxies will be used between the three different models for each type of compensation:

Table 4: *proxies used for independent variables*

Proxy	***Independent Variable***
Stock performance	Market performance
Accounting performance	EBITDA margin
Labor market	Tenure
COVID-19 Dummy	COVID-19
Geographical diversification dummy	Complexity
Ln (Total assets)	Size
Tobin's Q	Growth opportunities
Standard deviation	Risk

With regards to compensation, it is now worth mentioning the effective definition of the four different types of compensation used. Fixed compensation is the dollar value of the base salary earned by the named CEO during the year. Stock compensation is the dollar value of stocks at the time of issuance. Option compensation is the dollar value of options at the time of issuance computed using the Black and Scholes method a reference. Total compensation is the sum of fixed, stock, option, bonus, and pension compensation. Referring to the database manual, bonus compensation is defined as the dollar value of bonuses earned by the CEO during the year. Furthermore, pension was defined as the dollar value of pension paid by the firm to the CEO.
Before showing empirical results, this study will introduce the theory behind the specific model adopted. Since lower-level data units that follow this type of structure can be nested in one higher-level unit, the dataset can be analyzed as a hierarchical structure. For instance, lower-level units can be nested within industries or repeated observations over time on the same firm. Firms nested in the same group or cluster are expected to show more similarities among each other than when compared to firms from different groups or clusters. Authors refer to models based on this data structure as mixed-effect models, random-effect models, hierarchical linear models, variance components-based models, or mixed models (Cameron & Trivedi, 2005).
Hamilton (2013) defines a mixed-effect model as a special type of regression analysis that accounts for two categories of effects. The first allowed effect is the fixed one and it refers to intercepts (i.e., the point where the regression line crosses the y-axis at x = 0) and slopes (the acclivity of the regression line) as a tool to explain the population as a whole similarly to an OLS regression. The second allowed effect is the random one and it refers to individual

intercepts and slopes that differ among distinct groups or clusters of the sample. For example, if the random-effect model describes firms, a mixed-effect model would have different intercepts and/or slopes for each firm. Lastly, mixed-effect models can handle missing data if a random subject effect is included. The random subject effect combined with fixed model effects leads to a prediction of missing values.

Mixed-effect models account for fixed and random effects.
All these main sub-determinants will be included in the mixed-effect model as fixed effects. However, the model adopted will also account for the specific company, year, and operating sector as a random factor. The final regression equation including all the factors will therefore be;

$$
\begin{aligned}
Ln(Compensation) &= \alpha + \beta_1 Tenure + \beta_2 DummyCovid + \beta_3 StockReturn \\
&+ \beta_4 EBITDAMargin + \beta_5 (DummyCovid * StockReturn) \\
&+ \beta_6 (DummyCovid * EBITDAMargin) \\
&+ \beta_7 DummyInternational + \beta_8 LnTotalAssets \\
&+ \beta_9 Tobin'sQ + \beta_{10} StandardDeviation + (1|Company) \\
&+ (1|Year) + (1|Sector) + \varepsilon
\end{aligned}
$$

The following tables will include Fixed compensation (i.e., table 3.1), Stock compensation (i.e., table 3.2), Option compensation (i.e., table 3.3), and Total compensation (i.e., table 3.4).

Table 5.1: *Regression model for fixed compensation*

	LogFIXED			**LogFIXED**			**LogFIXED**		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	6.73	6.62 – 6.83	**<0.001**	5.38	5.11 – 5.65	**<0.001**	5.48	5.05 – 5.91	**<0.001**
Tenure	-0.01	-0.01 – -0.00	**<0.001**				-0.00	-0.01 – 0.00	0.144
Dummy Covid [1]	0.07	-0.02 – 0.15	0.146				0.02	-0.09 – 0.13	0.729
Stock Return	-0.01	-0.03 – 0.01	0.527				-0.01	-0.04 – 0.01	0.359
EBITDA Margin	0.12	-0.17 – 0.41	0.403				-0.38	-0.78 – 0.01	0.056
Dummy Covid [1] * Stock Return	0.04	0.00 – 0.08	**0.026**				0.01	-0.04 – 0.06	0.579
Dummy Covid [1] * EBITDA Margin	0.19	-0.08 – 0.46	0.169				0.00	-0.42 – 0.42	0.994
Dummy International [1]				-0.06	-0.19 – 0.08	0.419	-0.06	-0.23 – 0.12	0.516
Log Total Assets				0.16	0.13 – 0.19	**<0.001**	0.16	0.12 – 0.21	**<0.001**
Tobin's Q				0.04	0.02 – 0.06	**<0.001**	0.05	0.02 – 0.08	**<0.001**
Standard Deviation				-0.00	-0.00 – 0.00	0.142	-0.00	-0.01 – 0.00	0.248
Random Effects									
σ^2	0.40			0.37			0.36		
τ_{00}	1.21 Company			0.79 Company			0.88 Company		
	0.07 Sector			0.04 Sector			0.05 Sector		
	0.00 Year			0.00 Year			0.00 Year		
ICC	0.76			0.69					
N	9 Year			9 Year			9 Year		
	309 Sector			314 Sector			267 Sector		
	1405 Company			1445 Company			913 Company		
Observations	7172			7286			3884		
Marginal R^2 / Conditional R^2	0.004 / 0.761			0.054 / 0.710			0.141 / NA		

Table 3.2: *Regression model for stock compensation*

	LogSTOCK			**LogSTOCK**			**LogSTOCK**		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	7.69	7.55 – 7.84	**<0.001**	4.20	3.92 – 4.47	**<0.001**	4.58	4.22 – 4.95	**<0.001**
Tenure	0.01	0.00 – 0.01	**<0.001**				0.01	0.00 – 0.01	**<0.001**
Dummy Covid [1]	0.40	0.14 – 0.65	**0.002**				0.24	0.06 – 0.41	**0.010**
Stock Return	0.03	0.01 – 0.04	**0.002**				0.02	-0.01 – 0.04	0.131
EBITDA Margin	0.57	0.33 – 0.82	**<0.001**				-0.26	-0.59 – 0.08	0.136
Dummy Covid [1] * Stock Return	-0.00	-0.03 – 0.03	0.806				-0.06	-0.10 – -0.02	**0.006**
Dummy Covid [1] * EBITDA Margin	-0.03	-0.24 – 0.18	0.770				-0.05	-0.41 – 0.31	0.787
Dummy International [1]				0.03	-0.08 – 0.13	0.623	0.05	-0.08 – 0.17	0.474
Log Total Assets				0.43	0.40 – 0.45	**<0.001**	0.39	0.35 – 0.42	**<0.001**
Tobin's Q				0.05	0.03 – 0.08	**<0.001**	0.04	0.01 – 0.06	**0.002**
Standard Deviation				-0.00	-0.00 – 0.00	0.342	-0.00	-0.01 – 0.00	0.061
Random Effects									
σ^2	0.22			0.29			0.22		
τ_{00}	0.76 Company			0.35 Company			0.33 Company		
	0.14 Sector			0.11 Sector			0.15 Sector		
	0.03 Year			0.02 Year			0.01 Year		
ICC	0.81			0.63			0.69		
N	9 Year			9 Year			9 Year		
	301 Sector			306 Sector			256 Sector		
	1332 Company			1340 Company			839 Company		
Observations	6370			6150			3314		
Marginal R^2 / Conditional R^2	0.030 / 0.812			0.388 / 0.774			0.355 / 0.799		

Table 3.3: *Regression model for option compensation*

	LogOPTION			LogOPTION			LogOPTION		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	7.12	7.00 – 7.25	**<0.001**	3.71	3.44 – 3.98	**<0.001**	4.04	3.65 – 4.44	**<0.001**
Tenure	0.01	0.01 – 0.02	**<0.001**				0.01	0.01 – 0.02	**<0.001**
Dummy Covid [1]	0.25	0.13 – 0.37	**<0.001**				0.08	-0.02 – 0.18	0.117
Stock Return	0.05	0.03 – 0.07	**<0.001**				0.03	0.01 – 0.06	**0.006**
EBITDA Margin	0.39	0.02 – 0.75	**0.036**				-0.23	-0.59 – 0.13	0.208
Dummy Covid [1] * Stock Return	-0.01	-0.05 – 0.04	0.685				-0.02	-0.06 – 0.03	0.503
Dummy Covid [1] * EBITDA Margin	-0.32	-0.69 – 0.04	0.080				-0.39	-0.77 – -0.01	**0.046**
Dummy International [1]				0.01	-0.11 – 0.13	0.879	0.07	-0.08 – 0.23	0.341
Log Total Assets				0.39	0.36 – 0.42	**<0.001**	0.36	0.32 – 0.40	**<0.001**
Tobin's Q				0.11	0.09 – 0.13	**<0.001**	0.09	0.06 – 0.11	**<0.001**
Standard Deviation				0.00	0.00 – 0.00	**0.010**	0.00	-0.00 – 0.01	0.149
Random Effects									
σ^2	0.23			0.26			0.22		
τ_{00}	0.85 Company			0.51 Company			0.51 Company		
	0.14 Sector			0.17 Sector			0.17 Sector		
	0.00 Year			0.00 Year			0.00 Year		
ICC	0.81			0.72					
N	9 Year			9 Year			9 Year		
	259 Sector			300 Sector			253 Sector		
	828 Company			1245 Company			787 Company		
Observations	3445			5788			3181		
Marginal R^2 / Conditional R^2	0.016 / 0.816			0.286 / 0.801			0.574 / NA		

Table 3.4: *Regression model for total compensation*

	LogTOTAL			**LogTOTAL**			**LogTOTAL**		
Predictors	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*	*Estimates*	*CI*	*p*
(Intercept)	8.41	8.29 – 8.54	**<0.001**	5.14	4.91 – 5.37	**<0.001**	5.41	5.05 – 5.76	**<0.001**
Tenure	-0.01	-0.01 – -0.00	**0.008**				0.00	-0.00 – 0.01	0.085
Dummy Covid [1]	0.23	0.03 – 0.44	**0.022**				0.15	0.02 – 0.29	**0.030**
Stock Return	0.02	0.00 – 0.04	**0.045**				0.01	-0.01 – 0.04	0.263
EBITDA Margin	0.30	0.03 – 0.58	**0.031**				-0.26	-0.59 – 0.07	0.124
Dummy Covid [1] * Stock Return	0.05	0.01 – 0.09	**0.008**				-0.01	-0.06 – 0.04	0.578
Dummy Covid [1] * EBITDA Margin	0.23	-0.06 – 0.51	0.122				-0.26	-0.68 – 0.15	0.213
Dummy International [1]				-0.02	-0.11 – 0.07	0.667	0.01	-0.11 – 0.12	0.934
Log Total Assets				0.39	0.37 – 0.42	**<0.001**	0.37	0.34 – 0.41	**<0.001**
Tobin's Q				0.06	0.05 – 0.08	**<0.001**	0.05	0.03 – 0.07	**<0.001**
Standard Deviation				-0.00	-0.00 – 0.00	0.868	-0.00	-0.00 – 0.00	0.609
Random Effects									
σ^2	0.47			0.35			0.38		
τ_{00}	0.78 Company			0.27 Company			0.32 Company		
	0.04 Sector			0.05 Sector			0.05 Sector		
	0.01 Year			0.01 Year			0.00 Year		
ICC	0.64			0.48			0.49		
N	9 Year			9 Year			9 Year		
	309 Sector			314 Sector			267 Sector		
	1416 Company			1451 Company			916 Company		
Observations	7228			7322			3900		
Marginal R^2 / Conditional R^2	0.014 / 0.646			0.378 / 0.679			0.308 / 0.648		

This part of the study will now analyze the results from the variable performance. Hypothesis 1 predicted a positive relationship between executive compensation and the performance of the company. Tables 3.1, 3.2, 3.3, and 3.4 indicate diverging results related to EBITDA margin and Stock performance. Results suggest that there is no relationship between fixed compensation and CEO's performance. However, it is possible to conclude that stock performance is always positively correlated to option compensation. Generally, models indicate a positive relation between stock performance with stock and total compensation which is less significant when controlling for operating characteristics. The impact of EBITDA margin on stock, option, and total remuneration is ambiguous. Finally, the hypothesis suggesting a positive relationship between the performance of the firm and the remuneration of the CEO can be rejected for fixed compensation models. However, this hypothesis can be partially rejected for the rest of the models only concerning accounting performance. This would suggest that remuneration committees value market performance over accounting performance. The finding is coherent with the specifics of firms operating in Anglo-Saxon systems and theories sustaining a better valuation of CEOs' performance mediated by market valuation.

The study will now examine findings related to the value of the CEO in the labor market. Following Gong (2011) and the assumption that tenure can be used as a proxy for CEOs' value, Hypothesis 2 predicted a positive relation between CEOs' tenure and their compensation.
Results suggest that the hypothesis stating a positive relationship between pay and tenure can be partially rejected. This hypothesis can be accepted concerning stock and option compensation. According to Dechow and Sloan (1994), managers can adopt a myopic approach when investing preferring results in the short term over the ones in the long term. Furthermore, Hill & Phan (1991) denoted the detrimental effect of a higher tenure. For a definition, as tenure increases, the horizon between the current period and the retirement period gets shorter. Hence, executives will be less motivated to pursue profitable investments to maintain a proper reputation. With these premises, a positive relation between incentive-based remuneration (i.e. stocks and options) and tenure could be a tool to guarantee that CEOs will maintain a long-term vision while performing their task.

COVID-19 crisis impacted on different economies. Findings on the effect of this emergency on corporate governance practices are still ambiguous due to the particular nature of this situation.

Hypothesis 3.a predicted that CEOs operating during the COVID-19 crisis will have a higher remuneration with regards to the pre pandemic period. However, estimates from the study seem to lead to different relationship.

Apparently, hypothesis 3.b can be partially rejected. On the one hand, findings suggest an increase of fixed and total compensation with respect to performance metrics through the pandemic period. However, the findings are not significant after controlling for operating characteristics. On the other hand, results related to stock and option compensation imply a negative beta related to performance metrics during the pandemic time. Again, results are significant only for a model (i.e., model 3) but not for both of them.

Findings would suggest that through the COVID-19 crisis compensation packages were less prone to reward with stock and option compensation performance's goal. However, it appears that performance metrics positively affected the overall total compensation.

Next, this study will consider the factor size. Hypothesis 4 envisioned a positive relationship between the size of the firm and the CEO's remuneration. Tables 3.1, 3.2, 3.3, and 3.4 indicate similar results related to the variable size. Findings imply that hypothesis 4 cannot be rejected. Each model suggests that CEOs' remuneration is positively correlated to the size of the firm for which they are working. Results match predictions derived by other authors. Simon (1957) argued that remuneration should be hierarchical. As bigger companies are usually formed by different layers represented by subsidiaries, executives operating in a larger firm should gain more than managers working for smaller firms. Another theory presented by Rosen (1992) suggested that executives working in bigger firms perform more tasks. Hence, their remuneration should contain a premium for this additional effort.

Hypothesis 5 sustained that CEOs operating in a more complex environment would earn higher remuneration. As expressed in the relative paragraph, complexity can be proxied by the degree of diversification. Hence, this study accounted for the difference between geographically diversified and non-geographically diversified firms as a tool to analyze the degree of complexity. Results would suggest that hypothesis 5 can be rejected due to the lack of significance among retrieved estimations. This could indicate that there is not a major trend among remuneration committees in rewarding a higher remuneration to CEOs. However, Graham et al. (2012) reported that observable time-invariant features of a firm can be absorbed by random effects such as manager or firm. Since one of the random effects used in the model was firm and it is unlikely that a relevant number of firms changes to geographically diversified in a short time horizon, the rejection of the hypothesis could be a consequence of the adopted design.

Based on previous analyses performed in different geographical region than the United States, hypothesis 6 expected that CEOs working for firms operating in the United States will receive higher pay if their company have higher growth potential. This study used Tobin's Q as a proxy for growth potential.

Models from tables 3.1, 3.2, 3.3, and 3.4 exhibits similar findings regarding the growth potential of the firm. Findings imply that hypothesis 6 cannot be rejected. There is reason to acknowledge the existence of a positive relationship between growth opportunities as measured by Tobin's Q and fixed, stock, option, and total remuneration. While theories related to growth potential and remuneration had polar implications, findings from this study would suggest that there is a positive relationship between growth opportunities and remuneration. This can be explained as the existence of a need to attract managers skilled enough to sustain the growth of the company. Furthermore, the findings would be also in line with the need for a compensation package that accounts for the monitoring complexity in an environment rich in growth opportunities (Conyon, 2006).

Hypothesis 7 argued that CEOs operating for a riskier firm would receive a higher remuneration as a premium for the bear additional risk.

On this matter, tables 3.1, 3.2, 3.3, and 3.4 show similar findings. Estimates on risk would indicate that hypothesis 7 can be rejected. Each model does not show any significant relationship between risk and compensation. While this could be a result of the design of this study, it is important to highlight that the authors had different findings regarding risk and executive compensation. In particular, Petacchi (2013) pointed out that the relationship between executive compensation and firm risk could theoretically be negative, positive, or U-shaped.

Finally, the presence of a positive beta between the Covid Dummy and stock/option/total compensation is instrumental in addressing endogeneity issues and reverse causality. For instance, the literature has debated whether performance is a driver of compensation or whether compensation is a driver of performance. In other words, the correlation between performance-based remuneration and performance renders it challenging to understand which driver acts first in the relationship. However, during the COVID-19 crisis, several studies showed an average decline in performance. Comparing these results to the study findings suggesting an increase in compensation during the pandemic, it can be assumed that compensation is not a driver stronger enough to influence performance.

This paper grows the current field of literature by empirically examining the compensation practices of United Stated firms after the COVID-19 crisis.

The study also differs from many similar works in its methodology. Several authors have used basic regressions to study the main components influencing CEOs' remuneration. In doing so, these studies have simplified by treating the base years and sectors in which the companies operate as dummy variables. On the contrary, this study adopted a regression by treating year, industry, and individual companies as random effects. The results of this more complex model are results with higher explanatory power. Furthermore, the model could work under the assumption of independence between the various results and capture the intrinsic differences between the individual random effects.

The study shows some extent of similarities between theories related to agency problems concerning remuneration and modern policies adopted by firms. First of all, the paper included four main models related to four distinct types of remuneration. As the same independent variables showed diverging results in terms of beta and significatively, it is possible to assume that different types of compensation required separate analyses.

The study first explored determinants related to performance. Significative results from this study would indicate a positive relationship between market performance and accounting performance with respect to stock, option, and total compensation. While the results seem to be less significant for more comprehensive models, it would appear that the extraordinary remunerations of CEOs are justified by a related positive performance.

Findings imply that COVID–19 crisis increased stock, options, and total compensation. This might suggest that compensation committees tried to retain more expert CEOs with incentive-based remuneration in order to deal with the pandemic crisis. However, results indicate that during the COVID–19 crisis the relationship between market performance with stock/total remuneration and accounting performance with option remuneration decreased. This would hint that CEOs' compensation was less based on their performance. Hence, CEOs had lower incentives to provide better results. Finally, the presence of higher CEOs' compensation during a period of generally poor performance would suggest that performance is more significant in driving compensation than remuneration is in driving performance.

The study highlighted a trend to offer higher remunerations to more sophisticated firms. Size seems the main and most cohesive driver of remuneration among proxies related to complexity. All four types of remuneration are positively and significantly correlated with company size in every model examined. Results suggest that CEOs working for firms with higher growth opportunities are paid more. Hence, it can be assumed that companies requiring goals that can sustain long-term growth are more willing to pay CEOs with skills useful to achieve these objectives. Again, results related to opportunities are similar in all the models.