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Managerial compensation and capital structure: the impact of options on leverage decisions

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Introduction

The principal-agent problem and the resulting agency costs have always represented fundamental challenges in corporate governance, particularly in the context of managerial decision-making. This thesis explores how the structure of CEO remuneration influences corporate capital structure choices, with a focus on the impact of stock options on executives' risk preferences and leverage decisions. Unlike direct stock ownership, options become more valuable as stock price volatility increases, creating, in theory, an incentive for CEOs to pursue riskier financial strategies. This work starts with a theoretical description of agency costs, outlining their emergence in the literature and their development, describing the various types and the control mechanisms that can be put in place to mitigate their magnitude. It then goes on to study executive compensation, focusing on its components, controversies and regulatory aspects. Finally, the two arguments described above are combined, first from a theoretical and then from an empirical point of view, analysing how the possible incentives created by the salary structure could induce the manager to act in his own interests and not those of the company. By examining the intersection of executive pay and capital structure, this thesis provides an insight on how compensation design influences managerial behavior and corporate financial stability.

1. Agency Costs

1.1 The principal – agent problem

Human beings, since the dawn of the species, have formed vertical hierarchical structures to enable efficient coordination, decision-making and resource management. This inevitably led to the creation of roles of subordination, where a person worked for the interests of those above him in the hierarchical ladder. To ensure that the interests of the different members of the hierarchical ladder are aligned, incentive schemes have always existed to direct the behaviour of individuals and act as motivational levers, so that a common direction is created and everyone is incentivised to perform their tasks to the best of their ability, benefiting from this.

In modern societies, this concept can be applied to the employee working under the direction of an employer, who defines tasks and objectives. To align the interests of both parties, a scheme of incentives is put in place: the most common are monetary (salaries, bonuses, production bonuses), but there are also non-monetary and psychological incentives (opportunities for personal growth, recognition of social status, sense of belonging, personal fulfilment, etc.).

The result is a principal-agent relationship that changes over time and needs to be constantly monitored to ensure that everyone's interests are aligned and objectives are met.

It may also happen, however, that the incentive schemes are not constructed in the right way, and the agent's actions may diverge from the principal's best interests due to different goals, information asymmetry, or misaligned incentives, leading to the creation of agency costs.

Setting the right incentives is no easy task, not least because the social, political and economic environment often changes rapidly and incentives need to be adjusted and modified to reflect these changes.

Summarising, the principal – agent relationship could be defined as *a contract under* which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision making authority to the agent.¹

We find this kind of relationship very often in the corporate sphere: it is the relationship between shareholders and managers, between employers and employees, between investors and fund managers.

But they are also principal-agent relationships that we find in other types of contexts, such as those between citizens and elected officials, technology users and software developers, donors and charities, countries and diplomats, readers and journalists.

The high prevalence of this type of relationship in every part of the social fabric has led economists to take an interest in the subject, going to study what happens in this type of connection, highlighting inefficiencies and conflicts in organizations, suggesting ways to design better systems of governance and incentive alignment and offering a framework to analyze ethical and policy questions, such as the "social

¹ Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure.

responsibility" of corporations, laying the groundwork for modern organizational economics and corporate finance.

1.2 Theoretical origins and context

Focusing more on principal-agent relationships in the business environment, in this chapter we will review the main works in the scientific literature that have pioneered this branch of economics, starting with a fundamental work that laid the foundations for many modern economic theories: Adam Smith's '*Wealth of Nations (1776)*'.

Although he did not formalise the concept of principal-agent and agency cost, his observations on the corporate dynamics between owners and managers are perfectly consistent and a source of inspiration for later work in this area.

When he wrote his work, joint - stock companies were spreading in society, where for the first time owners delegated management to professional managers, thus setting the stage for possible conflicts of interest.

Smith also describes one of the main themes of the principal-agent relationship, the alignment of incentives between owners and managers. It is no coincidence that one of the most famous quotes from his work is on this subject:

"The directors of such [joint-stock] companies, however, being the managers rather of other people's money than of their own, it cannot well be expected, that they should watch over it with the same anxious vigilance with which the partners in a private copartnery frequently watch over their own. Like the stewards of a rich man, they are apt to consider attention to small matters as not for their master's honour, and very easily give themselves a dispensation from having it. Negligence and profusion, therefore, must always prevail, more or less, in the management of the affairs of such a company."²

Two other fundamental works for understanding principal-agent relations and agency costs were '*The Nature of the Firm (1937)*' and '*The Problem of Social Cost (1960)*' by Ronald Coase. By focusing on transaction costs, Coase highlighted the fundamental economic trade-offs that arise whenever decision-making is delegated.

Later in time, Stephen Ross in his work '*The Economic Theory of Agency: The Principal's Problem (1973)*' coined the term 'agency theory' for the first time, focusing on how principals design contracts to incentivise agents while minimising costs associated with asymmetric information and conflicting interests.

Almost simultaneously, Armen Alchian and Harold Demsetz in 'Production, Information Costs, and Economic Organization (1972)' analyzed team production and the role of monitoring in mitigating shirking, improving the understanding of how agency problems develop when there is collaborative effort and teamwork. Then Oliver Williamson explored governance structures, emphasizing how firms minimize opportunism and agency problems by designing efficient contracts and organizational forms in his 'Markets and Hierarchies (1975)'

Finally in 1976 Jensen and Meckling, in their '*Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure*', synthesised all the concepts of previous works into one cohesive framework. They gave a clear and unambiguous

² Smith, A. (1776/1976). An Inquiry into the Nature and Causes of the Wealth of Nations (Edwin Cannan, Ed., 5th ed.). University of Chicago Press.

definition of agency costs and analyzed the implications of ownership and control separation for firms' financial and organizational structures.

Their paper helped bring the attention of economists and finance on governance, ownership structure, and managerial behavior, emphasising the internal conflicts and inefficiencies caused by the separation of ownership and control. This has changed the view of the company from one oriented solely towards the optimal allocation of resources for profit maximisation, where the company was seen as a black box, to a more complex approach that also takes into account he roles of individuals within them, the conflicts of interest and the costs of maintaining alignment between principals and agents.

Subsequently, there was a refinement of agency theory, and one of the greatest contributions was undoubtedly made by Eugene Fama in '*Agency Problems and the Theory of the Firm 1980*'. He shows how agency problems could be mitigated not only through internal mechanisms (monitoring, bonding etc.), but also through market forces that could impose useful discipline in the alignment of interests.

For example, the labour market is in itself disciplining for the manager's performance, because a manager who does not work well then will not have much room in the labour market once his term of office is over. For this reason, he is pushed to perform as well as possible, so that he can resell his achievements and obtain a more prestigious position in another company. Another disciplining force is that created by the capital market, since a manager acting opportunistically could cause the value of the company to drop dramatically, at which point it could easily become scalable and he could, downstream, be replaced.

Finally, competition in the product and labour market governs the manager's actions as he becomes replaceable if the results are not satisfactory.

Fama's insights influenced the design of executive compensation tied to stock performance and strengthened the rationale for market-based governance solutions like activist shareholders, opening the door to innovations that we still find within the company's structure today.

After focusing on market forces and external mechanisms, Fama returns to the topic of control mechanisms, this time with a focus on internal mechanisms and in collaboration with Jensen. In 1983, in "*Separation of Ownership and Control*" they propose the concept of decision systems as a way to mitigate agency problems through the division of decision-making responsibilities, focusing specifically on the governance challenges in firms where ownership is separetad from the control (for example publicly traded corporations).

Underlying it all was the division between decision management and decision control, so the decision-making process was made up of various actors and not by a single person with full powers.

The presence of a board of directors would have been an excellent control mechanism on the work of managers, having to ratify actions to be taken and having to monitor the performance of actions already taken. Shareholders also play a key role in the decision-making process, as they act as residual claimants, and therefore have a vested interest in the company being run in a functional and efficient manner.

Jensen and Fama stated that firms that allocate decision rights effectively and install appropriate monitoring and control mechanisms can mitigate agency problems while maintaining organizational efficiency.

The idea of separating decision-making authority is now common in large organizations, from governments to multinational corporations, but was not at the time this paper was released. This work laid the foundation for the adoption of corporate governance practices, that we find today in any company, and it gave a boost to the birth of modern shareholder activism.

Finally, among the works on the subject worth mentioning are:

- '*Moral Hazard and Observability (1979)*', in which Holmström describes how an incentive structure should be designed in the case of information asymmetry and moral hazard
- 'An Analysis of the Principal-Agent Problem (1983)', in which Grossman and Hart focus on optimal contracting of a principal – agent relationship under asymmetric infomation
- 'The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration (1986)', also written by Grossman and Hart, where they study the link and influence between ownership structure and agency cost, focusing particularly on control rights and residual decision-making

- 'Large Shareholders and Corporate Control (1986)' by Shleifer and Vishny where it is highlighted the role of the large shareholder and the possibility of reducing agency costs through good monitoring management.
- 'The Theory of Capital Structure (1991)', in which Harris & Raviv explore how debt financing disciplines managers, as a manager will be very cautious about taking on debt in highly risky projects, because if he were to fail to repay the debt, then a financial default would be created that could lead to bankruptcy and thus to the loss of his job. This aligns managerial behavior with the goal of maximizing firm value, thereby reducing agency costs.

The following is a summary table which helps summarise the path of agency costs in the literature:

Author(s)	Title and year	Key contributions and impact on agency costs theory
Adam Smith	The Wealth of Nations (1776)	Identified the separation of ownership and control in joint-stock companies as a source of potential conflicts of interest between owners and managers. Provided the foundational understanding of principal-agent dynamics, inspiring future research on governance and incentive alignment.
Ronald Coase	The Nature of the Firm (1937)	Introduced the concept of transaction costs to explain why firms exist, essential for later developments in agency theory.
Armen Alchian & Harold Demsetz	Production, Information Costs, and Economic Organization (1972)	Explored the challenges of team production and the critical role of monitoring in reducing shirking. Introduced monitoring as a central mechanism for mitigating agency costs.
Stephen Ross	The Economic Theory of Agency: The Principal's Problem (1973)	Coined the term agency theory and formalized its framework. Developed mathematical models to design optimal contracts under conditions of asymmetric information.
Michael Jensen & William Meckling	Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure (1976)	Synthesized prior theories into a global framework defining agency costs as the sum of monitoring, bonding, and residual loss. Explored the implications of ownership structures on conflicts between principals and agents. Highlighted the inefficiencies in the separation of ownership and control. Defined agency cost theory as a distinct area of study, moving the focus from firms as "black boxes" to entities with internal conflicts and governance challenges.

Bengt Holmström	Moral Hazard and Observability (1979)	Developed models for structuring incentives in the presence of moral hazard and information asymmetry. Advanced the theoretical framework for contract design under conditions of hidden actions, deepening the understanding of agency costs.	
Eugene Fama	Agency Problems and the Theory of the Firm (1980)	Highlighted the role of market forces in disciplining managerial behavior. Argued that external mechanisms can complement internal controls in mitigating agency problems. Broadened the scope of agency theory by incorporating external governance tools like market-based discipline, influencing modern corporate governance practices.	
Eugene Fama & Michael Jensen	Separation of Ownership and Control (1983)	Introduced decision systems to mitigate agency problems by dividing responsibilities into decision management and decision control.	
Sanford Grossman & Oliver Hart	An Analysis of the Principal- Agent Problem (1992)	Investigated optimal contracting in principal-agent relationships, focusing on how contracts allocate risk and incentives under asymmetric information. Contributed to the understanding of contractual solutions to agency problems.	
Sanford Grossman & Oliver Hart	The Costs and Benefits of Ownership (1986)	Explored the influence of ownership structures on control rights and agency costs, focusing om the role of residual control rights in addressing agency conflicts.	

Andrei Shleifer & Robert Vishny	Large Shareholders and Corporate Control (1986)	Emphasized the monitoring role of large shareholders in reducing agency costs. Explored how concentrated ownership complements external governance mechanisms. Established the importance of shareholder activism and large shareholder monitoring in reducing agency conflicts, shaping corporate governance policies.
Milton Harris & Artur Raviv	The Theory of Capital Structure (1991)	Analyzed how debt financing can discipline managers by imposing financial obligations that restrict discretionary spending. Explored the trade- offs between debt and equity in managing agency conflicts.

Table 1: The path of agency costs in the literature

1.3 The components of agency costs

After analysing the literature on the subject, this section will propose a breakdown of agency costs into all its components and the relationships in which these costs can occur.

Jensen and Meckling, in addition to the unambiguous definition of agency costs seen above, also divided agency costs into three broad categories:

- Monitoring costs: Monitoring costs are the expenses incurred by the principal to oversee, monitor, and restrict the agent's actions to ensure alignment with the principal's interests. Underlying these costs is information asymmetry, as the agent has more information about its actions, and he may act opportunistically. Consequently, the principal will have to control the agent's actions and this will inevitably lead to the creation of monitoring costs.
- **Bonding costs**: Bonding costs are expenses incurred by the agent to commit to actions that align with the principal's interests or to reassure the principal of their reliability. An example would be the penalties included in the manager's compensation scheme, should he engage in unethical behaviour.
- **Residual loss**: Residual loss refers to the reduction in the principal's welfare due to divergence between the agent's decisions and the decisions that would maximize the principal's utility. This is because, even with monitoring and bonding costs, the interests of the two parties will never be perfectly aligned, as they tend to diverge spontaneously.

A classic example could be the manager pursuing personal perks (e.g., luxury offices, cars or even jet) at the expense of firm value, and no matter what the amount of monitoring and bonding costs, there will always be room for residual inefficiencies and thus costs.

The monitoring costs, bonding costs and residual loss can manifest differently depending on the specific context of the business and based on the agency relationship that is under observation.

The two most common principal-agent relationships in the businesses are those between shareholders (principals) and managers (agents), which leads to the creation of **agency costs of equity**, and that between creditors (principals) and shareholders/managers (agents), which results in the formation of **agency costs of debt**.

1.3.1 Agency cost of Equity

As mentioned above, in listed companies very often shareholders delegate decisionmaking authority to managers. This entails the possibility that the manager acts out of self-interest and not for the good of the company, thus leading to a possible divergence of interests.

The most common problems could be those of:

• Managerial Perquisites: There are frequent scandals involving CEOs of large companies, accused of having spent millions of euros of the companies they managed to buy houses, cars, parties for personal purposes. Sometimes this is obvious and it is easy to blame managers for their fraudulent actions, but at other

times the division between personal and corporate purposes is not so clear-cut and it is therefore difficult to tell whether the manager is really pursuing corporate interests or his own when using company money.

- Empire building: this happens when the manager invest in projects for the sole purpose of enlarging the company, neglecting the maximisation of the return for the shareholders.
- The free cash flow problem³: It occurs when the company has substantial resources to finance investments and this pushes the manager to invest even in projects with a negative NPV, for the sole purpose of enhancing his prestige, effectively denying an economic return to the shareholders.
- **Risk Aversion**: This is the opposite problem to the one seen above, here the manager might avoid investing in projects with the sole aim of minimising risk, and thus ensure stability in the workplace. This, however, leads to a loss of investment opportunities and, at the same time, to a lack of possible return for investors.

To avoid the occurrence of these problems, and to ensure that the interests of principal and agent are aligned, monitoring and bonding costs emerge. Mitigating these costs requires a combination of governance mechanisms, performance incentives, and financial discipline, as seen in successful corporate strategies worldwide.

³ Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. American Economic Review, 76(2), 323–329.

1.3.2 Agency costs of Debt

The term agency costs of debt generally refer to those costs that arise from the relationship between creditors (principals) and shareholders or managers (agents).

It all stems from the fact that creditors would like their money to be used in a responsible and efficient manner, not least because their ultimate goal is to receive the interest-bearing loan back. On the other hand, however, managers or shareholders might use the money to prioritise the interests of those holding equity in the company, or to undertake highly risky investments that could lead to financial default.

In this case, therefore, the problems that may arise are different from those encountered in the case of agency costs of debt:

- Asset Substitution Problem: This happens when the company, having borrowed the money, uses it for much riskier projects than originally planned. In practice, what happens is risk shifting, where creditors see their money being used for high-risk projects that, if profitable, will give the shareholders a huge gain in terms of the value of their share, while for the creditors nothing actually changes, as the interest share is generally fixed. This is an incentive for managers and shareholders to invest in riskier projects, also because generally the higher the risk, the higher the potential return on investment. Of this potential return, creditors receive nothing, apart from seeing the loan repaid with interest, which is why the latter would prefer safe and rational investments.
- Underinvestment Problem: is the opposite problem to the one seen above, in this case the company, once it has obtained the funds, avoids investing in

projects with positive NPV because it is highly risk averse, or because the shareholders do not see short-term gains for them, but only benefits for the creditors in the event of a decision to invest.

- **Debt Overhang**: This is the case when a company is highly indebted, resulting in a reluctance on the part of creditors to extend further loans. Even if one had projects with positive NPV, they could not be realised due to lack of funds, and this only makes the company's situation even worse.
- Dividend Payments: Again, we are talking about indebted companies that, in situations of fiinancial distress, might opt for a hefty dividend distribution in order to solely favour the interests of shareholders. Obviously, this move weakens the likelihood of being able to repay creditors even more, which is why creditors in no way want the heavily indebted company to distribute dividends.

Again, to cope with all these problems, monitoring and bonding costs emerge, with the aim of aligning the interests of the two parties as much as possible. Understanding and managing these costs is crucial for firms to optimize their capital structures and maintain trust with creditors.

Both forms of agency costs underscore the need for robust corporate governance and control mechanisms, in order to establish clear systems and processes that ensure transparency and accountability in the actions of the manager. The next chapter will list the main tools that are used in companies and their role in mitigating information asymmetry, moral hazard, and opportunistic behaviour, which are the fundamental problems which then lead to the formation of agency costs.

1.4 Corporate governance and control mechanisms

Corporate governance refers to the system of rules, practices, and processes used to manage and control a corporation.

The study of corporate governance has evolved from fundamental economic observations, such as those of Adam Smith, to become a full-fledged field of research within economics.

Some of the contributors to the development of this field have already been named above (Coase, Jensen and Meckling, Fama etc.), but it is also worth adding to the list Adolf Berle and Gardiner Means⁴, who together with Coase were the first to introduce this concept in the 1930s.

The need for corporate governance arose in response to the separation of ownership and control in companies, a phenomenon that originated in the 16th and 17th centuries with the early joint-stock companies, but spread widely in the early 20th century.

To provide a better understanding of the subject, reference will be made to a work of the Organisation for Economic Co-operation and Development.

The OECD in its work Principles of Corporate Governance, first published in 1999 and then periodically updated to keep pace with the fast-changing corporate environment, helps provide a thorough understanding of what corporate governance is based on and what the founding principles should be, to guide corporations in developing good corporate governance practices.

⁴ J. V., Berle, A. A., & Means, G. C. (1933). The modern corporation and private property. *Columbia Law Review*, *33*(3), 557.

The OECD Principles are structured around six areas:

- I. Ensuring the basis for an effective corporate governance framework
- II. The rights and equitable treatment of shareholders and key ownership functions
- III. Institutional investors, stock markets, and other intermediaries
- IV. Disclosure and transparency
- V. The responsibilities of the board
- VI. Sustainability and resilience

These principles are fundamental to creating a corporate governance strategy, which then has to be implemented in some way.

Indeed, corporate governance dictates the structure, processes and goals of a company, but then requires actions to implement them. This is where control mechanisms come into play, acting as an essential element to implement the objectives set at the strategic level in corporate governance by providing systems to monitor, influence, and align the actions of managers (agents) with the interests of shareholders, creditors, and other stakeholders (principals).

Control mechanisms can be both internal and external. The former are created and operate within the company, having a direct influence on the actions of managers and the decision-making process, while the latter are mechanisms that develop outside the company and indirectly influence the behaviour of managers, very often through the exercise of pressure

The most common internal control mechanisms are:

- **Board of Directors**: One of the essential elements of a listed company, now indispensable within organisations. The composition of this body may vary greatly depending on the legislation and the country in which it operates, but its tasks and duties remain more or less unchanged: ratifying the company's most important decisions, supervising the work and monitoring the performance of managers, approving the company's financial results and ensuring that the shareholders' interest is represented.
- Internal Audits and Risk Management: Audits can be carried out directly by the board of directors, but also by third parties who are completely independent of the organisational apparatus of the company. This ensures that the opinion expressed in the audit is impartial and free of conflicts of interest.

The same can be said for risk management, which is becoming increasingly important in the highly volatile economic environment of recent years.

- Incentive Structures: As we said at the beginning of this work, an incentive structure can be very helpful in aligning the different goals of managers and shareholders. There are many types of incentives that can be used. One of the most famous are the stocks (and options), which incentivises the manager to do everything possible to increase the company's market value. Another incentive could be a bonus scheme, linked to profitability, sales or other metrics defined at the beginning of the reporting period.
- **Decision Systems**: The decision-making process can be implemented in various ways, depending on the company, the industry, market volatility, the number of

competitors and countless other factors. At the base we can find more centralised decision-making systems, where all decisions are in the hands of a few or a single person, or decentralised decision-making systems, where the decision-making bodies are multiple and vary depending on the type of decision to be made. Certainly the division of decision-making reduces the concentration of power, and with it therefore reduces the risk that an individual can act in his or her own interest without hindrance.

• Code of Conduct and Ethics: This tool is useful for establishing clear and shared rules so that any misbehavior is reduced.

As already mentioned, control mechanisms can also come from outside the company, and can directly or indirectly influence the governance of a company. These include:

• Market Discipline: The fact that the company is in a market, and for this reason is generally placed in competition with other companies, spontaneously creates a control mechanism for which the manager must perform adequately. We find two mechanisms, one based on the capital market, where the manager who performs inadequately will cause the value of the shares to plummet and this makes the way easy for a hostile takeover of the company, with the associated dismissal of the underperforming manager. The other mechanism is the labour market, as all the actions of a affect his future job assignments, manager can and certainly underperformance is not a good calling card. Therefore, by the mere fact that the company is in a market, the manager will be pressurised to act conscientiously and to the best of his or her ability.

- **Regulatory Compliance**: The company's presence in the market also requires compliance with the legislative apparatus in force. This limits and dissuades the manager from committing improper actions.
- Creditors and Debt Covenants: Creditors, as expressed above, have every interest in the manager behaving properly, because in the event of bankruptcy it would be very difficult for them to get their capital back. This is why they can monitor and possibly put pressure on the manager to act in the best possible way.

The combination of all these mechanisms, if applied correctly, will ensure compliance with corporate governance principles, thereby also reducing costs and agency conflicts. Of course, the meticulous implementation of control mechanisms will also come at a price, which is why it is crucial to find a trade-off and balance of costs in order to optimise corporate performance

1.5 Empirical studies on the impact of corporate governance on agency costs and companies

Having understood what corporate governance is, an interesting aspect to explore is its impact on corporate performance and the behaviour of managers. Can a change in corporate governance strategies or legislation affect the results of a company and its management? The scientific literature on this subject is very clear and the answer is affirmative. The following are two important studies that have quantified the impacts of a change in governance, showing that governance is an important instrument of discipline for the manager and that a change can significantly impact the choices the manager will make during his or her tenure.

The first study analysed is '*Enjoying the quiet life? Corporate governance and managerial preferences (2003)*', where Bertrand & Mullainathan analyse the impact a relaxation of corporate governance measures can have on the performance of managers. More specifically, they study the effects of the enactment of anti-takeover laws, i.e. those laws that prevent hostile takeover. As seen above, the threat of a takeover is a tool that disciplines the manager to act in the best possible way, and the elimination of this market discipline could make the manager no longer risk being the victim of a hostile takeover if his performance is not efficient. Therefore, the authors tried to understand whether there were any changes in the behaviour and performance of companies once the law came into force.

The first effect noted is the salary increase to employees, both blue collar and white collar. Following the implementation of the law, the former saw an average salary increase of 1.3 percent, the latter as much as 4 percent. This can simply be explained in the fact that by raising wages, the manager would enjoy "peace" with both workers and unions, and thus his performance and position would become even more stable. Obviously raising salaries too much becomes inefficient, since those resources could be utlized in other ways. In practice, the manager, being sure that there can be no hostile scaling, no longer aims at cost minimization and maximum operational efficiency, shifting his focus to ensuring the stability of his position.

Moreover, no increase in productivity occurred downstream of the wage increase; on the contrary, a decrease in total factor productivity (TFP) was found once the law went into effect, combined with a decrease of about 1 percent in return on capital This paper clearly demonstrates the impact that a regulatory change and an easing of corporate governance measures can have on the performance of managers. Weakening external governance through reduced takeover threats leads to inefficiencies and agency costs, as there has been a radical change in managers' incentives and goals from maximizing shareholder value to maintaining job stability.

Another interesting aspect is the impact that corporate governance can have on CEO salaries, as analyzed in the paper '*Corporate governance, chief executive officer compensation, and firm performance (1998)*' by Core, Holthausen and Larcker.

Using a sample of 495 annual observations across 205 firms, the authors examine how board and ownership structures influence CEO compensation, arriving at results that are definitely significant and worth mentioning.

First of all, in the case of CEO duality (where the CEO is also the board chair), the chief receive an additional compensation of \$152,577. Moreover, the CEO's pay is directly proportional to the size of the board and one member increase in the size of the board is linked with a \$30,601 increase in total CEO compensation. In contrast, one element that decreases CEO pay is the presence of blockholders, where the presence of this external entity leads to a decline of \$86,100 in total compensation. Another interesting link is that between compensation and the amount of equity the CEO owns,

where a 1% increase in CEO equity ownership translates into a \$8027 reduction in the compensation.

This results show that board and ownership structure can clearly influence manager pay. Obviously too high pay will not benefit the company as it will waste resources that could have allocated, more efficiently, to other activities, thus leading to the creation of agency costs.

These two studies just shown in this paragraph, and their empirical results, clearly demonstrate how good corporate governance can influence the performance of managers and their incentive structure, emphasizing the importance toward this subject.

2. The executive pay

2.1 Components of the executive compensation

As we have just seen, the compensation of managers can also be a source of agency costs, since if not properly designed, it can lead to a misalignment of incentives between shareholders and CEOs.

First of all, it is important to understand the structure of the compensation, which includes both a monetary and a non-monetary part:

- **Base salary**: this is the monetary part, common to all jobs, usually quantified on an annual basis and before taxes and contributions. Generally, this part of the compensation is not the main source of income for the CEO, as it represents a small part of the total remuneration. The percentage of base salary out of total compensation may vary depending on the industry and the country in which the company operates.
- Short-Term Incentives (STI): here we find that part of remuneration linked to short or very short term objectives (generally not exceeding one year). Upon reaching certain pre-set KPIs, the manager will receive a bonus, very often of a monetary nature, which will be added to his or her basic salary. Obviously, the CEO will be enticed to reach these targets, trying to do everything possible to obtain a higher remuneration, and this may also mean neglecting long-term goals in order to achieve effective short-term results.

- Long-Term Incentives (LTI): To prevent the manager from focusing only on short-term goals, we often also find incentives linked to more ambitious, long-term targets. This incentivises the CEO to broaden the horizons of vision and to be more forward-looking. Generally, this type of incentive is not strictly monetary in nature, but rather financial (shares or derivatives of the company). For example, with options the executive receives the right to purchase company shares at a predetermined price (strike price) after a vesting period, thus creating an incentive for the manager to increase the value of the shares over the long term, so as to maximise his return. Other types of LTIs can be performance shares or restricted stock units (RSUs).
- **Perquisites (perks)**: In this section we find all those benefits of a non-monetary nature that are given to the manager to improve his or her quality of life. Classic examples include cars, private jets, health and wellness benefits, housing allowances etc.
- **Benefits and retirement plans**: In this category we find the classic benefits provided to the employees of a company, which, however, often include additions when one reaches prestigious positions within the company (as in the case of the CEO). Among the most common benefits are life insurance, health insurance, access to supplementary pension funds, etc.
- Change-in-control agreements and severance payments: They are compensation parts that the manager only has access to if a change of ownership or control should occur. One example is the golden parachute, a large payouts

that often encompass cash, stock options, bonuses, and other benefits in the event of a change of control at the corporate level (mergers and acquisitions, hostile takeovers, etc.), triggered if the executive is terminated or leaves the company under specific conditions following the change in control. Another example of severance payment is an exit package, that is a remuneration package that the manager gets in case he or she is fired

Thus, compared with compensation for most workers, there is a higher level of complexity and a large number of possible combinations among the various parts of compensation. Choosing the right mix of tools to form appropriate remuneration can be a key lelement to the success of the company, as it would align the interests of shareholders with those of the CEO, going on to create a synergy of intent that would benefit all parties. Conversely, compensation designed in the wrong way could cause the manager to behave in the wrong way, pursuing his or her own interests and not those of the company, creating agency costs and damage to the business.

Obviously, the weighting of the various parts of compensation is also subject to historical trends, as the pay structure has varied considerably over the years. In the beginning, managers' compensation consisted exclusively of salary and bonuses, i.e. basically only a monetary part. Since the 1970s, however, there has been a real change in the pay structure, with new instruments, such as LTIPs (Long-Term Incentive Plans), shares and options, gradually becoming more and more present and substantial within the remuneration scheme. In the last decade of the twentieth century, the strictly monetary part (salary and bonus) accounted for barely half of the entire compensation,

settling at around 40% in the early 2000s. Below is a graph showing the historical development of the pay structure, thus providing a clearer picture of the changes over time, from a work of Frydman and Jenter (2010)



Figure 1 : Median level and the average composition of CEO pay in the 50 largest firms in 1940, 1960, and 1990 (for a total of 101 firms) Frydman, Carola and Jenter, Dirk, CEO Compensation (March 19, 2010). Rock Center for Corporate Governance at Stanford University Working Paper

It is clear from the graph that there has been a shift towards a type of remuneration that largely includes non-liquid instruments (such as shares and options), with the aim of align the CEO's financial interests with shareholder outcomes (since in theory if the manager achieves positive results, this should lead to an increase in the value of the shares, and if the stocks are owned by both managers and shareholders, both are incentivised towards the same goal).

The strong presentation of equity-based incentives, however, could also have a negative effect on the manager's actions, as CEOs may become overly focused on short-term stock price fluctuations to maximize the value of their shares and options, forgetting the well-being of the company in the long run.

Moreover, the market is subject to periodic fluctuations and bullish and bearish periods. In this context, even a manager who operates in the right way and pursues good objectives may not see a rise in the share price. For example, in a bear market phase the manager may be demotivated to work hard if his pay depends to a large extent on equity-based instruments, because the price of shares and stocks is also determined by external factors beyond his control, and even well-performing companies might see their stock prices fall during a stock market downturn. All this could lead to demotivation of the CEO, thus reducing his potential performance. Of course, this can also happen in the opposite direction, where in a positive macroeconomic situation, the share price of a company might rise regardless of the contribution made by the CEO. Finally, the significant presence in the pay of instruments linked to the company's share price could incentivise the manager to commit outright fraudulent acts, manipulating financial results for the sole purpose of obtaining a rise in the share price, which would then correspond to enormous profits.

Another graph that helps to understand the variations over the years in CEO remuneration is the following:



Figure 2 : Median level and the average composition of CEO pay in S&P 500 firms from 1992 to 2008

Frydman, Carola and Jenter, Dirk, CEO Compensation (March 19, 2010). Rock Center for Corporate Governance at Stanford University Working Paper

Here it is even more clear the inexorable decline in the weight of wages in total remuneration. The CEO, as a result, has seen the fixed and secure share of compensation decline year after year, to the benefit of bonuses and non-monetary components instead.

Another interesting trend is the weight of options on the total, with a dramatic increase ending around the early 2000s, where half of the salary was on average made up of this derivative instrument, and then decreasing and settling at around 25% of the remuneration.

This can be explained by multiple factors, first the dot-com bubble and the market crash that followed, with the value of shares in many companies falling dramatically. This also caused the value of options to plummet, making this instrument not particularly appealing to executives. In secundis, in 2004, the Financial Accounting Standards Board (FASB) required companies to expense stock options on income statements, reducing their attractiveness as a cost-effective compensation tool. Finally, with the various corporate governance reforms that followed, it was preferred to make greater use of shares and not options within remuneration, as they were considered a safer instrument and guaranteed a better alignment of incentives with shareholders, limiting excessive risk-taking on the part of the CEO.

2.2 A deep dive into the options world

The last section highlighted the change that has taken place over the years in the type of remuneration offered to CEOs, with the advent of an increasing portion of compensation based on, or closely linked to, the company's equity.

If it is clear to understand the concept of action as is a financial security that represents proportional ownership in a corporation, it is not as easy to understand the concept of an option, due to its nature as a derivative product, which bases its value entirely on the performance of the share price to which it refers.

A stock option is a financial derivative that gives the holder the right, but not the obligation, to buy or sell a stock at a predetermined price (the strike price) within a specified time period.

They are divided into two broad categories:

- Call Option: The right to buy a stock at a predetermined price.
- **Put Option**: The right to sell a stock at a predetermined price.

Of course, call options and not put options are usually present in the CEO's remuneration, as the former incentivises the manager to increase the value of the shares and the company, the latter incentivises the opposite behaviour. In fact put options benefit when stock prices decline, which would create a perverse incentive for executives to lower the stock price, but firms want executives to work towards value creations, not hedging against their own company's failure.

The value of an option consists of two parts: intrinsic and extrinsic value. The intrinsic value, is the difference between stock price and strike price, in a call option, and the difference between the strike price and the stock price in a put option, with of course the lower bound of the domain set at 0.

In the market, however, these contracts are almost always priced higher than their intrinsic value, and the part of the price of an option that cannot be explained by the intrinsic value goes to form the so-called time value (or extrinsic value).

This increase in the value of the option with respect to its mere intrinsic value is due to the fact that, during the time between the purchase of an option and its maturity, the price of the underlying asset may fluctuate, causing the option price to change as well. The extrinsic value therefore represents the potential for the option to become valuable before reaching expiry. Obviously, extrinsic value is also subject to the volatility of the underlying, and consequently, at the same price and maturity, options whose underlying is more volatile will tend to be more expensive than options referring to securities with low volatility. Three terms are used in the jargon to describe the presence or absence of intrinsic value within the option:

Options In-the-Money	Options At-the-Money	Options Out-of-the-		
(ITM)	(ATM)	Money (OTM)		
ITM CALL OPTIONS	ITM CALL OPTION	OTM CALL OPTIONS		
when	when	when		
Strike price < Stock price	Strike price = Stock Price	Strike price > Stock price		
ITM PUT OPTIONS	ITM PUT OPTIONS	OTM PUT OPTIONS		
when	when	when		
Strike price > Stock price	Strike price = Stock price	Strike price < Stick price		
Table 2: Types of options				

In the continuation we will see how, when there is a strong optionary presence in CEO compensation, whether the option is in the money or out of the money can change a CEO's behaviors or inclinations, incentivizing him or her to take or not take certain actions.

Regarding option pricing, one of the most widely used mathematical models is the Black-Scholes-Merton model, which involves the use of partial differential equations:

$$rSrac{\partial f}{\partial S}+rac{\partial f}{\partial t}+rac{1}{2}\sigma^2S^2rac{\partial^2 f}{\partial S^2}-rf=0$$
As with any partial differential equation, it needs boundaries and initial conditions to be solved, which for european call are:

$$C(S,T)=max(S-K,0)$$
$$C(0,t)=0$$
$$C(S,t)\approx S-Ke^{-r(T-t)}$$

And for an european put are:

$$P(S,T)=max(K-S,0)$$

 $P(0,t)=Ke^{-r(T-t)}$
 $P(S,t)=0$

where:

- f(S,T)= price of the option; C(S,T)=price of the call; P(S,T)= price of the put
- S = stock price
- t = time
- σ = volatility of the stock
- r = risk-free interest rate
- K= Strike price
- T=expiration date

By imposing these conditions, the equation can be solved, obtaining:

```
C=S_0N(d_1)-Ke^{-rT}N(d_2)
```

$$P=Ke^{-rT}N(-d_2)-S_0N(-d_1)$$

Where

$$d_1 = rac{\ln(S_0/K) + (r+\sigma^2/2)T}{\sigma\sqrt{T}}
onumber \ d_2 = d_1 - \sigma\sqrt{T}$$

And N(d) refers to the cumulative standard normal distribution function, in this case representing probabilities under a risk-neutral framework.

The basic idea is that the call price (C) is determined by the difference between the expected stock price (adjusted for risk) and the discounted strike price, while the put price (P) is based on the discounted strike price minus the probability-adjusted stock price.

2.3 Challenges and controversies in executive compensation

One of the first problems addressed in this section will be that of pay-performance sensitivity, defined as the dollar change in the CEO's wealth associated with a dollar change in the wealth of shareholders. It tends to be the case that the greater the link between these two parameters, the greater the alignment of incentives between those involved: if the CEO knows that his pay will go way up if he produces more value for shareholders, then he will have an incentive to act in the good of the company and maximize the return to shareholders.

The foundational study on this theme is "Performance Pay and Top Management (1990)" by Jensen and Murphy, where the authors calculate that, on average, CEO wealth changes by \$3.25 for every \$1,000 change in shareholder wealth, with the

largest incentives coming from stock ownership. This is not a very positive result, as it represents a fairly low sensitivity, and consequently, a suboptimal alignment of interests between CEO and shareholders. Moreover, since the largest delta in CEO earnings comes mainly from stock ownership (and options), he or she could prioritize stock price manipulation over long-term growth.

Another not too exciting result is that the pay-performance sensitivity has declined significantly between the 1930s and the 1980s, going from 17.5 ¢ per \$1,000 in the 1930s to 1.9 ¢ per \$1,000 in the 1970s and 1980s.

In practice, corporate performance and CEO pay are becoming less and less correlated, resulting in resounding cases where CEOs still see pay increases afront of corporate performance that worsens year by year. This of course inevitably creates agency costs, as the CEO is not at all interested in maximizing value for shareholders, as he already knows that this will affect his pay very little.

Moreover, there are numerous studies in the literature (*Core, Holthausen, and Larcker* (1999) to name one) that have shown how excessive CEO compensation is negatively associated with future firm performance, confirming the idea that where there is low pay performance sensitivity, there will be greater misalignment of interest and consequently worse business performance, highlights the importance of aligning pay with performance through stronger governance mechanisms.

Another two critical issues that could create diverging interests between managers and shareholders are the golden parachutes and the severance packages, two components of the managers' pay, discussed above. While designed to attract and retain top talent, these arrangements can exacerbate agency problems, as they very often reward managers regardless of their results. These instruments may incentivize executives to pursue short-term strategies or accept risky acquisitions that boost immediate returns but harm long-term value, since the manager is aware that, regardless of his or her performance, he or she will in any case receive a substantial remuneration at the end of his or her term or in the event of a change of ownership.

One of the most striking cases in modern history that showed the strong hypocrisy of these instruments was the subprime mortgage crisis, which then led to a global economic crisis affecting billions of people. During this period, some individuals who were at the head of the banks responsible for the crisis, saw their savings rise sharply as a result of severance packages and golden parachutes.

For example Merrill Lynch CEO Stanley O'Neal, forced out in 2007, with a \$161.5 million golden parachute, or American International Group CEO Martin Sullivan, fired in 2008, with a severance package of \$47 million. These examples clearly illustrate the lack of performance-linked payouts, and the risks this disconnect may bring on the actions of CEOs.⁵

Certainly, in order to avoid the risk of these distortions occurring, an intervention at the governance level, coupled with strong board oversight, is needed.

For example, clawback provisions could be included in the CEO's remuneration contract, allowing firms to recover payouts if they are later deemed unjustified due to poor performance, misconduct, or financial restatements.

⁵ Rewarding Failure 2009, PublicCitizen (www.citizen.org)

Another caution the board should have is to put in place a stronger performance-based compensation system, together with a cap on golden parachutes and severance packages.

This is only possible if the board of directors is independent and strong, thus creating a balance and deterrence to possible malicious actions by the CEO.

2.4 The role of the Board of Directors in Executive Compensation

The board of directors plays an essential role in shaping, approving, and overseeing executive compensation to ensure it aligns with the organization's strategic objectives and shareholder interests, onsequently it will be up to the board to ensure that agency costs are minimised.

Sometimes it is up to the entire board of directors to discuss the CEO's remuneration, other times a special compensation committee is created, hopefully consisting of members who are independent of the CEO, so that they cannot be influenced by him in decisions regarding the pay. A key responsibility of the board is also to establish the pay-performance sensitivity (PPS), a key parameter, discussed in the previous section, which is fundamental in defining the success or failure of a manager's remuneration scheme

Since 2010, in the USA, thanks to the The Dodd-Frank Wall Street Reform and Consumer Protection Act, shareholders have increased their power and voice over CEO compensation, also thanks to instruments such as Say-on-Pay Votes, which provides an obligation for public companies to hold non-binding shareholder votes on executive compensation packages, ensuring that boards consider shareholder perspectives in pay decisions. It has been demonstrated how this type of mechanism can increase the sensitivity of CEO pay to poor performance (Ferri, F., & Maber, D. A. (2013)), thus shifting shareholders' interest not to the amount of pay in absolute terms, but rather to whether or not that pay is justified by performance. In addition, the law provides for stricter disclosure requirements, thus increasing transparency on the decisions and quantification of CEO pay (e.g. CEO-to-median worker pay ratios), giving investors a clearer picture of the choices made in the boardroom. Lastly, it dictates stricter independence requirements for board members who are to determine CEO pay.

The importance of board independence and the presence of shareholder monitoring is extensively studied within the literature, with results confirming that firms with weaker governance structures are more likely to exhibit CEOs and directors higher compensation and poor firm performance (Brick, Palmon, and Wald (2002)).

Another important study on the usbject is "CEO compensation and board structure" by Chhaochharia, V., & Grinstein, Y., in which the authors study the trend of CEO compensation following the introduction of a law to enhance board oversight, after the crisis of the early 2000s. The results, on a sample 865 firms between 2000 and 2005, show how non-compliant companies saw a drop of 17,5% in CEO compensation following the introduction of the law, compared to companies complying with the regulations, highligting the importance of the presence of independent directors on the board and their effect on CEO pay decisions. The table shows the results of panel regressions, where the dependent variable is the natural log of total CEO compensation (variable tdc1 in Execucomp). The sample consists of a balanced panel of 865 firms that exist in Execucomp between 2000 and 2005. Sales is the natural log of company sales (Compustat data item 12). ROA is the natural log of one plus net income before extraordinary items and discontinued operations divided by the book value of assets—all measured in (*t*-1). Returns is the natural log of the annual gross stock return (dividend reinvested), measured in year (*t*-1). Tenure is the number of years the CEO served in the firm. Dummy (Board noncompliant 2002) is a dummy variable that equals one if the firm did not have a majority of independent directors on the board in 2002 and zero otherwise. Dummy (Compensation committee noncompliant 2002) is a dummy variable that equals one if the firm did not have an independent noninating committee and zero otherwise. A director is defined as an independent director if the director was not an employee of the firm during the previous three years, if the director does not have family affiliation of the officers of the firm, and if the director does not have any business transactions with the firm. Dummy ('00–'02) is a dummy variable that equals one if the observation is in the period 2000 to 2002 and zero otherwise. Dummy ('03–'05) is a dummy variable that equals one if the observation is in the period 2000 to 2002 and zero otherwise. Industry-year fixed effects are the Fama-French 48 industry dummies (Fama and French (1997)) interacted with year dummies. All variables are adjusted for inflation using 2002 as the base year. The numbers in parentheses are robust standard errors, clustered at the firm-period level. *,**,*** indicates significance at the 10%, 5%, and 1% levels, respectively.

Dependent variable: Log(total compensation)								
	(1)		(2)		(3)		(4)	
Dummy (Board noncompliant '02) * Dummy ('03-'05)	-0.192	**					-0.218	**
	(0.086)						(0.093)	
Dummy (Compensation committee noncompliant '02)								
* Dummy ('03–'05)			-0.014				0.060	
			(0.064)				(0.058)	
Dummy (Nominating committee noncompliant '02)								
* Dummy ('03–'05)					-0.033		-0.006	
					(0.033)		(0.053)	
Sales * Dummy ('00-'02)	0.305	***	0.290	***	0.291	***	0.304	***
	(0.066)		(0.068)		(0.071)		(0.066)	
Sales * Dummy ('03-'05)	0.268	***	0.259	***	0.258	***	0.266	***
	(0.072)		(0.073)		(0.075)		(0.071)	
ROA* Dummy ('00'02)	0.321		0.346		0.351		0.332	
	(0.399)		(0.404)		(0.405)		(0.397)	
ROA * Dummy ('03-'05)	0.260	*	0.248	*	0.252	*	0.257	*
	(0.150)		(0.148)		(0.146)		(0.149)	
Returns * Dummy ('00-'02)	0.123	***	0.124	***	0.124	***	0.124	***
	(0.033)		(0.034)		(0.034)		(0.033)	
Returns * Dummy ('03-'05)	0.269	***	0.269	***	0.269	***	0.270	***
	(0.048)		(0.048)		(0.048)		(0.048)	
Tenure	-0.034		-0.029		-0.030		-0.034	
	(0.022)		(0.024)		(0.022)		(0.022)	
Firm fixed effect	+		+		+		+	
Industry- year fixed effect	+		+		+		+	
Ν	5,190		5,180		5,180		5,180	
Adjusted -R ²	26%		26%		24%		25%	

Figure 3 CEO compensation and board structure

Chhaochharia, V., & Grinstein, Y. (2009) CEO compensation and board structure

Similar results in this respect also emerge from the study by Ozkan, N. (2007), where it is also shown how the presence of institutional and blockholder ownership has a generally negative impact on CEO compensation, implying that these actors could raise the monitoring level on CEO compensation issues.

2.5 The regulation of CEO remuneration: EU and USA

Very often in the financial sphere, a legislative regime is constructed in the aftermath of a scandal or market crash, limiting the causes of the problem and attempting to remedy the behaviour that generated the crisis. This was the case for The Securities Exchange Act of 1934, a crucial piece of U.S. federal legislation that regulates the secondary trading of securities in the U.S. financial markets. The law was created in response to the stock market crash of 1929 and the subsequent Great Depression, with the aim of restoring confidence among investors, increasing transparency and fairness in the stock market.

As for the CEO's compensation, with this law public companies are obliged to file proxy statements that disclose detailed information about executive pay, including salaries, bonuses, stock options, and other benefits, furthermore they are also required to report CEO and executive pay in the Annual Reports (Form 10-K). This ensures that shareholders have access to all information regarding the CEO's pay, thus being able to judge whether the remuneration is in line with company performance.

Another very important piece of legislation on the subject is the Sarbanes-Oxley Act of 2002 (SOX), also written in the aftermath of the dot-com bubble and the Enron and WorldCom scandals. One of the objectives of the law was to discourage executives from committing financial fraud and misrepresentation, as in those years (also due to the sharp rise in the weight of shares and options on the total compensation, as seen above) managers had a strong incentive to do anything to drive up the share price, thus bringing in huge personal gains by selling shares and derivatives, but at the expense of long-term sustainability and value for shareholders.

This act introduced the possibility of including Clawbacks of Bonuses in the remuneration contract, giving the company the ability to recover bonuses, stock options or other incentives received by Chiefs when they are found guilty of misconduct. In addition, CEOs and CFOs must personally certify the accuracy of financial statements, thus guaranteeing on the authenticity of the values reported in official documents, thereby increasing their liability in the case of data falsification.

Finally, after the subprime mortgage crisis and the financial crisis of 2008, the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 was passed, implementing all the provisions seen in the previous paragraph.

Europe too, in the wake of the dot-com bubble and the Enron scandal, has decided to move at the legislative level to formulate new recommendations and directives to ensure greater transparency and accountability in the financial markets, also touching on the sphere of top managers' compensation.

With the EU Transparency Directive (2004/109/EC), the European Union has put public companies in its crosshairs, requiring, among other things, that the annual reports drawn up by companies must include information concerning remuneration policies, total remuneration paid, any contingent or deferred compensation and benefits in kind granted to each member of the administrative, management or supervisory bodies. In addition the Market Abuse Directive (Directive 2003/6/EC) and the successive regulation No 596/2014 requires senior executives to notify their share transactions and prohibits insider trading, to avoid any form of market manipulation carried out by people inside the company, who therefore have more information about the company than outside investors, thus having an enormous advantage should they decide to sell or buy shares at certain times, knowing then the consequences that a future company communication could have on the markets. Another very important law on the subject is the Shareholder Rights Directive II (SRD II) (Directive 2017/828), which introduced the right for the shareholders to approve or reject the policies on pay structures and performance criteria of the CEO, through a binding or advisory vote (similar to the Say-on-Pay vote seen above). It also introduces the obligation to disclose the CEO-to-average-employee pay ratios, with the aim of promoting fairness in income distribution.

Lastly, the European Union has decided to regulate more carefully key sectors for finance and markets, namely banking ad investment. With the Capital Requirements Directive V (CRD V) (Directive 2019/878), the regulator introduced a pay cap for variable remuneration ,which cannot exceed 100% of fixed remuneration or 200% with shareholder approval: this was clearly done to limit excessive risk-taking on the part of the managers of these companies, who, faced with the opportunity to earn stratospheric bonuses, might be tempted to take enormous risks, which could, however, undermine the financial stability of the company and of the entire market.

The section concludes with a zoom on current legislation in italy for a better understanding of the local regulatory framework on CEO compensation. The first dictates on the subject come from the civil code, which in article 2364 mandates that the shareholders' meeting determines the remuneration of directors unless otherwise stated in the company's by laws and in the article 2389 specifies that remuneration for directors with special responsibilities (e.g., CEO) must be determined by the board of directors, upon the recommendation of the remuneration committee. Then, the main regulatory source in force in the Italian Republic on finance and financial intermediation, the TUF (Testo Unico della Finanza), in article 114-bis regulates incentive plans (options, bonuses, stocks etc.) or performance-based compensation, requiring shareholder approval and clear disclosure and in article 123-ter mandates listed companies to publish a remuneration report, which includes the company's remuneration policy and the actual remuneration paid to directors, auditors, and executives.

Moreover, Italy, as a member country of the European Union, has implemented the above-mentioned directives, consequently all the regulatory framework valid for the EU is clearly also valid in Italy.

2.6 Empirical evidence on Chief compensation and firm

performance

In this chapter, three scientific papers will be analysed, showing how the topic of managerial compensation and firm performance is nuanced, since it is complex and very context-dependent and it's a problem that includes endogeneity and the difficulty of measuring long-term value creation.

The first paper discussed is "How Much Does Performance Matter? A Meta-analysis of CEO Pay Studies (2000)" by Tosi, Werner, Katz and Gomez-Mejia, a meta-analysis

that examines the relationship between CEO compensation and firm performance by aggregating and synthesizing findings from a large body of empirical studies. This is an excellent work to understand how much pay-performance sensitivity really impacts managers' remuneration and how much is related to contextual factors.

Going into more detail, the two hypotheses tested in the study are as follows:

- H1: Firm performance is an important determinant of CEO compensation (agency prediction)
- H2: CEO compensation is largerly insensitive to firm performance and primarly determined by firm size (managerialist prediction)

The first thing the authors point out, before analysing the results, is the strong link between the absolute financial performance level and the absolute firm size. This is due to the fact that if financial results are reported in the studies in absolute terms, it is clear that larger firms will have higher financial results, in absolute terms, because they have significantly higher business volumes than small and medium-sized firms. For this reason, the two parameters are correlated, thus yielding a sub-optimal result. To overcome this, the authors create a single factor, agglomerating the variables of the two factors listed above, called aggregated firm size, with the aim of returning a more accurate result that better explains the link between this parameter and CEO pay. The dependent variable chosen is CEO pay, while the independent variables are related to firm performance and firm size. The results are grouped in the table below:

	Total	# of		SD	SD	Explained	95% Confidence	2
	<i>n</i>			003	103.	variance		<u>X</u>
Absolute Financial Per	rforman	ce Lev	els ²					
Total Comp r _{xy}	1233	15	.392	.181	.156	.153	.343 to .439	56.06
Total Comp r _{xf}	1233	15	.403	.185	.162	.162	.354 to .449	60.32
Changes in Financial I	Perform	ance						
Changes in Comp r _{xy}	1599	9	.180	.184	.169	.034	.132 to .228	57.75
Changes in Comp r _{xf}	1599	9	.203	.203	.190	.041	.155 to .250	71.96
Return on Equity-Sh	ort Terr	n						
Total Comp r _{xv}	3046	24	.202	.102	.055	.041	.167 to .236	34.12*
Total Comp r _{xf}	3046	24	.212	.106	.065	.045	.178 to .246	37.85
Return on Assets								
Total Comp r _{xy}	2687	12	.107	.084	.051	.011	.069 to .144	19.21*
Total Comp r _{xt}	2687	12	.117	.091	.063	.014	.079 to .155	23.12
Absolute Firm Size								
Total Comp r _{xx}	8187	53	.413	.201	.191	.170	.394 to .431	482.68
Total Comp r _{xf}	8187	53	.520	.267	.262	.271	.504 to .536	1099.43
Change in Size								
Changes in Comp r _{xy}	1250	8	.148	.107	.072	.022	.093 to .202	53.93
Changes in Comp r _{xf}	1250	8	.225	.162	.143	.051	.171 to .277	36.20
Aggregated Firm Size								
Total Comp r _{xx}	8187	53	.412	.200	.189	.169	.393 to .430	475.61
Total Comp r _{xf}	8187	53	.643	.390	.389	.413	.630 to .656	3621.49

Table 10. Results of Meta-Analysis for Effect Sizes Using Fischer's zTransformation1

Analysis by the Schmidt-Hunter Method. Significance of χ^2 noted by * when $p \ge .05$, indicating homogeneity of studies (a single grouping).

 ${}^{2}r_{xy}$ = unadjusted composite correlation which accounts for correlations between variables that load on the same factor; r_{xt} = adjusted composite correlation which accounts for correlations between variables that load on the same factor and the variables' factor loading.

Figure 4 Source: How Much Does Performance Matter? A Meta-analysis of CEO Pay Studies (2000), Tosi, Werner, Katz and Gomez-Mejia

Looking at the bottom, it emerges that company size explains as much as 40% of the variance in CEO pay levels, and is by far the parameter that affects compensation the most.

On the other hand, with regard to the effects of financial performance, measured through ROE and ROI, the results are not very positive, as the latter explain only 4.5%

and 2% of the variance in CEO pay levels respectively

These results, as the author also reminds us, are perfectly in line with what has been pointed out by Jensen and Murphy (1990): the pay performance sensitivity tool as a means to reduce agency costs in structuring CEO pay is poorly supported and applied by companies, where currently what matters more is the size of the company in choosing CEO pay levels, and not their performance.

The second study analysed in this section is the famous '*Executive Compensation* (1999)' by Kevin J. Murphy. It is a comprehensive review of executive compensation, which provides a detailed examination of empirical and theoretical aspects of CEO pay, including pay-performance sensitivity, international comparisons, and governance implications.

An interesting piece of evidence to emerge from the study is that pay-performance sensitivity is inversely proportional to company size, as shown in the figure below.

Therefore, CEOs of large companies tend to have a lower alignment of incentives with shareholders than managers of small and medium-sized companies. This suggests that agency costs amplify and increase as the company grows in size. This is also true because in large firms it is very likely that the CEO does not have a large ownership stake in the firm, increasing the misalignment, whereas in small and medium-sized firms the CEO generally has a larger ownership stake, and will therefore automatically be more aligned with ownership interests. Another interesting result that emerges from the figure below is that pay-performance sensitivities are driven primary by stock options and stock ownership, so equity-based compensation is the primary driver of increased pay-performance sensitivity in the 1990s. This emphasises the importance of these instruments to ensure greater alignment between ownership and control.



Note: Sample includes all companies in the S&P 500, based on ExecuComp data. Pay component percentages are derived by computing the percentages for each CEO, and averaging across CEOs; the bar height depicts median compensation. Options are valued at grant date using ExecuComp's modified Black-Scholes formula. Other pay includes restricted stock (valued at face value), payouts from long-term incentive plans, and miscellaneous other compensation. Mining/manufacturing include firms with two-digit SIC codes 10-29; financial services 60-69, and utilities 49.

Other relevant findings from Murphy's analysis are that larger firms often show less responsiveness to performance in turnover decisions and that CEO pay-performance sensitivity is generally weak, but it is significantly increasing over time.

Another measure of pay-performance sensitivity could be determined through the measure of effective CEO ownership, since it is a parameter that measures the gain (or loss) the CEO has when the company increases (or decreases) its value by \$1.

Below is a graph showing the evolution of this parameter over the time span from 1992 to 2011, contained in Murphy's 2013 paper entitled 'Executive compensation: Where we are, and how we got there.'



Note: Percentage ownership for stock and restricted stock measured as the CEO's shareholdings divided by the total number of shares outstanding. Effective percentage ownership for stock options measured by weighting each option held by that options "Black-Scholes Delta" and dividing by the total number of shares outstanding. Year-end options under the pre-2006 disclosure rules estimated using the procedure described in Murphy (1999).

Figure 6 Median Effective Percentage Ownership for CEOs in S&P 500 Firms, 1992-2011.

Executive compensation: where we are, and how we got there (2013) by Kevin J. Murphy

From this graph, it emerges that the pay-performance sensitivity saw an increase in the years from 1992 to 2003, and then plummeted in the following years. Undoubtedly a contribution to the decline of this parameter was made by the Dot-com Bubble crisis and the 2008 financial crisis, which affected the returns of many stocks (and consequently the value of the options) on the market, even if not strictly related to the banking world.

The drop in the value of shares even in cases where the company was performing well, and the related options going out of the money as a consequence, have led to a drastic drop in pay performance sensitivity, with a value in 2011 that closely resembles that of 20 years earlier. The graph also shows that the growth of stocks and restricted stock holdings was not particularly high. The same cannot be said for options, which, on the other hand, have seen a considerable increase in their use, with all the merits (and shortcomings) that this tool brings with it.

2.7 The ESG trend in CEO compensation

The trend of incorporating environmental, social, and governance (ESG) metrics into CEO compensation has definitely grown in recent years, finding more and more interest from economists and shareholders. In *"The Perils and Questionable Promise of ESG-Based Compensation (2022)"* by Lucian A. Bebchuk and Roberto Tallarita, the authors examines 97 S&P 100 companies and their 2020 CEO compensation packages and they found that 52.6% of companies included ESG metrics in CEO compensation structures, although, in most cases, ESG metrics account for only 1.5%–3% of the total CEO pay. An increase in the integration of ESG issues within remuneration, through

corporate social responsibility (CSR) criteria in the structuring of CEO pay, was also noted by Caroline Flammer, Bryan Hong, and Dylan Minor in their paper "*Corporate Governance and the Rise of Integrating Corporate Social Responsibility Criteria in Executive Compensation: Effectiveness and Implications for Firm Outcomes (2018)*", where they state that the percentage of the S&P 500 companies that had adopted CSR contracting has increased from 12% in 2004 to 37% by 2013. The study shows how the adoption of CSR contracting has brought a number of benefits to the companies:

- Increase in long-term orientation (measured by the longterm index of Flammer and Bansal, 2017)
- Increase in firm value (measured by Tobin's Q)
- Increase in social and environmental initiatives (measured by the KLD-index)
- Reduction in emissions (measured by the toxic release inventory (TRI))
- Increase in green patents

This is obviously relevant from a managerial point of view, as the boards can leverage CSR contracting to align executive incentives with long-term stakeholder and societal goals, improving both governance and firm outcomes.

However, other studies have shown that fulfilling financial targets negatively correlates with fulfilling ESG targets (Homroy et al., 2023), thus creating a crossroads for shareholders and CEOs, who must decide what is most relevant to long-term growth. In addition, limited disclosure and a lack of objective criteria to delineate the achievement of ESG targets, which are often more difficult to quantify objectively than financial targets, makes external evaluation of the effectiveness of incentives difficult, making it complex to understand whether targets have really been achieved or whether greenwashing was used for the sole purpose of unlocking an increase in bonus and pay.

3.Executive compensation and capital structure decisions

3.1 Executive compensation as a tool to influence capital structure

As already mentioned at the beginning of this work, the alignment of incentives between principal (shareholders) and agent (CEO) is essential to ensure that the latter acts in the interest of the company and does not only pursue his own interests.

The compensation of the CEO and its structure and composition may play a key role in the alignment of incentives, as a balanced mix of stock, options, and performance incentives can mitigate excessive risk-taking.

In this chapter, the impact of executive compensation on capital structure decisions will be analysed and quantified, focusing on how CEO incentives influence investment and financing decisions. Indeed, if there is an incentive-based link between compensation type and capital structure, the manager's pay could also be used as a means to influence the CEO's work, thus steering him towards certain choices. Furthermore, by analysing the structure of the CEO's pay, it could predicted, in probabilistic terms, what his financial and leverage choices will be during his term of office. For example, two important components within a CEO's modern remuneration package, stocks and options, might have different impacts on risk appetite and debt choice.

When a significant portion of a CEO's wealth is tied to firm equity, they become more risk-averse, as their personal wealth is exposed to firm-specific risk, so high stock

ownership discourages leverage. In this case, the manager wants to avoid excessive volatility in the share price and a potential risk of financial distress, prefering conservative financing policies, such as maintaining cash reserves and reducing debt levels to safeguard personal wealth.

With options, however, the opposite case could occur, because stock options provide asymmetric payoffs, incentivizing higher risk-taking, as the expected value of options increases with stock return volatility.

Knowing all this, shareholders and compensation committees could use and calibrate these two instruments within the manager's remuneration, according to their optimal view on the capital structure, thus anticipating the CEO's possible behaviour dictated by incentive compensation.

3.2 Six challenges in designing equity-based pay

The growth in the weight of equity-based compensation within CEO pay structures, as seen above, goes to tie the capital structure of companies to the compensation of its top managers. This in theory should ensure greater alignment of incentives between ownership and control, but it also creates possible challenges to keep in mind when deciding on a CEO's future pay.

Brian J. Hall, in his work "*Six challenges in designing equity-based pay (2003)*", describes the challenges to outlining optimal remuneration, and subsequent incentives. The author groups them into 6 categories:

3.2.1 Mismatched time horizons

One of the key issues with equity-based pay is the misalignment of managerial time horizons with long-term shareholder value creation. Equity-based pay is often criticized for incentivizing short-term earnings management to satisfy market expectations, sometimes at the expense of long-term performance. Executives may artificially inflate stock prices by cutting R&D or making decisions that boost shortterm earnings while harming long-term cash flows, or they can liquidate stock and options before long-term performance materializes. This problem is particularly concerning for retiring executives or those facing job insecurity. To mitigate shorttermism, companies should extend vesting periods and implement executive ownership requirements, as asking executives to build and hold substantial stock positions over time strengthens long-term incentives

3.2.2 Gaming

The pressure to meet market expectations, especially in overvalued firms, can incentivize accounting tricks, misleading disclosures, or outright fraud.

Such behaviors may involve, for example, inflating short-term profits through accounting techniques, or stock price manipulation. In addition, there could be the case of backdating and timing of option grants, where CEO waited for the period of favorable news releases to maximize the return from options. Of course, the temptation to game the system increases when the rewards for manipulation are high, and the risks of punishment are low. It is therefore essential that the board of directors strengthens corporate governance and internal controls by monitoring high-risk behaviour, reinforcing ethical standards and shifting the focus from share price alone to a broader assessment of executive performance.

3.2.3 The Value-Cost "Wedge"

For firms, the cost of granting equity is its opportunity cost: the amount the company could receive if it sold the shares to outside investors. However, executives (and employees) tend to value equity grants at a discount due to their risk aversion and lack of portfolio diversification. Because executives are often required to hold large amounts of company stock, they cannot freely diversify their personal wealth, making them less willing to assign full market value to their equity compensation. The author points out that for stock grants, the discount in value is modest (typically 15% lower than market value), but for stock options, the value-to-cost (V/C) ratio can range from 0.8 to as low as 0.4, meaning executives often discount option value by 20% to 60% relative to its Black-Scholes valuation. This discrepancy results in a "deadweight loss" to shareholders, as the firm must grant more equity to achieve the intended incentive effect.

3.2.4 The Leverage-Fragility Tradeoff

Stock options are a leveraged incentive tool, allowing companies to grant more options than shares for the same cost. Because options magnify gains when stock prices rise, they provide executives with strong incentives to increase firm value. However, this leverage effect works both ways, so when stock prices decline, options lose value much more rapidly than shares, making them fragile incentives. Furthermore, many firms reprice underwater options or grant new options to offset devalued grants, diluting shareholder equity. We will discuss options and their effect on the CEO's incentives in more detail in the continuation of the discussion.

3.2.5 Aligning Risk-Taking Incentives

In the absence of incentives, CEOs tend to be overly conservative, because they are more likely to be fired for poor performance, making them hesitant to pursue risky but high-payoff strategies. As we have seen, this can be corrected through the weighted introduction of equity-based compensation within pay. Option, since they became more valuable as stock volatility increases, became the perfect instrument for incentivizing risk-taking. However, their actual impact on executive behavior depends on whether the options are at-the-money (ATM), in-the-money (ITM), or out-of-the-money (OTM). The strongest risk-taking incentives occur when options are deeply out-of-the-money, as these provide executives with a "lottery-like" payoff structure, where taking on volatility is the only way to generate value. Thus, standard at-the-money options may not always increase risk appetite, especially as they move deeper into the money over time. This aspect will also be explored later (Lewellen (2006))

3.2.6 Avoiding Excess

CEO pay has outpaced average worker compensation, and some firms grant excessive golden parachutes and severance packages even for underperforming executives. The complexity of equity pay reduces transparency, making it easier for overly friendly boards to justify excessive executive compensation without fully grasping the true value transfer to executives, a situation that might be avoided if equity-based pay were simpler and more transparent.

The challenges in designing equity-based pay reflect the complex trade-offs between incentive alignment, risk-taking behavior, and shareholder value protection. Companies must carefully calibrate equity compensation structures to mitigate shorttermism, manipulation, excessive risk-taking, and inefficiencies.

3.3 Executive risk appetite and leverage decisions

Finding the optimal level of indebtedness, or around it, is critical to maximising shareholder value. For this reason, it is essential to understand the CEO's appetite for risk and debt, as both overinvestment and underinvestment could lead the company into less than rosy scenarios.

If a company is in a state of over-indebtedness, it will have to pay high interest charges, which can strain cash flow, reducing financial flexibility and, consequently, making it impossible for the company to invest further if there are growth opportunities or research and development plans. All this, in a competitive market, is detrimental to the company, which will find itself less prepared for product and market changes. Moreover, a highly indebted company will face an exorbitant cost of capital, with the looming risk of bankruptcy or financial distress. Finally, the company will also be

much more volatile to market fluctuations, during recessions or industry-specific downturns.

While excessive debt can be dangerous, being overly conservative with borrowing can also be detrimental, as the lack of funds could lead to underinvestment in important areas in order to keep up with competitors, such as research and development market entry, CAPEX etc. An under-indebted company, moreover, miss out on potential tax benefits since interest expenses are tax-deductible in many jurisdictions.

Consequently, companies need to strike a balance between leveraging debt for growth and maintaining financial stability, ensuring they remain competitive and adaptable to changing market conditions. To do so, it is indispensable that shareholders balance risk-taking incentives with financial stability, ensuring that executive compensation policies support optimal capital structure choices.

To understand the importance of leverage decisions and the impact that bad decisions can have on a company, two cases will be illustrated below, to clarify how mismanaging financial strategies can lead to catastrophic business failure.

The first case is that of Toys "R" US, founded in 1948 by Charles Lazarus, with the idea of selling toys just like food was sold in supermarkets, revolutionizing the toy industry by offering a wide selection of toys in large warehouse-style stores. In 2005, this chain was acquired by a consortium of private equity firms, through a leveraged buyout (LBO), a financial transaction involving the acquisition of the company's ownership with borrowed funds, with the company's own assets as collateral for the loan. This greatly burdened the company's debt position, which among other things

was competing with rising companies such as Walmart and Amazon, which were again revolutionizing the way goods were sold and bought. Precisely because of its heavy debt position, Toys R US was unable to keep up with the competition, sticking to physical stores and not focusing effectively on e-commerce. Because of this, slowly sales began to decline and the company's financial position continued to deteriorate year by year. In September 2017, the company filed for Chapter 11 bankruptcy protection and by March 2018, it announced the closure of all its stores in the U.S., leading to 33,000 job losses.⁶

The opposite case, however, is that of BlackBerry, formerly known as Research In Motion, founded in 1984 by Mike Lazaridis and Douglas Fregin. The firm was a pioneer in mobile communication, providing secure email services and QWERTY-keyboard devices that appealed to corporate professionals. By 2008, BlackBerry controlled nearly 20% of the global market, reaching a valuation of \$80 billion. From there on, however, things changed very quickly, as the company did not invest enough in innovation and research and development, thus being totally overpowered by competitors such as Apple and Samsung. By 2013, BlackBerry's global market share

⁶ https://www.cnbc.com/2019/01/26/toys-r-us-built-a-kingdom-and-the-worlds-biggest-toy-store-then-they-lost-it.html

https://www.reuters.com/article/business/how-5-billion-of-debt-caught-up-with-toys-r-us-idUSKCN1BV0FQ/ https://www.reuters.com/article/us-toys-r-us-restructuring/toys-r-us-says-to-shut-a-fifth-of-its-u-s-storesidUSKBN1FD09L/

https://www.reuters.com/article/business/toysrus-closes-31-billion-financing-facilities-idUSASB0BKTY/ https://www.reuters.com/article/business/toys-r-us-seeks-bankruptcy-to-survive-retail-upheavalidUSKCN1BT2AU/

https://www.nytimes.com/2023/06/21/books/review/plunder-brendan-ballou-these-are-the-plunderers-gretchen-morgenson-joshua-rosner.html

https://www.nytimes.com/2018/06/30/business/toys-r-us-closing.html

https://www.nytimes.com/2018/03/15/business/toys-r-us-bankruptcy.html

https://www.nytimes.com/2017/09/19/business/dealbook/toys-r-us-bankruptcy.html

had dropped below 3%, and by 2016 it was less than 1%, announcing shortly afterwards the cease of the smartphones manufacturing. Probably a greater allocation of resources in research and development, including through more debt, could have led the company to different fortunes, remaining competitive in the smartphone sector and allowing the switch to the touchscreen, which instead came too late, when competitors were unreachable⁷.

Both these examples show how financial mismanagement can lead to business failure: Toys "R" Us took on excessive debt, which prevented it from innovating and modernizing, while BlackBerry failed to invest in emerging technologies, allowing competitors to outpace it. Over-indebtedness, can limit a company's ability to invest in necessary upgrades, leading to an inability to compete in a rapidly evolving market. Conversely, underinvestment, as demonstrated by BlackBerry, can transform a oncedominant business obsolete when it fails to recognize and respond to industry shifts. This therefore clearly shows how the incentives for risk-taking and leveraging should be measured carefully, as the damage caused by poor choices could be irreparable.

⁷ https://www.investopedia.com/articles/investing/062315/blackberry-story-constant-success-failure.asp https://techcrunch.com/2022/01/03/blackberry-phones-once-ruled-the-world-then-the-world-changed/ https://www.statista.com/chart/8180/blackberrys-smartphone-market-share/ https://stockanalysis.com/stocks/bb/market-cap/

https://www.forbes.com/sites/tomtaulli/2013/09/23/lessons-from-the-fall-of-blackberry/ https://www.reuters.com/article/us-blackberry-lawsuit/blackberry-must-face-revived-u-s-lawsuit-overblackberry-10-

idUSKBN1GV2XY/#:~:text=BlackBerry%20decided%20in%202016%20to%20stop%20making,prosecution%20of %20James%20Dunham%2C%20a%20former%20chief

3.4 Empirical evidence on executive compensation and capital structure

This chapter will analyze the empirical evidence that has emerged from the scientific literature, thus going on to quantify the impact that executive compensation can have on capital structure decisions.

One of the most important studies on the subject is certainly that carried out by JL Coles, ND Daniel, L Naveen, entitled "*Managerial incentives and risk-taking (2006)*", which aims to answer two essential questions:

- Does higher vega lead to riskier corporate policies, such as increased R&D, higher leverage, and reduced capital expenditures?
- Does firm risk and policy choice affect the compensation structure, influencing both vega and delta?

Vega is the sensitivity of CEO wealth to stock price volatility. In other words, it represent a measure of how the value of a CEO's stock option holdings changes in response to a change in the volatility of the company's stock returns.

This parameter is relevant because stock options are convex instruments, and so they increase in value when volatility rises. Unlike shares, which can lose value if stock prices decline, with unlimited loss potential, options offer limited downside risk (since the owner does not have to exercise them if the stock price falls below the strike price) but unlimited upside potential when stock price volatility increases.

So, theoretically, if a CEO is granted a large portion of compensation in stock options, their wealth becomes highly sensitive to volatility, as options gain value when stock price fluctuations intensify, and if a CEO's pay is mostly in fixed salary or restricted stock, their incentives are more aligned with stability rather than volatility.

Delta measures the sensitivity of a CEO's wealth to changes in the company's stock price. More formally, it represents the change in the value of an executive's equity holdings for a 1% change in the firm's stock price. In mathematical terms, delta is the partial derivative of the CEO's equity-based compensation with respect to stock price movements.

Intiutively, A CEO with high delta is motivated to increase firm value since their personal wealth grows with rising stock prices. Consequently, it could be argued that delta and vega often create opposite incentives, as a high vega directs the CEO towards risk-seeking, while a high delta directs the CEO towards a risk-averse situation.

The paper then uses empirical data to understand what effects these two parameters may have on CEO capital structure choices, using a reference sample of firms in the S&P 500, S&P Midcap 400, and S&P Smallcap 600, for the period 1992-2002.

First, in the table below, we see the effects that an increase in vega or delta can have on the amount of R&D expenditure and CAPEX: hence, it is clear that both vega and delta are closely related to the investment choices in R&D and CAPEX. In particular, the effect of a one standard deviation increase in vega is to increase investments in R&D and decrease CAPEX. This could be explained because R&D projects have uncertain payoffs and long development cycles, leading to higher earnings volatility while CAPEX investments generally provide stable but predictable returns with less volatility, and CEOs incentivized by vega may reduce CAPEX spending in favor of riskier projects that increase stock price fluctuations. Higher delta seems, on the contrary, to lead to conservative policies: lower R&D and higher CAPEX.

Another interesting connection is that between debt and the vega coefficient. As we can see in the table, vega has a significant effect on leverage and a one standard deviation change in vega increases book leverage by 65% (the mean value is 0.23, so there is a change of 0.15).

Again, the delta effect is opposite, with a decrease in debt found as this coefficient increases. This is an important result, as it shows how there is a link between the structure of managerial compensation and the choices the CEO makes regarding capital structure. Underlying this is always a question of incentives, which must be delineated in the right way so that the manager is aligned with the shareholders' vision, thus avoiding speculative actions for personal gain.

The dependent variable is book leverage defined as book debt divided by book value of total assets. Vega is the dollar change in the CEO's wealth for a 0.01 change in standard deviation of returns. Delta is the dollar change in the CEO's wealth for a 1% change in stock price. Predicted and residual incentives are the predicted values and residuals from regressions of vega and delta on endogenous and control variables. Control variables are as described in Appendix 1. The predicted signs for the variables of interest are given to the left of the coefficient. Dollar values are in millions of year 2002 dollars. Intercepts not reported. t-statistics based on robust standard errors are within parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level.

Independent Variables		Industry FE	Firm FE	Predicted	Predicted+ Residuals
Vega _{t-1}	(+)	0.056 ^{***} (2.8)	0.024 (1.3)		
Predicted Vega t-1	(+)			0.556 ^{***} (5.2)	0.576 ^{***} (5.5)
Residual Vega _{t-1}	(+)				0.047 ^{**} (2.1)
Delta t-1	(±)	-0.008 ^{***} (-2.8)	-0.010 ^{***} <i>(-3.6)</i>		
Predicted Delta t-1	(±)			-0.087 ^{***} (-6.5)	-0.088 ^{***} (-6.6)
Residual Delta _{t-1}	(±)				-0.003 (-1.0)
Tenure		-0.001 ^{**} (-2.2)	-0.000 (-0.4)	0.002 ^{***} (4.6)	0.002 ^{***} <i>(4.7)</i>
Cash compensation		-0.004 ^{**} (-2.0)	-0.008 ^{***} (-4.6)	-0.013 ^{***} (-4.6)	-0.013 ^{****} (-4.7)
Log(sales)		0.013 ^{***} <i>(7.3)</i>	0.046 ^{****} (13.4)	0.013 ^{***} (4.1)	0.013 ^{***} (4.0)
Market-to-book		-0.002 (-0.7)	-0.000 (-0.2)	0.004 (1.6)	0.005 [*] (1.7)
ROA		-0.382 ^{***} (-9.3)	-0.412 ^{***} (-20.6)	-0.364 ^{***} <i>(-8.8)</i>	-0.362 ^{****} (-8.7)
Net PPE		0.073 ^{***} (5.0)	0.004 (0.2)	0.066 ^{***} <i>(4.6)</i>	0.067 ^{***} <i>(4.7)</i>
R&D		-0.350 ^{***} <i>(-5.9)</i>	-0.012 (-0.3)	-0.435 ^{****} (-6.6)	-0.437 ^{***} (-6.6)
Z-score (x 10 ⁻⁶)		-1.25 ^{**} (-2.1)	-1.310 ^{***} <i>(-4.5)</i>	-0.918 ^{**} (-2.0)	-0.915** (-2.0)
Firm fixed effects			YES		
2-digit SIC controls		YES		YES	YES
Observations		8865	8865	7396	7396
R ²		18%	9%	21%	21%

Figure 7 Source: "Managerial incentives and risk-taking (2006)" by Coles, ND Daniel, L Naveen

Simultaneous regressions of book leverage, vega, and delta are reported. Book leverage is book debt divided by total assets. Vega is the dollar change in the CEO's wealth for a 0.01 change in standard deviation of returns. Delta is the dollar change in the CEO's wealth for a 1% change in stock price. Control variables are as described in Appendix 1. The predicted signs for the variables of interest are given to the left of the coefficient. Dollar values are in millions of year 2002 dollars. Intercepts not reported. t-statistics based on robust standard errors are within parentheses. ***, **, and * indicate statistical significance at the 1%. 5%. and 10% level.

Indonondont Variables		Book		Voga		Dolta
Vega t	(+)	1.322 ^{***}		vega		5.203 ^{***}
Delta t	(±)	-0.233 ^{***} (-3.8)		0.013 ^{***} (3.6)		(10.2)
Tenure		0.007 ^{***} (3.2)				0.031 ^{***} (27.2)
Cash compensation		-0.003 (-0.5)		0.028 ^{***} <i>(24.0)</i>		
Log(sales)		0.000 (0.0)		0.032 ^{***} <i>(32.1)</i>		-0.024 <i>(-1.3)</i>
Market-to-book		0.033 ^{**} <i>(2.5)</i>		0.008 ^{***} <i>(</i> 7. <i>1</i>)		0.165 ^{***} <i>(22.1)</i>
ROA		-0.179 ^{***} <i>(-5.3)</i>				
Net PPE		0.073 ^{***} <i>(3.3)</i>				
R&D		-0.512 ^{***} (-5.6)	(+)	0.088 ^{***} (5.6)	(-)	-1.239 ^{***} <i>(-8.9)</i>
Z-score (x 10 ⁻⁶)		-0.841 ^{**} (-2.0)				
Book leverage			(+)	0.038 [*] <i>(1.7)</i>	(-)	-1.232 ^{**} (-2.5)
CAPEX			(-)	-0.061 ^{***} <i>(-3.3)</i>	(+)	0.721 ^{***} <i>(4.1)</i>
Firm risk			(+)	0.022 ^{***} (15.1)	(±)	-0.019 <i>(-1.2)</i>
Surplus cash						0.036 (0.2)
2-digit SIC controls		YES		YES		YES
Observations		9438		9438		9438

Figure 8 Source: "Managerial incentives and risk-taking (2006)" by Coles, ND Daniel, L Naveen

In conclusion, what emerges even more from this study is the im portance of correctly structuring CEO pay, since the composition of remuneration can influence, even overwhelmingly, the choices the CEO will make in terms of capital structure, investments and choice of risk profile.

Another aspect to take into account is that options, as seen above, can be in, at or out of the money. It is plausible to ask, at this point, whether the status of the option can change the manager's incentives. The answer would seem to be positive, as found in Lewellen's (2006) study, which highlighted how CEO financing incentives have a significant impact on leverage decisions, also demonstrating how stock options do not always encourage risk-taking, showing that in-the-money options actually increase risk aversion and lead to lower leverage.

This is true because an option in the money has a stock price (S_0) which is higher than the strike price (K). This means that the CEO who holds these options is already theoretically in a positive situation, since by selling the options he would make a profit This implies a change in his attitude to risk, since if it is true that out-of-the-money options have convex payoffs and their value increases more as stock price volatility increases, encouraging CEOs to take more risks, when the stock becomes in-the-money the CEO's wealth becomes increasingly exposed to downside risk if the stock price drops, and so the CEO wants to protect their paper gains rather than gamble with firm risk. All this is reflected in a shift in the incentives of the CEO, who initially, with out-ofthe-money options, has an incentive to take on debt to increase the volatility of the share price (and consequently the option price), but instead, with in-the-money options, seeks to reduce risk and volatility to ensure that the gains from exercising the options are stable, resulting in a lower propensity to take on debt and a risk-averse attitude. Finally, another important study on the subject is that of Berger, Ofek and Yermack (1997), in which the link between stock options and the presence of debt is further noted, as shown below. The regression shows that the link between debt and options is stronger than the link between debt and stock ownership. The results on options are also found to be more statistically significant than those on shares (in all four cases, the option coefficients are significant at 1% level). This confirms what was said earlier, with managers pushing debt to increase share price volatility and consequently the price of options.

Regression coefficient estimates: Determinants of capital structure levels

OLS regression coefficients for models of capital structure levels. The sample consists of 3,135 observations for 435 companies in the 1984-91 period. Variable definitions appear in Table I. T-statistics appear in parentheses below each coefficient estimate. The left columns present pooled cross-sectional time series estimates for the entire sample, while the right columns present cross-sectional regressions using the time series mean values within each company.

Pooled	Pooled	Within-firm averages	Within-firm averages	
Leverage	<u>Leverage</u>	<u>Leverage</u>	<u>Leverage</u>	
(book value)	(market value)	(book value)	(market value)	
0.137 ***	* 0.231 ***	0.198 **	0.335 ***	
(3.69)	(5.82)	(2.06)	(3.21)	
2.567 ***	* 3.054 ***	4.592 ***	4.700 ***	
(5.16)	(5.75)	(3.09)	(2.90)	
-0.042	-0.088 ***	-0.084	-0.121	
(1.45)	(2.82)	(1.23)	(1.62)	
-0.006 **	-0.013 ***	-0.016 *	-0.029 ***	
(2.11)	(4.23)	(1.75)	(2.84)	
0.0001	0.025	-0.036	-0.006	
(0.01)	(1.47)	(0.92)	(0.14)	
-0.037 ***	* -0.028 **	-0.046	-0.034	
(3.06)	(2.11)	(1.52)	(1.04)	
-0.332 ***	-0.747 ***	-0.361 ***	-0.945 ***	
(11.22)	(23.61)	(4.26)	(10.24)	
-4.688 ***	• -1.870 ***	-6.161 ***	-2.293	
(8.53)	(3.19)	(4.18)	(1.43)	
0.083 ***	• 0.053 **	0.127 **	0.092	
(3.88)	(2.33)	(2.40)	(1.59)	
0.035 ***	* 0.046 ***	0.031 ***	0.034 ***	
(10.40)	(12.87)	(3.86)	(3.91)	
Yes	Yes	Yes	Yes	
Yes	Yes	No	No	
3,135	3,133	435	435	
0.276	0.421	0.391	0.535	
18.0	34.3	4.2	7.4	
0.00	0.00	0.00	0.00	
	Pooled Leverage (book value) 0.137 ** (3.69) 2.567 ** (5.16) -0.042 (1.45) -0.006 ** (2.11) 0.0001 (0.01) -0.037 ** (3.06) -0.332 *** (11.22) -4.688 *** (8.53) 0.083 *** (8.53) 0.083 *** (10.40) Yes Yes Yes 3.135 0.276 18.0 0.00	PooledPooledLeverage (book value)Leverage (market value) 0.137 **** (3.69) 0.231 2.567 **** (5.16) 3.054 2.567 **** (5.16) 3.054 -0.042 (1.45) -0.088 -0.042 (1.45) -0.013 (2.82) -0.006 *** (2.11) -0.006 (0.01) -0.025 (1.47) -0.037 (3.06) -0.747 (2.11) -0.332 (3.06) -0.747 (2.11) -0.332 (3.19) -0.747 (3.19) 0.083 (3.88) -1.870 (2.33) 0.035 (10.40) 0.053 (12.87) Yes 	PooledPooledWithin-firm averagesLeverage (book value)Leverage (market value)Leverage (book value) 0.137 *** (3.69) 0.231 *** (2.06) 2.567 *** (5.16) 0.575 0.198 ** (2.06) 2.567 *** (5.16) 3.054 *** (5.75) 4.592 *** (3.09) -0.042 (1.45) -0.088 *** (2.82) -0.084 (1.23) -0.006 ** (2.11) -0.013 *** (1.75) -0.006 ** (0.01) -0.025 (1.47) -0.036 (0.92) -0.037 *** (2.11) -0.028 ** (1.52) -0.332 *** (23.61) -0.361 *** (4.18) -4.688 *** (2.33) -1.870 (2.40)*** (3.88) 0.035 *** (2.33) 0.021 (2.40) 0.031 0.035 *** (0.421) 0.031 *** (3.89)Yes 	

*** Significant at 1% level

** Significant at 5% level

* Significant at 10% level

Figure 9 Source: "Managerial entrenchment and capital structure decisions (1997)" by Berger, Ofek and Yermack
4. Empirical analysis on Italian listed companies

4.1 The sample

The sample used in this analysis, provided by Professor Laura Rondi, whom I would like to thank most sincerely, consists of 2617 observations on 173 Italian companies over a time span from 2000 to 2021. This type of dataset is called panel, and contains longitudinal observations, with a two-dimensional structure, in which each unit of the database (in this case each company) is observed over a time span of variable length. By its nature this type of dataset is unbalanced, and this means some data are missing for certain businesses in some years, because companies enter or exit the market during the observation period.

The dataset contains within it numerous variables, relating to the financial, economic and social spheres of the company. For the analysis conducted in this work, only a subset of variables will be used, as listed below:

ceo_age	Age of the CEO
CEO_Chair	Dummy for the CEO Duality
Concentrazione	Percentage held by the majority shareholder (or sum
	if the majority shareholder is a family)
Debt_Asset	Total financial debt
	Total Assets
Debt_Equity	Total financial debt
	Equity
debtml	Medium and long-term debts
debtot	total financial debts
debtst	Short term financial debt
empl	Number of employees in the company
firmname	Name of the company

InstInv	Dummy for the presence of institutional investors
Inpay	natural logarithm of the variable Total_comp
Insales	natural logarithm of the variable sales
MarketToBook	Market-to-book ratio
mktcap	Market capitalization of the company
Nfirm	Unambiguous company reference
nobs	Unambiguous observation reference
Perc_comp_fissa	Fixed
	Total Compensation
Perc_comp_variabile	Variable
	Total compensation
ROA	ROA of the company
sales	Sales of the company
StockOptionDum	Dummy indicating options within the CEO's compensation
tenure	Tenure of the CEO (in years)
Totale_comp	total remuneration of the CEO (including the fair
	value of equity compensation, if any)
totasset	Value of the total asset of the company
uni_degree	dummy for the presence of the degree in the CEO's
	educational background
year	Year observation reference

Table 3: Varbiable list

4.2 Descriptive statistics

To better understand the characteristics of the dataset used in this analysis, it is provided a statistical description of the main variables. In particular, there will be reported measures of central tendency (mean) and dispersion (standard deviation), in order to identify any anomalies, skewed distributions or outliers that could influence the results of the regressions.

Variable	Obs	Mean	Std. Dev.	Min	Max
ceo age	2286	55.836	9.546	29	86
CEO Chair	2586	.307	.462	0	1
Concentrazione	2198	.549	1.487	0	69.716
Debt Asset	2276	.336	.773	0	24.067
Debt Equity	1989	1.342	3.09	0	70.15
debtml	2276	1652247	9480155	0	1.785e+08
debtot	2284	2275324.5	13426855	0	2.726e+08
empl	2284	7797.278	20894.45	27	223953
InstInv	2577	.48	.5	0	1
MarketToBook	2204	1.35	.739	.377	7.769
mktcap	2273	2302313.4	7570376.8	0	1.022e+08
Perc comp fissa	2173	.833	.235	.001	1
Perc comp variabile	2173	.167	.235	0	.999
ROA	2140	.027	.068	775	.401
sales	2284	2806347.9	10265944	4600	1.272e+08
StockOptionDum	2145	.317	.465	0	1
tenure	2514	8.151	7.13	1	42
Totale comp	2409	1005.346	1662.156	0	36720
totasset	2276	5478701.9	21176155	7968	2.847e+08
uni degree	2279	.819	.385	0	1

Table 4: Descriptive statistics

Another interesting analysis that can be done, having enough data to support it, is to understand whether the empirical data reflect the trends on CEO compensation expressed in the previous chapters.

First, it is interesting to note the average trend in the value of total compensation over the years:



Figure 10: Average Italian CEO compensation per year (K€)

Two aspects clearly emerge from the graph: the first is that CEO remuneration has increased significantly in Italy over the last twenty years, with the average salary having more than doubled in the space of twenty years. The second interesting aspect that emerges is the impact that national or global crises can have on CEO compensation. Looking closely at the graph, there are three-year periods in which the average ceo compensation decreases, which perfectly match with the three major economic crises that occurred in USA, Europe and beyond. The first was the dot-com bubble, a massive speculative boom in the stock prices of internet-based companies (dot-coms) that occurred between the mid-1990s and early 2000s, followed by a dramatic crash in 2000-2002, with the Nasdaq that lost nearly 80% of its value, wiping out trillions of dollars. The aftermath of the crisis, albeit with less intent, has also arrived in Europe and Italy, putting the stock markets and thousands of companies under pressure.

The second was the subprime crisis (2007-2009), caused by excessive lending to highrisk (subprime) borrowers in the U.S. housing market, which caused another crash in global stock markets and the failure of several US banks (Bear Stearns, Lehman Brothers, AIG etc.)

The third crisis is closely linked to the second, as Europe's banking system was heavily exposed, leading to the Eurozone crisis (2010-2012) that affected all the European countries, with the most difficult situations experienced by countries such as Greece, Ireland, Portugal, Spain, and Italy, the states with greater exposure to sovereign debt. Finally, as studies on the subject have also shown (i.e. Bedford et al. 2023), the pandemic crisis did not impact the average CEOs' salaries; indeed, paradoxically, the opposite effect occurred, with average salaries rising driven mainly by the tech sectors, which saw exponential growth during the pandemic.

Another interesting aspect is that concerning the percentage of fixed versus variable compensation, and how these two parts of compensation have changed over the years.



Figure 11: Average variable compensation percentage of Italian CEOs per year

Again, the empirical data correspond exactly to what has been described in the previous chapters: over the years there has been a steady increase in the variable part of compensation at the expense of the fixed component, as a way to increase payperformance sensitivity.

However, the magnitude of the two phenomena just shown is of lesser intensity than their American counterparts, and this can be explained by the fact that in Italy, many companies have a concentrated ownership, often family or state-owned, while in the US, public companies with a diffuse shareholding prevail. Furthermore in Italy persist a more conservative corporate culture, which emphasises management stability and less its incentivisation through stock options and high bonuses. In addition, here again it could be seen a possible effect of the subprime crisis, which has had a significant impact on the structure of CEO compensation, both in Italy and globally.

The crisis has led to increased scrutiny by regulators and public opinion on excessive or perceived unjustified compensation, and in order to reduce the risk of litigation and maintain a good reputation, many companies have limited the variable portion, focusing on more transparent and predictable compensation. In addition, many companies reduced the emphasis on the variable component to prevent CEOs from being incentivized to pursue risky, short-term strategies, having clear in mind the disaster and consequences that excessive risk-taking brought to global markets following the outbreak of the crisis.

The increase in the fixed portion sought to promote a more prudent approach to corporate management, so as to limit what had happened in the USA a few years earlier from happening again. The lowering of the variable share in the CEO compensation in the years following the crisis is clearly visible from the graph, and this confirms how CEO compensation is an extremely complex issue that can be influenced by countless macroeconomic factors.

4.3 Preliminar analyses

4.3.1 Pay-performance sensitivity in the Italian context

An interesting statistic is the pay-performance sensitivity, as it makes possible to assess how much the CEO's remuneration is linked to the company's performance. This is important because, as mentioned above, effective incentive system can align the interests of management with those of shareholders, reducing the risk of conflicts of interest (agency problem).

The regression model adopted from now on can be represented analytically as:

$$Y_{it} = \alpha_i + \beta_1 X_{1,it} + \dots + \beta_k X_{k,it} + u_{it}$$

Where

- Y_{it} is the dependent variable. *i* indicates the company and *t* indicates the reference year.
- α is the model intercept, which mathematically represent the value of Y when all X's are zero
- $X_{1,it}, ..., X_{k,it}$ represent the independent variables used, which will be described in detail below
- β₁,..., β_k are the coefficients of the regression variables. Each coefficient shows the expected change in the dependent variable (Y) for a one-unit increase in the independent variable (X), holding all other variables constant. Therefore through the coefficients it is possible to quantify the relationship between independent variables and the dependent variable.
- u_{it} is the error term, which captures unobserved factors affecting Y.

The following is a regression analysis aimed at quantifying pay-performance sensitivity in the Italian context, then adding control variables to better isolate the effect of the main independent variable on the dependent variable, reducing the risk of omission of relevant variables and improving the reliability of the results. In this regression, it has been used the conversion of certain variables into logarithms, so that the coefficient of the variables is a measure of elasticity, i.e. the percentage of change in CEO compensation following a 1% change in the variable in question. This can be explained mathematically because:

$$\ln(Y_i) = \alpha + \beta_1 \ln(X_i) + u_i$$
$$\ln(Y_i + \Delta Y) = \alpha + \beta_1 \ln(X_i + \Delta X)$$
$$\ln(Y_i + \Delta Y) - \ln(Y_i) = \beta_1 [\ln(X_i + \Delta X) - \ln(X_i)]$$

which for small variations of x becomes:

$$\frac{\Delta Y}{Y_i} = \beta_1 \frac{\Delta X}{X_i} \rightarrow \beta_1 = \frac{\Delta Y/Y_i}{\Delta X/X_i}$$

It is presented a panel model with fixed effects to control for time-invariant firm characteristics that could influence the relationship between CEO compensation and firm performance. The use of fixed effects allows to isolate intra-firm variation, mitigating problems of omitted variable bias. In addition, robust standard errors are applied to correct for heteroschedasticity and serial autocorrelation problems, improving the reliability of statistical inferences. This because traditional OLS assumes that the variance of the errors is constant (homoskedasticity), but if this assumption is violated , the standard errors will be biased, leading incorrect statistical inference. The

robust option on Stata corrects the standard errors so they are valid even when

heteroskedasticity is present.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	lnnav	lnnav	lnnav	lnnav	lnnav	lnnav
VIIIIIIIIIIII	mpuy	mpuy	mpuy	mpuy	mpuy	mpuy
lnmktcap	0.174***	0.0988**	0.0956**	0.0924**	0.0877**	0.0933**
-	(0.0463)	(0.0430)	(0.0420)	(0.0423)	(0.0413)	(0.0416)
Insales		0.361***	0.326***	0.326***	0.326***	0.320***
		(0.0916)	(0.0939)	(0.0939)	(0.0920)	(0.0917)
tenure			0.0256***	0.0303***	0.0305***	0.0302***
			(0.00636)	(0.00836)	(0.00831)	(0.00830)
ceo age				-0.00507	0.0654*	0.0679*
				(0.00538)	(0.0369)	(0.0370)
ceo_age_Squared					-0.000612*	-0.000633**
					(0.000311)	(0.000312)
Debt_Asset						0.0359***
_						(0.00769)
Constant	4.203***	0.439	0.725	1.016	-0.894	-0.972
	(0.590)	(1.065)	(1.078)	(1.048)	(1.312)	(1.309)
Observations	2,150	2,125	2,107	2,106	2,106	2,102
R-squared	0.040	0.103	0.133	0.136	0.143	0.144
Number of Nfirm	169	169	169	169	169	169

Table 5 Regression analysis on pay performance sensitivity over the period 2000-2021

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

For a 1% increase in the company's market cap, the CEO's pay increases by 0.174%. This means that if the market value of the company were to double, on average a CEO would see his pay increase by 17%. With the addition of control variables this percentage drops, settling around values between 0.09% and 0.01% (so respectively 9% and 10% in the case of a doubling of the market valuation).

Certainly the characteristics of the country under investigation, Italy, also weigh on these results, because there is a lower use of equity-based components compared to other country (like USA), a higher fixed component, as seen above, with a more family concentrated business model, resulting in less pressure to align pay with market performance.

It is also clear from the regression that increasing company size increases CEO pay. Thus it is confirmed what can intuitively be thought, namely that CEOs of larger companies earn more on average than CEOs of smaller companies. Another fairly intuitive result is that of tenure, and the positive effect that has on pay: the longer the tenure, the higher the pay downstream of the experience gained in the company.

With regard to age, it could be seen an initially positive effect on pay (younger CEOs gain experience, reputation, and negotiating ability, increasing their compensation), which, however, flattens out at some point and even becomes negative (older CEOs may approach retirement or be replaced, reducing their negotiating power, also the board may begin succession planning, reducing bonuses or long-term stock options). This nonlinear relationship can be seen by looking at the coefficients of the regression, as the first-degree coefficient has a positive coefficient, while the second-degree coefficient has a negative coefficient. Since the effect is parabolic, the exact point at which there is reversal coincides with the vertex of the parabola, which can be easily calculated:

$$vertex = -\frac{\beta_1}{2\beta_2}$$

where β_1 is the coefficient of the first-degree variable, and β_2 is the coefficient of the variable squared. Applying the formula to the case at hand shows that the reversal of the effect of age increase on pay occurs at 54.

From now on, since the presence of options will come into play, for more accurate results the investigation period will be narrowed down from 2011 to 2021. This is because in 2011, the Italian regulatory framework concerning the transparency of remuneration in listed companies underwent major changes. In view of the implementation of Commission Recommendations 2004/913/EC and 2009/385/EC the Council of Ministers issued Legislative Decree No. 259 of 30 December 2010 providing for the introduction of the new Article 123-ter in the Testo Unico della Finanza (TUF), which requires listed companies to prepare and publish an annual remuneration report. This report, divided into two sections, must illustrate the remuneration policy for the following year and provide an account of the remuneration paid to the members of the administration and control bodies, general managers and managers with strategic responsibilities. These provisions came into force on 31 December 2011 and were first applied at the shareholders' meetings to approve the 2011 financial statements.

The results of the regression on the restricted time period are shown below:

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Inpay	Inpay	lnpay	lnpay	lnpay	lnpay
lnmktcap	0.131**	0.112**	0.0911*	0.0901**	0.0959**	0.0944**
	(0.0586)	(0.0532)	(0.0464)	(0.0453)	(0.0457)	(0.0463)
Insales		0.233*	0.250*	0.246*	0.241*	0.239*
		(0.136)	(0.133)	(0.132)	(0.127)	(0.127)
tenure			0.0189**	0.0242*	0.0253**	0.0250**
			(0.00756)	(0.0123)	(0.0124)	(0.0124)
ceo_age				-0.00515	0.113***	0.116***
				(0.00884)	(0.0405)	(0.0407)
ceo_age_squared					-0.00103***	-0.00106***
					(0.000360)	(0.000362)
Debt_Asset						-0.0530***
						(0.00779)
Constant	4.948***	2.112	1.976	2.287	-1.014	-1.043
	(0.753)	(1.631)	(1.608)	(1.644)	(1.997)	(1.994)
Observations	965	943	935	934	934	933
R-squared	0.028	0.040	0.058	0.060	0.077	0.082
Number of Nfirm	144	144	144	144	144	144

Table 6 Regression analysis on pay performance sensitivity over the period 2011-2021

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

As can be seen, the signs of the coefficients remain unchanged, and thus their effects on the dependent variable are essentially the same as in the regression over the entire period from 2000 to 2021. The only coefficient that changes sign is the debt/assets ratio. Here, too, the effect of the 2008 crisis may be felt, as companies have become more cautious in their use of debt, and regulation has limited the use of aggressive compensation structures, with the consequence that highly indebted companies may have had to reduce CEO remuneration in response to pressure from investors and regulators.

Now it is interesting to understand the impact of stock options on pay-performance sensitivity: the following are two regressions, for the quantification of pay perfomance sensitivity, distinguishing between companies that do not include the option instrument within CEO remuneration and those that do, in order to determine if stock options truly align CEO incentives with firm performance or if they primarily encourage risk-taking without a corresponding increase in firm value.

Below is the first group of companies, where the dummy for the presence of options takes the value 0

Table 7 Regression analysis on pay performance sensitivity over the period 2011-2021 on the subgroup in whichthe CEO does not receive options

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	lnpay	lnpay	lnpay	lnpay	lnpay	lnpay
lnmktcap	0.170***	0.158***	0.125**	0.125**	0.136***	0.116**
	(0.0504)	(0.0531)	(0.0498)	(0.0498)	(0.0493)	(0.0533)
Insales		0.0422	0.0902	0.0890	0.0788	0.0962
		(0.114)	(0.114)	(0.114)	(0.107)	(0.115)
tenure			0.00933	0.00780	0.00843	0.00869
			(0.0104)	(0.0136)	(0.0140)	(0.0139)
ceo_age				0.00203	0.0851	0.0866
				(0.0110)	(0.0769)	(0.0772)
ceo_age_squared					-0.000738	-0.000751
					(0.000726)	(0.000729)
Debt_Asset						-0.535
						(0.493)
Constant	4.263***	3.881***	3.578**	3.489**	1.201	1.341
	(0.623)	(1.445)	(1.470)	(1.498)	(2.669)	(2.673)
Observations	612	592	585	585	585	584
R-squared	0.040	0.036	0.033	0.034	0.042	0.048
Number of Nfirm	107	107	107	107	107	107
	1	Dalarrat atau da				

Robust standard errors in parenthese *** p<0.01, ** p<0.05, * p<0.1

The pay performance sensitivity increases with respect to the analysis of the entire sample, while the signs of the coefficients of the variable of interest and the control variable remain almost the same.

Continuing, it is reported the regression performed on the sub-sample where the dummy on options takes value 1, thus in all those companies that use options within

the CEO's pay.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	lnpay	lnpay	lnpay	lnpay	lnpay	lnpay
lnmktcap	0.229**	0.147	0.148	0.112	0.0871	0.0866
	(0.103)	(0.116)	(0.118)	(0.113)	(0.109)	(0.108)
Insales		0.454	0.291	0.292	0.321	0.304
		(0.388)	(0.393)	(0.394)	(0.368)	(0.363)
tenure			0.0379***	0.0703**	0.0721***	0.0705**
			(0.0128)	(0.0270)	(0.0267)	(0.0270)
ceo_age				-0.0278	0.165	0.190
				(0.0211)	(0.135)	(0.134)
ceo_age_squared					-0.00173	-0.00195*
					(0.00114)	(0.00112)
Debt_Asset						-0.0507***
						(0.00823)
Constant	3.987***	-1.175	0.724	2.439	-2.905	-3.315
	(1.416)	(4.702)	(4.642)	(4.779)	(6.473)	(6.444)
Observations	269	268	267	266	266	266
R-squared	0.039	0.061	0.104	0.124	0.142	0.152
Number of Nfirm	63	63	62	62	62	62
	п	1 4 4 1	1 '	.1		

Table 8 Regression analysis on pay performance sensitivity over the period 2011-2021 on the subgroup in whichthe CEO receives options

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

As can be seen, excluding regression without control variables, the coefficients indicating pay-performance sensitivity are on average lower than in the previous case. This is an interesting result, and finding that pay-performance sensitivity is lower in firms where CEOs receive stock options could suggests that, rather than aligning executive incentives with firm performance, stock options in Italy may be subject to governance distortions and may not be the ideal instrument for the alignment of incentives between shareholders and managers.

But dividing the sample into two subgroups reduces the number of observations in each regression, which leads to an increase in the variance of the estimators and reduces the precision of the estimates. To fully understand the impact of the presence of options, the interaction between variables could be used, obtaining a single regression with interaction and running all observations simultaneously, producing more precise estimates.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	lnpay	lnpay	lnpay	lnpay	lnpay	lnpay
lnmktcap	0.184***	0.164***	0.134***	0.131***	0.142***	0.141***
	(0.0429)	(0.0468)	(0.0429)	(0.0429)	(0.0424)	(0.0422)
1.StockOptionDum	-0.712	-0.710	-0.657	-0.654	-0.622	-0.624
	(0.484)	(0.469)	(0.485)	(0.487)	(0.480)	(0.479)
1.StockOptionDum#c.lnmktcap	0.0636*	0.0622*	0.0576	0.0568	0.0533	0.0534
	(0.0379)	(0.0366)	(0.0373)	(0.0375)	(0.0373)	(0.0372)
Insales		0.126	0.155	0.156	0.143	0.137
		(0.130)	(0.129)	(0.130)	(0.122)	(0.120)
tenure			0.0175**	0.0213*	0.0217*	0.0212*
			(0.00761)	(0.0123)	(0.0123)	(0.0123)
ceo_age				-0.00374	0.125***	0.131***
				(0.00928)	(0.0478)	(0.0478)
ceo_age_squared					-0.00113***	-0.00118***
					(0.000432)	(0.000431)
Debt_Asset						-0.0575***
						(0.00875)
Constant	4.203***	2.808*	2.639*	2.850*	-0.689	-0.733
	(0.550)	(1.568)	(1.579)	(1.625)	(2.132)	(2.124)
Observations	881	860	852	851	851	850
R-squared	0.055	0.057	0.070	0.070	0.087	0.093
Number of Nfirm	133	133	133	133	133	133

Table 9 Regression analysis on pay performance sensitivity over the period 2011-2021 with interactionbetween stock option dummy and market capitalisation

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

The results are interesting, as the interaction between the coefficients is positive,

indicating that, in larger/profitable companies, the negative effect of the stock options dummy is mitigated or reversed. This also indicates that the compensation of CEOs receiving stock options is more sensitive to company performance, and this is in line with the theoretical purpose with which these equity-based instruments were added to CEO compensation, namely to align CEO and shareholder objectives, increasing PPS. In other words, pay-performance sensitivity is more pronounced in companies that offer stock options to their CEOs, but CEOs who receive stock options tend to have lower total remuneration than those who do not.

This could be explained by the fact that stock options represent a form of variable remuneration, the value of which is difficult to predict with certainty, and which is linked to the future performance of the company. CEOs might accept a lower theoretical remuneration in return for the potential future substantial gain from stock options.

Another interesting way to use interactions between variables is to link the dummy on stock options to the debt/asset ratio, to understand whether the relationship between pay and debt changes in the presence of the option instrument.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Inpay	Inpay	Inpay	Inpay	Inpay
Inmktcap	0.192***	0.172***	0.145***	0.142***	0.150***
	(0.0458)	(0.0494)	(0.0467)	(0.0465)	(0.0451)
Debt Asset	-0.413	-0.460	-0.350	-0.348	-0.405
—	(0.311)	(0.323)	(0.314)	(0.313)	(0.324)
1.StockOptionDum	0.00142	-0.0281	-0.000731	-0.00707	-0.0385
-	(0.129)	(0.128)	(0.123)	(0.123)	(0.124)
1.StockOptionDum#c.Debt Asset	0.358	0.407	0.302	0.300	0.350
• <u> </u>	(0.310)	(0.323)	(0.313)	(0.312)	(0.323)

Table 10 Regression analysis on pay performance sensitivity over the period 2011-2021 with interactionbetween stock option dummy and Debt/Asset ratio

Insales		0.151	0.176	0.176	0.161
		(0.135)	(0.135)	(0.136)	(0.126)
tenure			0.0175**	0.0210*	0.0213*
			(0.00780)	(0.0124)	(0.0124)
ceo age				-0.00344	0.135***
				(0.00938)	(0.0486)
ceo_age_squared				. ,	-0.00122***
					(0.000439)
Constant	4.257***	2.529	2.354	2.560	-1.185
	(0.624)	(1.610)	(1.614)	(1.661)	(2.149)
Observations	859	859	851	850	850
R-squared	0.056	0.061	0.072	0.073	0.092
Number of Nfirm	133	133	133	133	133
Ţ		•	.1		

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

The regression shows how, when isolated, both the effect of stock options and the effect of debt are negative on CEO pay. However, when their joint effect is analysed, the sign becomes positive, suggesting that the negative effect of debt on CEO pay becomes less pronounced (or even positive) when the CEO receives stock options.

This means that if, on average, for a CEO who does not receive options, an increase in the debt/asset ratio also leads to a decrease in pay, this is not true (or it is partly true, with a smaller effect) if the CEO receives options, and this clearly could be an incentive to indebtedness, as he/she will suffer less negative pay consequences than someone who does not receive options.

The result becomes even more evident when using a marginsplot, showing how the effect of debt (x-axis) on CEO pay (y-axis) changes according to the presence of stock options.



Figure 12 Margins plot of the interaction between the stock options dummy and the Debt/Asset ratio

4.3.2 The incentive part of the remuneration

A focus can also be made on the incentive share alone, so the part of the remuneration which is variable and depends on the performance of the company.

In this case, the dependent variable becomes *Perc_comp_variabile*, the ratio between the variable and the total compensation. The latter is set in relation to ROA and other control variables, in order to analyse the determinants of the incentive share of total remuneration.

The results below clearly show a positive correlation between ROA and the variable share of compensation, with more or less similar and always statistically significant coefficients in each model. Other factors that are positively correlated with the variable of interest are total sales and tenure. On the latter, the second-degree coefficient was also used to understand the possible existence of an arc relation. Fixed effects and the robust command were also used for this regression to improve the reliability of the results. The findings show that after a certain number of years in the company, the CEO tends to reduce the variable part of his compensation, although the second degree coefficient is not statistically significant. This could be explained on a theoretical level through incentive theory, as younger (or less experienced) CEOs are often more tied to variable incentives to align with shareholder interests and improve company performance, whereas when the CEO has been in the company for many years, he/she tends to be more oriented towards a long-term view and therefore there is less recourse to incentive compensation as a method of aligning interests.

A similar argument can be made with age, where the CEO may have a lower appetite for risk as he or she gets older, reducing the desire to aim for very ambitious or highrisk targets, which are often associated with higher variable compensation.

Finally, the last model has the addition of the varibile indicating the ratio of debt to assets. It can be seen that as this ratio increases, so does the percentage of incentive compensation, and this is an interesting result that lays the groundwork for the analyses that will be proposed later. This is because options are certainly part of equity compensation, which is in itself incentive. For this reason, the last model provides a clue to a possible interaction between debt and the incentive part of remuneration.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	Perc_comp_v ariabile						
ROA	0.286**	0.300***	0.270**	0.255**	0.241**	0.243**	0.246**
	(0.121)	(0.112)	(0.109)	(0.109)	(0.109)	(0.108)	(0.109)
lnsales		0.0923***	0.0831***	0.0841***	0.0834***	0.0839***	0.0838***
		(0.0221)	(0.0230)	(0.0232)	(0.0229)	(0.0225)	(0.0225)
tenure			0.00516***	0.00881***	0.0104***	0.00976***	0.00978***
			(0.00181)	(0.00320)	(0.00353)	(0.00360)	(0.00360)
tenure_sq				-0.000182	-0.000175	-0.000151	-0.000150
uarea				(0.000126)	(0.000124)	(0.000127)	(0.000126)
ceo_age					-0.00189	0.0102	0.0104
					(0.00127)	(0.00846)	(0.00844)
ceo_age_ Squared						-0.000104	-0.000106
Squarea						(7.10e-05)	(7.07e-05)
Debt_Ass							0.00544***
Ct							(0.00158)
Constant	0.165***	-1.057***	-0.978***	-0.998***	-0.897***	-1.245***	-1.249***
	(0.00304)	(0.291)	(0.302)	(0.307)	(0.302)	(0.350)	(0.349)
Observati ons	1,846	1,789	1,774	1,774	1,773	1,773	1,771
R- squared	0.008	0.052	0.064	0.066	0.069	0.071	0.071
Number of Nfirm	143	143	143	143	143	143	143

Table 11 Regression analysis over the period 2000-2021 on the incentive part of remuneration

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

4.3.3 T-test analyses

As a preliminary analysis, some t-tests are carried out to investigate whether there is a significant difference between the averages of two groups from the same population. The test is based on the Student's t-distribution, which is similar to the standard normal distribution but with wider tails, especially for small sample sizes.

The test statistic is calculated using the formula:

$$t=rac{ar{X}_1-ar{X}_2}{SE}$$

The obtained t-value is compared to a Student's t-distribution with a number of degrees of freedom, determined by the sample size. If the p-value associated with the test is below a pre-determined threshold (α typically 0.05 or 0.01), the null hypothesis (i.e. the one in which it is assumed that there is no difference between the averages of the two groups) is rejected and it is concluded that the difference between the averages is statistically significant.

The first t-test presented compares the total financial debt in companies where the CEO does not receive variable remuneration (i.e. he/she will only receive the fixed part), versus the debt in companies where the CEO receives a variable part of compensation. In this case there is a dummy variable that will have value 1 if there is a variable part in the CEO's compensation, 0 if otherwise.

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	1,167	512212.8	70231.03	2399189	374419.4	650006.1
1	1,137	4048676	554930.5	1.87e+07	2959872	5137480
combined	2,304	2257421	278539.1	1.34e+07	1711207	2803634
diff		-3536463	552350.1		-4619619	-2453308
diff :	= mean(0) -	- mean(1)			t :	= -6.4026
Ho: diff :	= 0			degrees	of freedom :	= 2302
Ha: d	iff < 0		Ha: diff !=	0	Ha: d	iff > 0
Pr(T < t) = 0.0000	Pr(T > t) =	0.0000	Pr(T > t)) = 1.0000

The analysis shows that statistically the average debt, in absolute values, is higher in companies where the CEO receives a variable part in his or her compensation.

Digging into the various components of variable remuneration, options certainly, as seen above, could act as an incentive to increase the company's leverage.

The second t-test will no longer have as a dummy the presence of variable compensation within the CEO's remuneration package, but rather the presence of options, in order to understand whether companies where this remuneration instrument is used have, on average, a higher leverage.

As shown below, again the t-test confirms what can intuitively be predicted, namely that the presence of options in compensation leads to higher average debt.

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0 1	1,493 687	1693040 3732694	389976 385941	1.51e+07 1.01e+07	928080.2 2974926	2457999 4490461
combined	2,180	2335811	294119.7	1.37e+07	1759027	2912596
diff		-2039654	631735.5		-3278521	-800786.6
diff : Ho: diff :	= mean(0) - = 0	mean(1)		degrees	t : of freedom :	= -3.2287 = 2178
Ha: d: Pr(T < t)	iff < 0) = 0.0006	Pr(Ha: diff != T > t) =	0 0.0013	Ha: d Pr(T > t	iff > 0) = 0.9994

Of course, absolute debt may be subject to bias, since the absolute value of debts does not take into account the size of the company. In addition, perhaps smaller companies may not provide for variable remuneration and equity-based instruments, given their complexity, and this causes a bias in the results. To avoid problems related to the size of the company, relative measures can be used, such as the debt to asset ratio, which expresses the proportion of debt to total assets of the company, providing an indication of how much debt the company has in relation to its size, making the measure comparable between companies of different sizes.

Even using this new metric, it appears that on average, companies where the CEO receives options tend to have a higher rate of debt.

Obviously, the t-test can be useful at a preliminary stage, but it still has limitations, as it compares the averages of a variable between two groups and tests whether the difference is statistically significant, however, it does not control for other variables that might influence the result. For this reason, regressions will be used to go deeper in the analysis, thus allowing to control for other variables, better isolating the effect of the main variable of interest.

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	1,492	.2918953	.004661	.1800382	.2827525	.3010381
1	686	.4270868	.0526447	1.378849	.3237224	.5304511
combined	2,178	.3344763	.0169314	.7901716	.3012729	.3676796
diff		1351915	.0363435		2064631	0639198
diff :	- = mean(0) ·	- mean(1)			t	= -3.7198
Ho: diff =	= 0			degrees	of freedom	= 2176
Ha: d:	iff < 0		Ha: diff !=	0	Ha: d	iff > 0
Pr(T < t)) = 0.0001	Pr(T > t) =	0.0002	Pr(T > t) = 0.9999

4.4 The link between stock options and debt, the italian case

Until now has been shown how the relationship between CEO stock options and corporate debt decisions is a critical area within the broader framework of agency theory and capital structure choices. Stock options could influence managerial risk preferences (due to their asymmetric payoff structure), which in turn could affect decisions regarding corporate leverage.

So, starting from theory, stock options encourage greater risk-taking because higher stock price volatility increases option value. Since leverage amplifies earnings volatility, CEOs with option-based compensation may favor higher debt levels to increase firm risk and maximize option payoffs.

There is empirical evidence to support this theory (i.e. Coles, Daniel, & Naveen (2006), Lewellen (2006), DeFusco, Johnson, & Zorn (1990)) but all these studies focus on the American market, which is inherently different from the Italian market. For this reason, it is interesting to examine empirically whether these hypotheses are also applicable to the Italian context, by analysing whether the use of stock options could influence the CEO's risk appetite, thus leading him towards a higher rate of debt.

Before starting with the analysis, it is also good to ask why it is important to look into this issue and why it is relevant to understand the possible existence of the link between stock options and debt within companies.

First of all, there is the compensation design theme, since firms must balance stock option incentives to encourage risk-taking without promoting excessive leverage that increases default risk. Excessive risk-taking leads to high debt levels, and it can increase the probability of financial distress, exposing firms to market shocks, and ultimately eroding long-term firm value. Therefore, understanding how options influence debt decisions is essential for designing compensation plans that balance incentives for growth with financial stability and quantifying the effect of the debt incentive that stock options implicitly donate can help in predicting the possible negative effects of introducing this instrument in CEOs' remuneration.

Understanding the real impact of the introduction of the option instrument could also lead to a positive change in compensation design, introducing longer vesting periods or performance-based conditions tied to debt metrics (e.g., limiting leverage growth) to align incentives with sustainable financial policies, or compensation plans that could be designed to penalize CEOs for excessive debt or poor debt-to-equity ratios, ensuring that risk-taking aligns with firm solvency and shareholder value, allowing the use of options to have only positive incentive effects, and not lead to excessive risk-taking by the CEO.

The second important theme is that of governance, because if stock options create incentives for excessive debt accumulation, ineffective governance could fail to detect or constrain this behavior, leading to long-term value erosion.

if it is true that options create incentives to indebtedness, then Boards could establish stricter internal controls, requiring regular reporting on debt metrics to prevent excessive leverage accumulation driven by CEO incentives, or appointing independent directors to compensation and audit committees to ensure objective oversight of leverage-related decisions and pay structures. Finally, the inherent risk of the introduction of options in remuneration could consequently encourage greater shareholder activism, pushing back against risky strategies that may offer short-term gains but threaten long-term stability.

Finally, the last theme closely related to the impact of options on debt is the regulatory one, since high leverage levels can threaten broader financial market stability and understanding how compensation structures drive leverage decisions is essential for the creation of regulatory frameworks that protect not just firms but also investors, creditors, and the economy. Some examples of policies implemented by the regulator could be the introduction of restrictions on option-based compensation for firms in high-risk sectors or mandate that option grants be accompanied by debt-risk assessments, require longer vesting periods or prohibit accelerated vesting that could incentivize short-term debt accumulation for quick payoffs, require to disclose how their compensation structures influence financial risk and leverage decisions, ensuring transparency for shareholders and regulators and so on.

Therefore, in summary, understand and quantify the relationship between stock options and debt could have profound effects on the regulatory, governance and corporate finance apparatus, because firms would need to rethink compensation structures to avoid misaligned incentives that increase financial fragility, boards would need to increase oversight and internal controls to monitor how compensation plans influence financial risk and policymakers might pursue regulatory reforms to safeguard against systemic risks and ensure that executive pay aligns with long-term financial health.

The model

Resuming the pattern seen above, the model used in the analysis can be formalised as

$$Y_{it} = \alpha_i + \beta_1 X_{1,it} + \dots + \beta_k X_{k,it} + u_{it}$$

Where

- Y_{it} is the dependent variable. In the present case, it is clearly a variable that somehow describes the company's level of indebtedness. For this reason, the ratio of total debts of financial nature (short, medium and long term) to the company's total assets was chosen. *i* indicates the company and *t* indicates the reference year.
- $X_{1,it}, ..., X_{k,it}$ represent the independent variables used, which will be described below

- β_1, \ldots, β_k are the coefficients of the regression variables.
- u_{it} is the error term.

The first independent variable is a the stock option dummy, which takes the value 1 if there is an option package in the CEO's remuneration, 0 otherwise. The control variables used are:

- Firm Size, because larger firms typically have greater access to debt markets. In this case, the number of employees was used as an indicator of size.
- **CEO total compensation**, because higher compensation may affect CEO decision-making regarding leverage. Here again there is the use of a logarithmic scale, because taking the log transformation makes the variable more normally distributed, which improves regression estimation.
- **Profitability**, because more profitable firms may use less debt (Pecking Order Theory). The variable used is the logarythm of the ebitda.
- Market-to-Book Ratio, because high-growth firms may use more equity over debt
- **CEO Tenure**, because more experienced CEOs may adopt more conservative leverage policies, as seen before.
- **CEO Age,** because younger CEOs might be more risk-taking, affecting leverage choices.

- CEO Duality (Dummy: 1 if CEO = Chairman, 0 otherwise), because CEO-Chair duality weakens governance and may increase risk-taking behavior, affecting leverage decisions.
- CEO Educational Background, because higher education might influence strategic decision-making.
- **Ownership Concentration**, because firms with concentrated ownership may control CEO risk-taking behavior.
- Institutional Ownership, because institutional investors may influence leverage decisions.

Of course, over the period 2011–2021, many external events could have influenced all firms, such as economic crises (in the previous chapter it was noted how crises can have an impact on CEO compensation), changes in government policies, industry trends or market-wide shock, and all this common shocks could bias the results. For this reason, it was chosen to control for year fixed effects, making the results more reliable, isolating better the true effect of CEO compensation choices, eliminating the effects of macroeconomic trends that have occurred over time.

The first regression presented is an ordinary least squares one, with heteroskedasticityconsistent standard errors, which provides a quick overview of the relationships between variables and helps answer the initial question:

"Is there any basic relationship between stock options and leverage?"

As can be seen from the results below, it would appear that the presence of stock options in CEO compensation is positively correlated with the debt-to-asset ratio. The coefficients are statistically significant in all four proposed models.

Also in line with expectations is the market-to-book ratio, which turns out to be negative as companies with a high MtB may be well regarded by the market, obtaining financing through equity more easily than through debt (although in this case the coefficient is not statistically relevant).

A strong negative correlation is present between the dependent variable and the variable indicating ownership concentration, clearly because companies where concentration is higher tend to better and more easily control the capital structure choices of the company, thus avoiding excessive debt.

The presence of institutional investors seems to have an expansive effect on the company's debt and risk appetite, while CEO tenure represents a constraint on risk taking, with the CEO becoming increasingly risk-averse as his years in the company increase.

Finally, it is also important to note that educational background has an impact on capital structure choices, as CEOs with a university degree seem to be less risk averse than those without this academic qualification.

	(1)	(3)	(4)	(5)
VARIABLES	Debt_Asset	Debt_Asset	Debt_Asset	Debt_Asset
StockOptionDum	0.262**	0.171**	0.276**	0.214**
	(0.108)	(0.0757)	(0.118)	(0.0906)
lnebitda		-0.0862**		-0.113**
		(0.0406)		(0.0518)
empl		1.38e-05**		1.17e-05**
		(6.14e-06)		(5.43e-06)
MarketToBook		-0.00979		-0.0172
		(0.0195)		(0.0229)
Concentrazione		-0.842**		-0.836***
		(0.338)		(0.313)
InstInv		0.158**		0.125**
		(0.0646)		(0.0586)
lnpay			0.0494***	0.112***
			(0.0170)	(0.0410)
tenure			-0.00788**	-0.00884**
			(0.00315)	(0.00344)
ceo_age			0.0172**	0.0176**
			(0.00746)	(0.00753)
CEO Chair			0.0924	0.117
			(0.0922)	(0.115)
uni_degree			0.0993**	0.0311
			(0.0437)	(0.0417)
			× ,	
2012.year	-0.0686	-0.107	-0.0866	-0.126
	(0.197)	(0.271)	(0.213)	(0.276)
2013.year	-0.0735	-0.132	-0.0957	-0.145
-	(0.189)	(0.266)	(0.204)	(0.269)
2014.year	-0.111	-0.172	-0.125	-0.185
•	(0.177)	(0.247)	(0.190)	(0.248)
2015.year	-0.0503	-0.0943	-0.0569	-0.112
•	(0.200)	(0.269)	(0.214)	(0.273)
2016.year	-0.0909	-0.0964	-0.0971	-0.103
	(0.175)	(0.230)	(0.186)	(0.230)
2017.year	-0.0935	-0.0667	-0.119	-0.102
	(0.176)	(0.225)	(0.189)	(0.227)
2018.year	-0.218	-0.133	-0.309*	-0.277
5	(0.175)	(0.219)	(0.187)	(0.229)
2019.year	-0.244	-0.197	-0.323*	-0.299
,	(0.176)	(0.223)	(0.187)	(0.224)
2020.year	-0.271	-0.201	-0.333*	-0.295
2	(0.192)	(0.229)	(0.191)	(0.241)
2021.year	-0.274	-0.222	-0.341*	-0.289
5	(0.191)	(0.227)	(0.194)	(0.252)
Constant	0.361**	1.081**	-0.970**	-0.493
	(0.154)	(0.441)	(0.445)	(0.324)
	<u> </u>	()	()	x)
Observations	892	679	850	671

R-squared	0.016	0.057	0.038	0.080

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 12 OLS analysis on the relationship between stock options and debt

Of course, while OLS is a good starting point, it ignores the panel structure of the data, which can lead to biased or inconsistent estimates, because observations from the same firm over time are likely correlated (autocorrelation phenomena). With the use of xtreg in stata it is possible to control for th unobserved characteristics by differencing them out, ensuring more accurate and consistent estimates. The model is presented below, with the addition of the interaction between the dummy on the presence of stock options in the CEO's remuneration and the logarithm of compensation:

VARIABLES Debt_Asset Debt_Asset Debt_Asset 1.StockOptionDum 0.652 0.651 0.667 (0.608) (0.615) (0.638) Inpay 0.000402 0.00707 0.00438 (0.0200) (0.0168) (0.0226) 1.StockOptionDum#c.Inpay -0.0950 -0.0944 -0.0963 1.StockOptionDum#c.Inpay -0.0950 -0.0944 -0.0963 1.StockOptionDum#c.Inpay -0.0950 -0.0944 -0.0963 Incbitda -0.0175 0.00836 -0.0197 (0.0220) (0.0101) (0.0277) empl -1.06e-06 -2.96e-06 -3.14e-06 (1.20c-06) (2.94c-06) (2.48c-06) tenure -0.000514 -0.000839 (0.00281) (0.00327) (0.00270) cco_age 0.00644 0.00630 uni_degree 0.00218 -0.00676 uni_degree 0.00218 -0.00676 (0.422) (0.442) (0.0217) MarketToBook		(1)	(2)	(3)
1.StockOptionDum 0.652 0.651 0.667 (0.608) (0.615) (0.638) lnpay 0.000402 0.00707 0.00438 (0.0200) (0.0168) (0.0226) 1.StockOptionDum#c.Inpay -0.0950 -0.0944 -0.0963 (0.0850) (0.0873) (0.0899) Inebitda -0.0175 0.00836 -0.0197 (0.0220) (0.0101) (0.0277) empl $-1.06e-06$ $-2.96e-06$ $-3.14e-06$ (1.20e-06) (2.94e-06) (2.48e-06) tenure -0.000514 -0.000849 (0.00281) (0.00720) (0.00720) ceo_age 0.00644 0.00630 uni_degree 0.00218 -0.00676 uni_degree 0.00218 -0.00676 (0.442) (0.445) (0.0271) MarketToBook -0.0376 -0.0387 (0.0217) (0.0228) (0.374) Instlnv -0.0235 -0.0235 (0.127) (0.129) (0.136) (0.133)	VARIABLES	Debt_Asset	Debt_Asset	Debt_Asset
1.StockOptionDum 0.652 0.651 0.667 (0.608) (0.615) (0.638) lnpay 0.000402 0.00707 0.00438 (0.0200) (0.0168) (0.0226) 1.StockOptionDum#c.Inpay -0.0950 -0.0944 -0.0063 (0.0850) (0.0873) (0.0899) Inebitda -0.0175 0.00846 -0.0197 empl $-1.06e-06$ $-2.96e-06$ $-3.14e-06$ (1.20e-06) (2.94e-06) (2.48e-06) tenure -0.000514 -0.000849 (0.00281) (0.00327) (0.00472) cco_age 0.00644 0.00630 (0.00720) (0.00720) (0.00720) CEO_Chair -0.466 -0.485 (0.442) (0.466) (0.466) uni_degree 0.00218 -0.00676 (0.0445) (0.0271) (0.0280) MarketCap 4.41e-07 1.74e-06 (2.14e-06) (3.32e-06) (0.528) MarketToBook -0.0387 (0.0217) (0.0217)		_		
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1.StockOptionDum	0.652	0.651	0.667
Inpay 0.000402 0.00707 0.00438 (0.0200) (0.0168) (0.0226) 1.StockOptionDum#c.Inpay -0.0950 -0.0944 -0.0963 (0.0850) (0.0873) (0.0899) Inebitda -0.0175 0.00836 -0.0197 (0.0250) (0.0101) (0.0277) empl -1.06e-06 -2.96e-06 -3.14e-06 (1.20e-06) (2.94e-06) (2.48e-06) tenure -0.000514 -0.000849 (0.00220) (0.00327) (0.00327) ceo_age 0.00644 0.00630 (0.00720) (0.00720) (0.00720) CEO_Chair -0.460 -0.485 (0.442) (0.466) (3.32e-06) MarketCap 4.41e-07 1.74e-06 (2.14e-06) (3.32e-06) (3.32e-06) MarketToBook -0.0576 -0.0387 (0.0217) (0.0235 -0.0235 Concentrazione -0.530 -0.314 (0.528) (0.374) (0.0217		(0.608)	(0.615)	(0.638)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Inpay	0.000402	0.00707	0.00438
1.StockOptionDum#c.Inpay -0.0950 -0.0944 -0.0963 (0.0850)(0.0873)(0.0899)Inebitda -0.0175 0.00836 -0.0197 (0.0250)(0.0101)(0.0277)empl $-1.06e-06$ $-2.96e-06$ $-3.14e-06$ (1.20e-06)(2.94e-06)(2.48e-06)tenure -0.000514 -0.000849 (0.00281)(0.00327)cco_age 0.00644 0.00630 (0.00720)(0.00720)CEO_Chair -0.460 -0.485 (0.442)(0.466).0.0471)uni_degree 0.00218 -0.00676 (0.0471)(0.0491).0.0371MarketCap $4.41e-07$ $1.74e-06$ MarketToBook -0.0576 -0.0387 (0.0445)(0.0271)(0.0271)Concentrazione -0.122 -0.123 (0.127)(0.128)(0.374)InstInv -0.122 -0.122 -0.123 2012.year -0.131 -0.122 -0.131 (0.133)(0.132)(0.138)2014.year -0.186 -0.190 -0.190 (0.177)(0.188)(0.185)2015.year -0.42 -0.209 -0.171 2016.year -0.204 -0.209 -0.171		(0.0200)	(0.0168)	(0.0226)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1.StockOptionDum#c.lnpay	-0.0950	-0.0944	-0.0963
$\begin{array}{llllllllllllllllllllllllllllllllllll$		(0.0850)	(0.0873)	(0.0899)
$ \begin{array}{c} (0.0250) & (0.0101) & (0.0277) \\ (0.0270) & (-2.96c-06) & -3.14c-06 \\ (1.20e-06) & (2.94e-06) & (2.48e-06) \\ (1.20e-06) & (2.94e-06) & (2.48e-06) \\ (0.00281) & (0.00327) \\ (0.00227) & (0.00327) \\ (0.00720) & (0.00720) \\ (0.00720) & (0.00720) \\ (0.00720) & (0.00720) \\ (0.00720) & (0.00720) \\ (0.00720) & (0.00720) \\ (0.00720) & (0.00720) \\ (0.0442) & (0.466) \\ (0.442) & (0.466) \\ (0.442) & (0.466) \\ (0.0471) & (0.0491) \\ MarketCap & 4.41e-07 & 1.74e-06 \\ (2.14e-06) & (3.32e-06) \\ (2.14e-06) & (3.32e-06) \\ (2.14e-06) & (3.32e-06) \\ MarketToBook & -0.0576 & -0.0387 \\ (0.0445) & (0.0271) \\ Concentrazione & -0.530 & -0.331 \\ (0.528) & (0.374) \\ InstInv & -0.0235 & -0.0234 \\ (0.0217) & (0.0286) \\ 2012.year & -0.122 & -0.122 & -0.128 \\ (0.127) & (0.129) & (0.136) \\ 2013.year & -0.131 & -0.122 & -0.131 \\ (0.133) & (0.132) & (0.138) \\ 2014.year & -0.186 & -0.190 & -0.190 \\ (0.177) & (0.188) & (0.185) \\ 2015.year & -0.142 & -0.126 & -0.140 \\ (0.124) & (0.120) & (0.130) \\ 2016.year & -0.204 & -0.209 & -0.217 \\ \end{array}$	lnebitda	-0.0175	0.00836	-0.0197
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		(0.0250)	(0.0101)	(0.0277)
$\begin{array}{ccccc} (1.20e-06) & (2.94e-06) & (2.48e-06) \\ (enure & -0.000514 & -0.000849 \\ (0.00281) & (0.00327) \\ (cco_age & 0.00644 & 0.00630 \\ (0.00720) & (0.00720) \\ CEO_Chair & -0.460 & -0.485 \\ (0.442) & (0.466) \\ uni_degree & 0.00218 & -0.00676 \\ (0.0471) & (0.0491) \\ MarketCap & 4.41e-07 & 1.74e-06 \\ (2.14e-06) & (3.32e-06) \\ MarketToBook & -0.0576 & -0.0387 \\ (0.0445) & (0.0271) \\ Concentrazione & -0.530 & -0.331 \\ (0.528) & (0.374) \\ 10.0217) & (0.0286) \\ 2012.year & -0.122 & -0.122 & -0.128 \\ (0.127) & (0.129) & (0.136) \\ 2013.year & -0.131 & -0.122 & -0.131 \\ (0.133) & (0.132) & (0.138) \\ 2014.year & -0.186 & -0.190 & -0.190 \\ (0.177) & (0.188) & (0.185) \\ 2015.year & -0.142 & -0.126 & -0.140 \\ (0.124) & (0.120) & (0.130) \\ 2016.year & -0.204 & -0.209 & -0.217 \\ \end{array}$	empl	-1.06e-06	-2.96e-06	-3.14e-06
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		(1.20e-06)	(2.94e-06)	(2.48e-06)
$\begin{array}{cccc} (0.00281) & (0.00327) \\ (0.00720) & (0.00720) \\ CEO_Chair & -0.460 & -0.485 \\ (0.442) & (0.466) \\ uni_degree & 0.00218 & -0.00676 \\ (0.0471) & (0.0491) \\ MarketCap & 4.41e-07 & 1.74e-06 \\ (2.14e-06) & (3.32e-06) \\ MarketToBook & -0.0576 & -0.0387 \\ (0.0445) & (0.0271) \\ Concentrazione & -0.530 & -0.331 \\ (0.528) & (0.374) \\ InstInv & -0.0235 & -0.0234 \\ (0.0217) & (0.0286) \\ 2012.year & -0.122 & -0.122 & -0.128 \\ (0.127) & (0.129) & (0.136) \\ 2013.year & -0.131 & -0.122 & -0.131 \\ (0.133) & (0.132) & (0.138) \\ 2014.year & -0.186 & -0.190 & -0.190 \\ (0.177) & (0.188) & (0.185) \\ 2015.year & -0.142 & -0.126 & -0.140 \\ (0.124) & (0.120) & (0.130) \\ 2016.year & -0.204 & -0.209 & -0.217 \\ \end{array}$	tenure	-0.000514		-0.000849
cco_age 0.00644 0.00630 (0.00720)CEO_Chair -0.460 -0.485 (0.442)uni_degree 0.00218 -0.00676 (0.0471)MarketCap $4.41e-07$ $1.74e-06$ ($2.14e-06$)MarketToBook -0.0576 -0.0387 (0.0445)Concentrazione -0.530 -0.331 (0.528)MarketToBook -0.528 (0.374) InstInv -0.0235 -0.0235 Q12.year -0.122 -0.122 Q12.year -0.131 -0.122 Q13.year -0.131 -0.122 Q14.year -0.186 -0.190 Q15.year -0.142 -0.126 Q15.year -0.142 -0.126 Q16.year -0.204 -0.209 Q17 -0.204 -0.209		(0.00281)		(0.00327)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	ceo_age	0.00644		0.00630
$\begin{array}{cccc} {\rm CEO_Chair} & -0.460 & -0.485 \\ (0.442) & (0.466) \\ {\rm uni_degree} & 0.00218 & -0.00676 \\ (0.0471) & (0.0491) \\ {\rm MarketCap} & 4.41e-07 & 1.74e-06 \\ (2.14e-06) & (3.32e-06) \\ {\rm MarketToBook} & -0.0576 & -0.0387 \\ (0.0445) & (0.0271) \\ {\rm Concentrazione} & -0.530 & -0.331 \\ (0.528) & (0.374) \\ {\rm InstInv} & -0.0235 & -0.0234 \\ (0.0217) & (0.0286) \\ 2012.year & -0.122 & -0.122 & -0.128 \\ (0.127) & (0.129) & (0.136) \\ 2013.year & -0.131 & -0.122 & -0.131 \\ (0.133) & (0.132) & (0.138) \\ 2014.year & -0.186 & -0.190 & -0.190 \\ (0.177) & (0.188) & (0.185) \\ 2015.year & -0.142 & -0.126 & -0.140 \\ (0.124) & (0.120) & (0.130) \\ 2016.year & -0.204 & -0.209 & -0.217 \\ \end{array}$		(0.00720)		(0.00720)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	CEO_Chair	-0.460		-0.485
uni_degree 0.00218 -0.00676 (0.0491) MarketCap $4.41e-07$ $1.74e-06$ $(2.14e-06)$ $(3.32e-06)$ MarketToBook -0.0576 -0.0387 (0.0445) (0.0271) Concentrazione -0.530 -0.331 (0.528) (0.374) InstInv -0.0235 -0.0234 (0.0217) (0.0217) (0.0286) 2012.year -0.122 -0.122 -0.128 (0.127) (0.129) (0.129) 2013.year -0.131 -0.122 -0.131 (0.133) (0.132) (0.138) 2014.year -0.186 -0.190 (0.177) (0.188) (0.185) 2015.year -0.142 -0.126 -0.140 (0.124) (0.120) (0.130) 2016.year -0.204 -0.209 -0.217		(0.442)		(0.466)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	uni_degree	0.00218		-0.00676
MarketCap $4.41e-07$ $1.74e-06$ ($2.14e-06$)MarketToBook -0.0576 -0.0387 (0.0445)Concentrazione -0.530 -0.331 (0.528)Concentrazione -0.530 -0.331 (0.528)InstInv -0.0235 -0.0234 (0.0217)2012.year -0.122 -0.122 0.127) (0.129) (0.1286)2013.year -0.131 -0.122 0.133) (0.132) (0.138) (0.133)2014.year -0.186 -0.190 0.190 (0.177) (0.188) (0.185) ($0.185)$ 2015.year -0.142 -0.126 0.124 (0.120) (0.130) ($0.120)$ 2016.year -0.204 -0.209 -0.204 -0.209 -0.217		(0.0471)		(0.0491)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	MarketCap		4.41e-07	1.74e-06
MarketToBook -0.0576 -0.0387 (0.0445)Concentrazione -0.530 -0.331 (0.528)InstInv -0.530 -0.331 (0.528)2012.year -0.122 -0.235 (0.0277)2013.year -0.122 -0.122 0.127)(0.129)(0.136) (0.129)2014.year -0.186 -0.190 (0.177)2015.year -0.142 -0.126 (0.124) -0.126 2015.year -0.142 -0.126 (0.120) -0.140 (0.130)2016.year -0.204 -0.209 -0.217			(2.14e-06)	(3.32e-06)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	MarketToBook		-0.0576	-0.0387
Concentrazione -0.530 -0.331 (0.528)InstInv -0.0235 -0.0234 (0.0217)2012.year -0.122 -0.122 2013.year -0.131 -0.122 2013.year -0.131 -0.122 2014.year -0.186 -0.190 2015.year -0.142 -0.126 2015.year -0.142 -0.126 2015.year -0.142 -0.126 2016.year -0.204 -0.209 2016.year -0.204 -0.209			(0.0445)	(0.0271)
InstInv $\begin{pmatrix} (0.528) & (0.374) \\ -0.0235 & -0.0234 \\ (0.0217) & (0.0286) \\ 2012.year & -0.122 & -0.122 & -0.128 \\ (0.127) & (0.129) & (0.136) \\ 2013.year & -0.131 & -0.122 & -0.131 \\ (0.133) & (0.132) & (0.138) \\ 2014.year & -0.186 & -0.190 & -0.190 \\ (0.177) & (0.188) & (0.185) \\ 2015.year & -0.142 & -0.126 & -0.140 \\ (0.124) & (0.120) & (0.130) \\ 2016.year & -0.204 & -0.209 & -0.217 \\ \end{bmatrix}$	Concentrazione		-0.530	-0.331
InstInv -0.0235 -0.0234 (0.0217)2012.year -0.122 -0.122 -0.128 (0.127)2013.year -0.131 -0.122 -0.131 2013.year -0.131 -0.122 -0.131 2014.year -0.186 -0.190 -0.190 (0.177)2015.year -0.142 -0.126 -0.140 (0.124)2016.year -0.204 -0.209 -0.217			(0.528)	(0.374)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	InstInv		-0.0235	-0.0234
$\begin{array}{cccccccccccccccccccccccccccccccccccc$			(0.0217)	(0.0286)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2012.year	-0.122	-0.122	-0.128
$\begin{array}{cccccccccccccccccccccccccccccccccccc$		(0.127)	(0.129)	(0.136)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2013.year	-0.131	-0.122	-0.131
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	·	(0.133)	(0.132)	(0.138)
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	2014.year	-0.186	-0.190	-0.190
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	•	(0.177)	(0.188)	(0.185)
$(0.124) \qquad (0.120) \qquad (0.130)$ $2016.vear \qquad -0.204 \qquad -0.209 \qquad -0.217$	2015.year	-0.142	-0.126	-0.140
2016. vear -0.204 -0.209 -0.217		(0.124)	(0.120)	(0.130)
	2016.year	-0.204	-0.209	-0.217

	(0.187)	(0.201)	(0.204)			
2017.year	-0.209	-0.207	-0.211			
	(0.182)	(0.192)	(0.193)			
2018.year	-0.115	-0.150	-0.114			
	(0.109)	(0.137)	(0.116)			
2019.year	-0.140	-0.177	-0.134			
	(0.107)	(0.134)	(0.111)			
2020.year	-0.103	-0.124	-0.0725			
	(0.0992)	(0.106)	(0.0995)			
2021.year	-0.171	-0.157	-0.150			
	(0.121)	(0.127)	(0.121)			
Constant	0.371**	0.833	0.647*			
	(0.158)	(0.532)	(0.353)			
Observations	718	667	667			
Number of Nfirm	124	110	110			
Debugt standard among in parentheses						

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 13 Regression analysis over the period 2011-2021 on the relationship between stock options and debt As can be seen, StockoptionDum's coefficients are still positive, but no longer statistically relevant. Moreover, the relationship between this dummy and pay has a negative sign, and this will be investigated later in the discussion.

As mentioned above, executives cannot sell their stock options immediately after receiving them. Instead, they must follow vesting schedules, which dictate when they can exercise the stock at the pre-set price and most stock options vest gradually over several years. This entails that stock options received at year t may take time to influence CEO decisions, and so they might increase leverage in the following years as the options become exercisable. To understand this, therefore, it is necessary to determine whether there is a relationship between the capital structure choices at time t and the options received by the CEO in previous years (e.g. 3 years, a duration common to many vesting periods).

To do this, it arises the need to use a lag in the dummy variable indicating the presence of stock options in the CEO's remuneration, as presented below. In this case L means that the variable has a one-year lag, L2 refers to a two-year lag and L3 to a three-year lag.

Table 14 Regression analysis with lagged variables over the period 2011-2021 on the relationship between stock options and debt

	(1)	(2)	(3)
VARIABLES	Debt_Asset	Debt_Asset	Debt_Asset
1L.StockOptionDum	0.272*		
	(0.153)		
lnpay	0.0151	0.0251	0.0301
	(0.0155)	(0.0229)	(0.0294)
1L.StockOptionDum#c.Inpay	-0.0407*		
	(0.0208)		
1L2.StockOptionDum		0.277**	
		(0.140)	
1L2.StockOptionDum#c.lnpay		-0.0364*	
		(0.0202)	
1L3.StockOptionDum			0.165
			(0.130)
1L3.StockOptionDum#c.lnpay			-0.0185
			(0.0193)
MarketCap	1.47e-06	-4.84e-06	-1.21e-05
	(2.21e-06)	(5.59e-06)	(1.30e-05)
lnebitda	0.00916	0.00610	0.00348
	(0.0111)	(0.0219)	(0.0269)
empl	-6.55e-06	-7.38e-07	5.17e-06
	(6.39e-06)	(1.54e-06)	(4.77e-06)
tenure	-0.00266	-0.00786	-0.00700
	(0.00322)	(0.00733)	(0.00567)
ceo_age	0.00191	0.00226	0.00133
	(0.00323)	(0.00374)	(0.00400)
CEO_Chair	-0.128	0.134	0.166
	(0.130)	(0.149)	(0.184)
uni_degree	-0.0184	-0.0114	0.0403
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	(0.0260)	(0.0425)	(0.0608)
Concentrazione	-0.377	-0.531	-0.659
	(0.375)	(0.574)	(0.675)
InstInv	-0.0503	-0.0409	-0.0288
	(0.0365)	(0.0258)	(0.0251)
2013.year	-0.0171		
	(0.0132)		
2014.year	-0.0775	-0.0585	
	(0.0623)	(0.0529)	
2015.year	-0.0271**	0.0104	0.0827
	(0.0129)	(0.0234)	(0.0844)
2016.year	-0.111	-0.0755	-0.000300
	(0.0849)	(0.0647)	(0.0134)
2017.year	-0.121	-0.0808	-0.00390
	(0.0844)	(0.0667)	(0.0181)
2018.year	0.00703	0.0392	0.107*
	(0.0650)	(0.0668)	(0.0586)
2019.year	-0.0815	0.0891	0.161*
	(0.0516)	(0.0971)	(0.0958)
2020.year	-0.0652	-0.00852	0.181**
	(0.0446)	(0.0447)	(0.0920)
2021.year	-0.0990	-0.00800	0.101
	(0.0610)	(0.0558)	(0.0842)
Constant	0.526**	0.423***	0.358*
	(0.226)	(0.163)	(0.195)
Observations	571	482	392
Number of Nfirm	107	105	101

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

As can be seen, the dummy variable is now statistically relevant in models with a oneyear and two-year lag. This suggests that indeed the company policies may enforcing holding periods could delay the incentive effect on decision-making and risk-taking. Furthermore, leverage adjustments often require strategic planning and board approval, suggesting that any behavioral response to stock option incentives may require time with and cannot be immediate. So, by incorporating a three-year lag in the regression, it could be possible to better capture the deferred nature of incentive-driven decisionmaking.

Looking at the regression in detail, it can therefore be stated that the positive coefficient of the stock opition dummy indicates that, on average, CEOs who receive stock options tend to be associated with firms that have higher leverage, compared to CEOs who do not receive stock options, and this is consistent with the literature and studies seen previously.

As for the interaction with lnpay, the negative coefficient, present in every regression, means that as CEO compensation increases, the impact of stock options on leverage decreases, and so for high-compensation CEOs, the large total compensation packages seems to offset or weaken the incentive to increase leverage.

This can also be explained intuitively since a CEO who earns a modest compensation package but holds stock options has a strong incentive to increase leverage and take risks to maximize option value, however, once he reaches a certain amount of compensation, he could prioritize job security and firm stability over excessive risktaking.

Finally, regressions using a forward-lagged dependent variable are shown below, with similar results to those seen previously. In this case F means that the variable has a forward lag of one year, F2 refers to a two-year lag and F3 to a three-year lag

	(1)	(2)	(3)
VARIABLES	F.Debt_Asset	F2.Debt_Asset	F3.Debt_Asset
1.StockOptionDum	0.358*	0.519**	0.128
	(0.203)	(0.246)	(0.179)
lnpay	0.00412	0.0196	0.0383
	(0.0136)	(0.0167)	(0.0356)
1.StockOptionDum#c.lnpay	-0.0538*	-0.0716**	-0.0159
	(0.0287)	(0.0325)	(0.0293)
MarketCap	3.26e-06	-2.61e-06	-1.18e-05
	(3.37e-06)	(4.29e-06)	(1.23e-05)
lnebitda	-0.0185	-0.00728	-0.00437
	(0.0249)	(0.0143)	(0.0210)
empl	-5.82e-07	3.15e-06	4.43e-06
	(1.00e-06)	(2.87e-06)	(4.80e-06)
tenure	0.000399	-0.00603	-0.00176
	(0.00211)	(0.00450)	(0.00319)
ceo_age	0.00267	0.00335	0.00719
	(0.00362)	(0.00356)	(0.00725)
CEO_Chair	-0.271	0.0397	-0.250
	(0.250)	(0.0325)	(0.248)
uni_degree	0.000285	0.0154	0.0146
	(0.0302)	(0.0283)	(0.0475)
Concentrazione	0.126	-0.0938	-0.197
	(0.135)	(0.252)	(0.300)
InstInv	-0.0129	0.0147	0.0216
	(0.0165)	(0.0156)	(0.0181)
2012.year	-0.0207	-0.0537	0.0690
	(0.0208)	(0.0471)	(0.0720)
2013.year	-0.0769	0.0215	0.00340
	(0.0654)	(0.0330)	(0.0153)
2014.year	-0.0136	-0.0496	0.000498
	(0.0143)	(0.0439)	(0.0172)
2015.year	-0.0903	-0.0522	0.153*
	(0.0710)	(0.0430)	(0.0820)
2016.year	-0.0913	0.122	0.159*
	(0.0701)	(0.0780)	(0.0838)
2017.year	0.0182	0.0820	0.174**

Table 15 Regression analysis with forward lagged variables over the period 2011-2021 on the relationship
between stock options and debt

	(0.0621)	(0.0610)	(0.0811)			
2018.year	-0.0419	0.0413	0.132			
	(0.0481)	(0.0360)	(0.0824)			
2019.year	-0.0138	0.0354				
	(0.0391)	(0.0374)				
2020.year	-0.0344					
	(0.0436)					
Constant	0.334**	0.142	-0.153			
	(0.159)	(0.118)	(0.375)			
Observations	580	488	394			
Number of Nfirm	109	107	105			
Robust standard errors in parentheses						

Robust standard errors in parenthese *** p<0.01, ** p<0.05, * p<0.1

For a better understanding of the interaction between the stock options dummy and pay, margins are presented. Instead of just looking at raw coefficients, margins help to visualize the actual impact of a variable at different levels of another variable. in this case, the margins refer to the second forwarg lagged model seen above



Figure 13 Margins plot of the interaction between the stock options dummy and CEO pay

For low levels of CEO compension, firms with stock options (red) have a higher predicted Debt/Asset ratio than firms without stock options (blue). This is consistent with agency theory, CEOs with stock options have an incentive to increase leverage to amplify equity returns, as higher leverage can boost stock price volatility. However, as the CEO pay increases , the predicted Debt/Asset ratio for firms with stock options gradually declines, eventually crossing below the Debt/Asset ratio of firms without stock options. This is an interesting result, suggesting that as CEOs receive higher compensation, the influence of stock options on leverage weakens. A possible explanation is the wealth effect: highly paid CEOs may become more risk-averse since they have more to lose from excessive leverage, prioritizing job security and financial stability over risk-taking.

5. Conclusions

The relationship between CEO stock options and corporate debt decisions is a foundamental aspect of corporate finance, governance, and executive compensation design. Already in the first chapters of this work, it emerged how finding the right mix of incentives was essential within a principal-agent relationship in order to align interests, and how the use of the option tool could be a solution to align shareholders' objectives with those of managers, beware of the risk taking and debt incentive that this instrument conferred.

Stock options, due to their asymmetric payoff structure, incentivize risk-taking by increasing in value with stock price volatility. As a result, CEOs with option-heavy compensation packages may prefer higher leverage, as debt-financed strategies amplify stock price movements, enhancing option values. This was confirmed by both the empirical studies analysed during the thesis and the empirical analysis conducted on the sample of Italian listed companies, showing a correlation between the presence of options in the remuneration package and a higher debt exposure.

However, it was also seen that this relationship is non-linear, and may depend on both the options type (Lewellen (2006)) or the magnitude of the pay, since the analysis showed that as total CEO compensation increases, the effect of stock options on leverage diminishes, and for highly compensated CEOs, stock options may even be associated with reduced leverage. These results highlight the importance of considering CEO wealth levels when designing incentive structures and suggest that stock options may not be a one-size-fits-all mechanism for influencing managerial risk-taking behavior. The implications of these findings are significant: firms may need to restructure executive pay to balance incentives, boards should strengthen monitoring mechanisms, and policymakers might consider regulatory interventions to mitigate systemic risks linked to option-driven debt accumulation.

References

Alchian, Armen A., and Harold Demsetz. "Production, information costs, and economic organization." *The American economic review* 62.5 (1972): 777-795.

Bebchuk, Lucian A., and Roberto Tallarita. "The perils and questionable promise of ESG-based compensation." *J. Corp. L.* 48 (2022): 37.

Bedford, Anna, et al. "Were CEO pay cuts during the COVID-19 pandemic merely symbolic? Shareholders' reaction and outrage." *Pacific-Basin Finance Journal* 79 (2023): 101993.

Berger, Philip G., Eli Ofek, and David L. Yermack. "Managerial entrenchment and capital structure decisions." *The journal of finance* 52.4 (1997): 1411-1438.

Berkovitch, Elazar, Ronen Israel, and Yossef Spiegel. "Managerial compensation and capital structure." *Journal of Economics & Management Strategy* 9.4 (2000): 549-584. Bertrand, Marianne, and Sendhil Mullainathan. "Enjoying the quiet life? Corporate governance and managerial preferences." *Journal of political Economy* 111.5 (2003): 1043-1075.

Black, Fischer, and Myron Scholes. "The pricing of options and corporate liabilities." *Journal of political economy* 81.3 (1973): 637-654.

Brander, James A., and Michel Poitevin. "Managerial compensation and the agency costs of debt finance." *Managerial and Decision Economics* 13.1 (1992): 55-64.

Brick, Ivan E., Oded Palmon, and John K. Wald. "Board Compensation Structure and Firm Performance." (2003).

Brick, Ivan E., Oded Palmon, and John K. Wald. "CEO compensation, director compensation, and firm performance: Evidence of cronyism?." *Journal of Corporate Finance* 12.3 (2006): 403-423.

Brick, Ivan E., Oded Palmon, and John K. Wald. "Too much pay-performance sensitivity?." *Review of Economics and Statistics* 94.1 (2012): 287-303.

Calcagno, R., and L. Renneboog. "Capital Structure and Managerial Compensation: the Effects of Remuneration Seniority." *Journal of Banking and Finance* 31.6 (2007): 1795-1815.

Chang, Chun. "Payout policy, capital structure, and compensation contracts when managers value control." *The Review of Financial Studies* 6.4 (1993): 911-933.

Chemmanur, Thomas J., Yingmei Cheng, and Tianming Zhang. "Human capital, capital structure, and employee pay: An empirical analysis." *Journal of Financial Economics* 110.2 (2013): 478-502.

Chhaochharia, Vidhi, and Yaniv Grinstein. "CEO compensation and board structure." *The Journal of Finance* 64.1 (2009): 231-261.

Coase, Ronald H. "The nature of the firm." *The Roots of Logistics*. Springer, Berlin, Heidelberg, 2012. 317-333.

Coase, Ronald Harry. "The problem of social cost." *The journal of Law and Economics* 56.4 (2013): 837-877.

Coles, Jeffrey L., Naveen D. Daniel, and Lalitha Naveen. "Managerial incentives and risk-taking." *Journal of financial Economics* 79.2 (2006): 431-468.

Congress. Securities Exchange Act of 1934. U.S. Government Publishing Office, 29 Dec 2022, <u>https://www.govinfo.gov/app/details/COMPS-1885</u>

Core, John E., Robert W. Holthausen, and David F. Larcker. "Corporate governance, chief executive officer compensation, and firm performance." *Journal of financial economics* 51.3 (1999): 371-406.

DeFusco, Richard A., Robert R. Johnson, and Thomas S. Zorn. "The effect of executive stock option plans on stockholders and bondholders." *The Journal of Finance* 45.2 (1990): 617-627.

DIRECTIVE (EU) 2017/828 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2017 DIRECTIVE (EU) 2019/878 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 20 May 2019 DIRECTIVE 2003/6/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 28 January 2003 DIRECTIVE 2004/109/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 December 2004 Douglas, Alan VS. "Capital structure and the control of managerial

incentives." Journal of Corporate Finance 8.4 (2002): 287-311.

Fama, Eugene F. "Agency problems and the theory of the firm." *Journal of political economy* 88.2 (1980): 288-307.

Fama, Eugene F., and Michael C. Jensen. "Separation of ownership and control." *The journal of law and Economics* 26.2 (1983): 301-325.

Ferri, Fabrizio, and David A. Maber. "Say on pay votes and CEO compensation: Evidence from the UK." *Review of Finance* 17.2 (2013): 527-563.

Flammer, Caroline, and Pratima Bansal. "Does a long-term orientation create value?
Evidence from a regression discontinuity." *Strategic Management Journal 38.9* (2017): 1827-1847.

Flammer, Caroline, Bryan Hong, and Dylan Minor. "Corporate governance and the rise of integrating corporate social responsibility criteria in executive compensation: Effectiveness and implications for firm outcomes." *Strategic Management Journal* 40.7 (2019): 1097-1122.

Frydman, Carola, and Dirk Jenter. "CEO compensation." *Annu. Rev. Financ. Econ.* 2.1 (2010): 75-102.

Grossman, Sanford J., and Oliver D. Hart. "An analysis of the principal-agent problem." *Foundations of Insurance Economics: Readings in Economics and Finance*. Dordrecht: Springer Netherlands, 1992. 302-340.

Grossman, Sanford J., and Oliver D. Hart. "The costs and benefits of ownership: A theory of vertical and lateral integration." *Journal of political economy* 94.4 (1986): 691-719.

Hall, Brian J. "Six challenges in designing equity-based pay." *Journal of Applied Corporate Finance* 15.3 (2003): 21-33.

Harris, Milton, and Artur Raviv. "The theory of capital structure." *the Journal of Finance* 46.1 (1991): 297-355.

Holmström, Bengt. "Moral hazard and observability." *The Bell journal of* economics (1979): 74-91.

Homroy, Swarnodeep, Taylan Mavruk, and Van Diem Nguyen. "ESG-linked compensation, CEO skills, and shareholder welfare." *The Review of Corporate Finance Studies* 12.4 (2023): 939-985.

Italian Civil Code: article 2364 and article 2389

Jensen, Michael C. "Agency costs of free cash flow, corporate finance, and takeovers." *The American economic review* 76.2 (1986): 323-329.

Jensen, Michael C., and Kevin J. Murphy. "Performance pay and top-management incentives." *Journal of political economy* 98.2 (1990): 225-264.

Jensen, Michael C., and William H. Meckling. "Theory of the firm: Managerial behavior, agency costs and ownership structure." *Corporate governance*. Gower, 2019. 77-132.

John, Teresa A., and Kose John. "Top-management compensation and capital structure." *The journal of finance* 48.3 (1993): 949-974.

Keller, Elisabeth, and Gregory A. Gehlmann. "Introductory comment: a historical introduction to the Securities Act of 1933 and the Securities Exchange Act of 1934." *Ohio St. LJ* 49 (1988): 329).

Lewellen, Katharina. "Financing decisions when managers are risk averse." *Journal of financial economics* 82.3 (2006): 551-589.

Means, Gardiner. *The modern corporation and private property*. Routledge, 2017. Mehran, Hamid. "Executive incentive plans, corporate control, and capital structure." *Journal of Financial and Quantitative analysis* 27.4 (1992): 539-560.

Merton, Robert C. "Theory of rational option pricing." *The Bell Journal of economics* and management science (1973): 141-183.

Murphy, Kevin J. "Executive compensation." Handbook of Labor Economics 3 (1999).

Murphy, Kevin J. "Executive compensation: Where we are, and how we got there." *Handbook of the Economics of Finance*. Vol. 2. Elsevier, 2013. 211-356.

OECD (1999), OECD Principles of Corporate Governance, OECD Publishing, Paris Office of the Federal Register, National Archives and Records Administration. 124 Stat. 1376 - Dodd-Frank Wall Street Reform and Consumer Protection Act. U.S. Government Printing Office, <u>https://www.govinfo.gov/app/details/STATUTE-124-Pg1376</u>

Office of the Federal Register, National Archives and Records Administration. Public Law 107 - 204 - Sarbanes-Oxley Act of 2002. U.S. Government Printing Office, 30 Jul 2002, <u>https://www.govinfo.gov/app/details/PLAW-107publ204</u> Ozkan, Neslihan. "Do corporate governance mechanisms influence CEO compensation? An empirical investigation of UK companies." *Journal of multinational financial management* 17.5 (2007): 349-364.

REGULATION (EU) No 596/2014 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 April 2014

Rewarding Failure (2009), PublicCitizen (www.citizen.org)

Ross, Stephen A. "The economic theory of agency: The principal's problem." *The American economic review* 63.2 (1973): 134-139.

Shleifer, Andrei, and Robert W. Vishny. "Large shareholders and corporate control." *Journal of political economy* 94.3, Part 1 (1986): 461-488.

Smirlock, Michael, Thomas Gilligan, and William Marshall. "Tobin's q and the Structure-Performance Relationship." *The American Economic Review* 74.5 (1984): 1051-1060.

Smith, Adam. The wealth of nations [1776]. Vol. 11937. na, 1937.

Tosi Jr, Henry L., and Luis R. Gomez-Mejia. "The decoupling of CEO pay and performance: An agency theory perspective." *Administrative Science Quarterly (1989):* 169-189.

Tosi, Henry L., et al. "How much does performance matter? A meta-analysis of CEO pay studies." *Journal of management 26.2 (2000):* 301-339.

TUF (Testo Unico della Finanza): article 114-bis and article 123-ter

Williamson, Oliver E. "Markets and hierarchies: analysis and antitrust implications: a study in the economics of internal organization." *University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship* (1975).

Sitography

https://stockanalysis.com/stocks/bb/market-cap/

https://techcrunch.com/2022/01/03/blackberry-phones-once-ruled-the-world-then-the-world-changed/

https://www.cnbc.com/2019/01/26/toys-r-us-built-a-kingdom-and-the-worlds-biggest-toy-store-then-they-lost-it.html

https://www.forbes.com/sites/tomtaulli/2013/09/23/lessons-from-the-fall-of-blackberry/

https://www.investopedia.com/articles/investing/062315/blackberry-story-constant-success-failure.asp

https://www.nytimes.com/2017/09/19/business/dealbook/toys-r-us-bankruptcy.html

https://www.nytimes.com/2018/03/15/business/toys-r-us-bankruptcy.html

https://www.nytimes.com/2018/06/30/business/toys-r-us-closing.html

https://www.nytimes.com/2023/06/21/books/review/plunder-brendan-ballou-these-are-the-plunderers-gretchen-morgenson-joshua-rosner.html

https://www.reuters.com/article/business/how-5-billion-of-debt-caught-up-with-toys-r-us-idUSKCN1BV0FQ/

https://www.reuters.com/article/business/toysrus-closes-31-billion-financing-facilities-idUSASB0BKTY/

https://www.reuters.com/article/business/toys-r-us-seeks-bankruptcy-to-survive-retail-upheaval-idUSKCN1BT2AU/

https://www.reuters.com/article/us-blackberry-lawsuit/blackberry-must-face-revived-u-s-lawsuit-over-blackberry-10-

idUSKBN1GV2XY/#:~:text=BlackBerry%20decided%20in%202016%20to%20stop%20making ,prosecution%20of%20James%20Dunham%2C%20a%20former%20chief

https://www.reuters.com/article/us-toys-r-us-restructuring/toys-r-us-says-to-shut-a-fifth-ofits-u-s-stores-idUSKBN1FD09L/

https://www.statista.com/chart/8180/blackberrys-smartphone-market-share/