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Essays on Executive Stock Options.

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ESSAYS ON EXECUTIVE STOCK OPTIONS

FELIPE RODRIGUES CRUZ

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"On one level, wisdom is nothing more profound than an ability to follow one's own advice" – Sam Harris

RESUMO
Com base em diversos estudos teóricos sobre como construir contratos ideais de compensação de gestores que reduzem ou eliminam a manipulação, investigamos teórica e empiricamente como as características de um Plano de Opções para Executivos (ESOP) afetam o comportamento dos gestores. Nossa tese é a de que características dos ESOP podem reduzir os incentivos manipulativos dos gestores. Testamos essa hipótese em três diferentes estudos. Em nosso primeiro estudo, analisamos argumentos teóricos sobre as características ideais de um ESOP e investigamos se empresas negociadas na bolsa brasileira as adotam. Focamos especificamente no horizonte temporal dos contratos, em mecanismos de definição ou redefinição do preço de exercício, na proteção de dividendos e na governança corporativa, pois a literatura sugere que essas características afetam os incentivos para manipulação. As empresas brasileiras se adequam a algumas das características ideais, como a alta qualidade dos mecanismos de monitoramento (governança corporativa), mas poderiam melhorar seus mecanismos de (re)definição de preços de exercício e adotar maiores prazos de incentivo, pois estes são mais adequados para lidar com manipulações. Ao não incluir provisões para redefinir os preços de exercício, as empresas foram incapazes de reagir aos efeitos da pandemia sobre os preços do mercado acionário. Com relação à associação entre características dos contratos e manipulações, em nosso segundo estudo analisamos como diferentes aspectos dos ESOP afetam medidas de Qualidade dos Lucros (EQ). Analisamos como as opções de ação dos gestores afetam a Persistência dos Lucros, os *Accruals* Discricionários, medidas de Lucro-Alvo e a Suavidade dos Lucros. Descobrimos que empresas que adotam contratos de compensação que incluem incentivos de longo prazo (incentivos que duram mais que cinco anos) têm maior EQ de acordo com as medidas de persistência, suavidade e *accruals* discricionários. Entretanto, gestores com contratos mais longos podem aumentar medidas de EQ artificialmente, pois eles têm maior probabilidade de não atingir medidas-alvo específicas se uma grande parcela de suas opções se tornar exercível no ano seguinte. Também descobrimos que grandes outorgas de opção no ano seguinte exacerbam as manipulações no ano atual, levando gestores a utilizar a manipulação negativa de *accruals* discricionários para não atingir medidas de lucro-alvo, reduzindo o preço de exercício das opções outorgadas. Não obstante, melhores mecanismos de monitoramento (maior independência do conselho e não possuir um CEO que é também o presidente do conselho de administração) em companhias que adotam opções aumentam a EQ. Por fim, em nosso terceiro e último estudo focamos em como as ESOP afetam pagamentos de dividendos e recompras de ações. Descobrimos que planos de opção sem proteção de dividendos (NDPESOP) levam as companhias a pagar menores dividendos em relação a seus valores de mercado, pois os dividendos afetam negativamente os ganhos dos gestores com opções no contexto desses planos. Ao garantir que gestores receberão os dividendos pagos durante o período de *vesting*, os ESOP com proteção de dividendos (DPESOP) anulam os efeitos negativos dos NDPESOP sobre os dividendos. Também encontramos que tanto os DPESOP quanto os NDPESOP afetam positivamente as recompras de ação, o que contradiz a literatura prévia, que indicava que a falta de proteção de dividendos leva à substituição de dividendos por recompras como forma de manter os níveis de distribuição de resultados inalterados. Por fim, encontramos novas evidências sobre os motivos pelos quais algumas empresas adotam a proteção de dividendos e outras não. Ao incluir uma proteção de dividendos nos ESOP, os gestores deixam ter incentivos para reduzir os pagamentos de dividendos. Em consonância, identificamos que incentivos de monitoramento (governança corporativa e controle estrangeiro) explicam a proteção de dividendos, o que sugere que os dividendos possuem um papel de monitoramento nas empresas brasileiras.
Palavras-chave: Planos de Opções de Ações de Gestores; Manipulação; Prazo de Vesting; Qualidade dos Lucros; Política de Distribuição de Resultados.

ABSTRACT
Based on several theoretical studies on how to build optimal management compensation contracts that reduce or eliminate manipulation, we theoretically and empirically investigate how features of an Executive Stock Option Plan (ESOP) affect managers' behavior. Our thesis is that ESOP features can reduce managers' manipulative incentives. We test this hypothesis through three different studies. In our first study, we analyze theoretical arguments on ideal features of an ESOP and investigate whether companies traded in the Brazilian Exchange conform to these. We specifically focus on contract time horizon, strike price setting and re-setting mechanisms, dividend protection and corporate governance, as the literature suggests that these features affect manipulation incentives. Brazilian companies conform to some of the ideal features, such as high quality monitoring devices (corporate governance), but could enhance their strike-price (re)setting mechanisms and adopt longer incentive horizons, as these are better suited to deal with manipulative behavior. By not including price re-setting provisions, these companies were unable to react the effects of the pandemic on stock market prices. Regarding the association between contract features and manipulation, in our second study, we analyze how ESOP features affect Earnings Quality (EQ) measures. We analyze how management stock options affect Earnings Persistence, Discretionary Accruals, Target Earnings Measures and Earnings Smoothness. We find that firms that adopt compensation contracts that include long-term incentives (incentives that last longer than five years) have higher EQ as measured by persistence, smoothness and discretionary accruals. However, managers with longer contracts might artificially enhance EQ measures, as they are more likely to miss specific target earning measures if a large sum of their options vests in the following year. We also find that large option grants in the following year exacerbate manipulations in the current year, leading manager to utilize negative manipulation of discretionary accruals in order to miss target-earning measures, reducing granted options' strike prices. Nevertheless, better monitoring devices (higher board independence and not having a CEO that is also the Board Chairman) within optioned-companies enhances EQ. At last, in our third and last study we focus on how ESOP affect dividend payments and share repurchases. We find that non-dividend-protected stock option plans (NDPESOP) lead companies to pay smaller dividends relative to their market value, as dividends negatively affect managers' stock option gains within these plans context. By guaranteeing that managers will receive dividends paid during the vesting period, dividend-protected ESOP (DPESOP) nullify the negative effect of NDPESOP on dividends. We also find that both DPESOP and NDPESOP positively affect share repurchases, which contradicts previous literature that has stated that the lack of dividend protection leads managers to substitute dividends for repurchases in order to maintain payout levels unaltered. At last, we find new evidence on why some companies adopt dividend protection and others do not. By including a dividend protection in ESOP, managers no longer have incentives to reduce dividend payments. Accordingly, we find that monitoring incentives (corporate governance and foreign ownership) explain dividend protection, which suggests that dividends play a monitoring role in Brazilian companies.
Keywords: Executive Stock Option Plans; Manipulation; Vesting Conditions; Earnings Quality; Payout Policy.

LIST OF ABBREVIATIONS

AC – Accruals component of Earnings
AR - Net Account Receivables
B3 - Brasil Bolsa Balcão
CA – Current Assets
CDP – Constant Dividend Payers
CEO – Chief Executive Officer
CF – Cash Flow component of Earnings
CG – Corporate Governance
CL - Current liabilities
DA – Discretionary Accruals
DEP – Depreciation and Amortization Expenses
DP - Dividend Payout
DPESOP – Dividend-Protected Executive Stock Option Plans
E – Earnings
EM – Earnings Management
EQ – Earnings Quality
ESOP – Executive Stock Option Plans
ExOp - Exercisable Options
FCF – Free Cash Flow
GrOp - Granted Options
L1 – Level 1
L2 – Level 2
LEV – Leverage
Loss% - Percentage of years a firm presents a loss
LT - Long-term
MKB – Market-to-Book
NDPESOP – Dividend-Protected Executive Stock Option Plans
NDA – Non-discretionary Accruals
NM – New Market
NPV - Net Present Value
OpCycle - Operational Cycle
OpLev - Operational Leverage
PPE - Property, Plants and Equipment
REV - Revenue
ROA – Return on Asset
RP - Repurchase Payout
STD - short-term debt
STDSales - Standard Deviation of Sales
SMOOTH - Earnings Smoothness
TM – Traditional Market
TP - Taxes Payable
VOL – Earnings Volatility

SUMMARY

CHAPTER 1
Essays on Executive Stock Options: Introduction

1 Introduction

To this day, Agency Theory (Jensen & Meckling, 1976) offers a robust framework that explains issues related to conflicts between managers and shareholders, as well as other types of conflicts. This theory sheds light on many important aspects of accounting, allowing us to understand phenomena such as the accounting scandals of Enron, WorldCom and Tyco. As well as providing reasoning for why this sort of accounting and financial scandals happen, agency theory also explains why other manipulations are common, such as payout policy manipulations by managers (Lambert *et al.*, 1989; Fenn & Liang, 2001; Cuny *et al.*, 2009). Furthermore, agency models can assist on the construction of management compensation contracts that reduce conflicts responsible for the occurrence of such manipulations whilst creating sustainable firm value. We assume that contracts that incentivize the creation of real – not manipulated - sustainable value are desirable for financial market investors and shareholders. Hence, we search for theoretical and empirical evidence on how to build such contracts - and whether they are feasible.

A firm's policy for compensating managers is an aspect considered to be of great relevance to the success of a company, because it defines the way in which they will act, as well as the kind of manager (agent) which will be attracted to work in the firm (Jensen & Murphy, 1990). Since a manager defines his actions based on his compensation contract and since those actions will affect the principal's residual results (Lambert, 2007), the way in which managers' contracts are designed is essential for agents to work in ways that create value and generate benefits for shareholders. A contract's design includes features such as performance measures, contract time-length, monitoring mechanisms, as well as other factors.

In the 1990s, in an effort to reduce agency conflicts, incentivizing managers to act in the interests of shareholders, the world observed the rise of stock-based compensation (Jensen & Murphy, 1990; Hall & Murphy, 2003). Given that shareholders are concerned with stock value and the need to create compensation plans for managers that align their interests, the payment of executives based on stock prices has become common in the last decades. In this context, Executive Stock Option Plans (ESOP) became increasingly important in the corporate world (Jensen & Murphy 1990; Hall & Murphy, 2003).

Stock options are contracts that allow a beneficiary to buy stocks of a firm in the future for a predetermined strike price (or exercise price). Normally, the exercise price is set as the market value of the company that offers the options at the time of grant (Hall & Murphy, 2003). Thus, usually the beneficiary only profits if the firm's shares become more valuable than they were at the time of grant. In this sense, it is common practice to set a minimum waiting time for options to become exercisable in order to strengthen managers long-term incentives, which is the vesting period.

Some authors consider management stock options as one of the main reasons behind scandals that involve manipulating accounting earnings, such as the ones previously mentioned, because incentives for managers to enhance stock prices could lead them to adopt these practices in order to influence investors' perceptions about the firm (Hall & Murphy, 2003; Kato *et al.*, 2005).

On the other hand, another approach states that stock options are a prominent mechanism to reduce agency conflicts, because they incentivize managers to enhance the firm's market value through real effort (Matos, 2001; Kato *et al.*, 2005). In addition to the benefit of linking manager's compensation to the firm's market value, options allow managers to obtain more elastic gains than the grant of restricted stocks for the same cost (Peng & Röell, 2014). In this sense, ESOP can offer higher incentives than other forms of compensation, because managers can obtain larger gains and, given that, become more motivated to enhance the firm's long-term market value.

These two views on stock options are not necessarily conflicting. Stock options may have played a large role at accounting scandals. After all, stock-based compensation can generate agency costs and lead managers to manipulate several corporate policies, such as payout policy (Lambert *et al.*, 1989; Fenn & Liang, 2001; Kahle, 2002; Hall & Murphy, 2003; Cruz & Lamounier, 2018 Zhang, 2018), accounting numbers through earnings management (Baker *et al.*, 2003; Bartov & Mohanram, 2004; Bergstresser & Philippon, 2006; Kadan & Yang, 2016) and the use of strategic timing to release good and bad news (Yermack, 1997; Aboody & Kasznik, 2000). However, one could argue that it is possible to structure stock options contracts in order to eliminate or at least reduce manipulative behavior by managers, whilst enhancing incentives for managers to strive for firm value creation. Accordingly, Peng and Röell (2014) highlight that a disadvantage of stock options is the fact that, when compensation contracts are not well structured, they can incentivize managers to focus excessively on short-term prices, and the myopic behavior can lead them to neglect long-term value creation.

The practice of focusing excessively on the short-term and sacrificing the long-term value of the firms, named short-termism, is prevalent among managers (Graham *et al.*, 2005; Marinovic & Varas, 2019). According to Marinovic and Varas (2019), the theoretical literature has adopted two approaches to understand this phenomenon. The first approach studies only the behavior of CEOs, analyzing their motivations without dealing with the topic of optimal incentives. The second approach, on the other hand, studies ideal compensation contracts constructed in order to mitigate manipulations by executives.

Despite of the negative aspects that can be associated with stock options, this kind of payment represents a significant portion of managers' compensation plans (Hall & Murphy, 2003; Bergstresser & Philippon, 2006). Hence, the investigation of ideal ESOP designs is a relevant topic for finance academics, as well as for practitioners. Given the relevance of the topic and the desire to build such contracts, several studies present theoretical models that try to build optimal incentive plans in face of manipulation by managers (Goldman & Slezak, 2006; Edmans *et al.*, 2012; Beyer *et al.*, 2014; Peng & Röell, 2014; Dutta, & Fan, 2014; Varas, 2018; Marinovic & Varas, 2019 among others). Findings from these studies indicate that certain characteristics are desirable in compensation plans. Accordingly, Kato *et al.* (2005) indicate that executive stock option plans can lead to shareholder value creation if they are well structured.

The possibility of building such contracts would have a large impact on several corporate policies, affecting the reliability of accounting numbers, as well as investment and payout policies, which has led us to study this topic. Hence, we have conducted three different studies on the topic, presented in chapters 2, 3 and 4.

We first investigate what the literature on ESOP design tells us about ideal contracts, and which corporate policies do these plans affect. In our first paper (chapter 2), titled "***Are Brazilian Exchange Traded Firms' Executive Stock Option Plans Well Designed?***", we investigate the theoretical (mostly) and empirical literature on stock-based compensation in order to draw conclusions on which features are important in order to align managers and shareholders' interests. We compare the desired features of stock option contracts with those of firms traded on Brasil Bolsa Balcão (B3), the Brazilian stock exchange.

In our literature review, we observe that studies on ESOP focus on creating incentives for value creation while eliminating or reducing manipulations. Compensation policy makers and shareholders are mainly concerned with creating incentives for managers to generate value. Even if manipulations by managers cannot be completely eliminated – after all, agency costs are always expected (Jensen & Meckling, 1976) -, in the end, what shareholders are truly interested in is the creation of firm value.

It is relevant to question how to structure compensation contracts in order to create a balance between managers' incentives to create sustainable firm value and their incentives to manipulate the short-term prices of stocks in the market, which can be wasteful (Peng & Röell, 2014). In this sense, many authors study how to build optimal contracts in the presence of stock-based compensation and manipulative incentives, discussing contract aspects that can lead to the total or partial elimination of manipulation and that can generate incentives for value creation (Acharya *et al.*, 2000; Hall & Murphy, 2003; Edmans *et al.*, 2012; Peng & Röell, 2014; Varas, 2018; Zhu, 2017; Marinovic & Varas, 2019; among others). The aspects of contracts discussed in these studies include the impact of managers' decision horizon and/or contract length, the role of corporate governance, mechanisms that reset exercise prices in order to restore incentives *etc*.

The horizon of incentives is a common theme in many studies that investigate optimal contracts in dynamic or static scenarios (Goldman & Slezak, 2006; Edmans *et al.*, 2012; Dutta, & Fan, 2014; Peng & Röell, 2014; Varas, 2017; Zhu, 2017; Marinovic & Varas, 2019; among others). Despite their differences, most of these studies reinforce the necessity of including long-term incentives in compensation in order to generate incentives that are more balanced. Overall, contracts should include long-term incentives, because compensation based solely on short-term performance has a negative side, as it encourages management to focus excessively on stocks' short-term value, which might lead to more manipulation and eventually harm value creation on the long-term (Peng & Röell, 2014; Marinovic & Varas, 2019).

Another important aspect of compensation is the role of Corporate Governance, which can be seen as a set of mechanisms (exogenous to the firm or not) that make it more costly for managers to manipulate their performance (Marinovic & Varas, 2019). Governance mechanisms include aspects such as the regulatory environment, the composition of the board of directors, the firm's auditors *etc*. Many theoretical models have analyzed the role of corporate governance on reducing manipulations and generating value creation incentives (Ryan and Wiggins III, 2004; Beyer *et al.*, 2014; Schroth, 2018; Marinovic & Varas, 2019). In short, the literature demonstrates that the strength of corporate governance is a relevant aspect for aligning the interests of shareholders and managers. Within companies with better corporate governance, contracts are more likely to generate the necessary incentives, as manipulation is very costly for managers in those firms, forcing them to try to maximize their utility through productive efforts.

At last, another important aspect of stock-based compensation is the necessity to restart incentives. Stock options, unlike restricted stocks, do not provide stable incentives regardless of the share price, because when the manager has stock options, the incentive value depends on the market price of stocks and the options exercise price, and tends to be smaller if the gap between them is very large (Hall and Murphy, 2003). Therefore, an additional problem that can emerge in option contracts is that options can go "underwater", which happens when they have an exercise price much higher than the market value of the shares, which generates a disincentive for managers. This issue is problematic, because factors that are not under the control of managers might affect stock prices negatively (e.g.: an economic crisis). Hence, the inclusion of a mechanism that allows for the re-setting of options strike price could be part of the optimal contract in order to reset incentives for effort averse agents, as lowering the options exercise might provide new incentives (Acharya *et al.*, 2000).

The mentioned aspects of executive stock option compensation, as well as other aspects that we explore in our studies, can affect both managers' incentives to manipulate corporate policies and their desires to enhance firm value through real effort. Academics have proposed many theoretical solutions to building stock-based compensation contracts that create ideal incentives for managers, even assuming scenarios in which they can manipulate their performance measures. We compare these solutions to what Brazilian exchange traded firms adopt in order to evaluate whether agency problems might be expected.

Even though our first study is mostly descriptive, it sets the stage for our next two chapters, in which we focus on how ESOP affect specific corporate policies. We assume that this literature could benefit from additional empirical evidence on the validity of the proposed solutions. We specifically find that ESOP characteristics can directly affect a firm's financial reporting (earnings quality) and payout policies.

Regarding financial reporting, one of the main concerns of accountants is to estimate earnings, considered as the main product of accounting. The extent to which a firm's reported earnings/accruals map into future cash flows is an accounting attribute that reflects the firm's Earnings Quality (EQ) (Bhattacharya *et al.*, 2013). However, EQ is not a singular concept across the literature (Dechow *et al.*, 2010), and it is not how managers' incentives can affect it. We discuss these issues in our second study (chapter 3): "**The Impact of Executive Stock Option Plans Features on Earnings Management and Earnings Quality**".

Since accruals are one of the possible sources of manipulation by executives, stock options can lead to Earnings Management (EM) (Baker *et al.*, 2003; Bergstresser & Philippon, 2006), which is the use of the discretion allowed by accounting standards to not reveal the truth about the firm. Considering the important role of earnings-related information on several economic decisions in financial markets (Takamatsu & Favero, 2013), this is a concerning matter.

An important aspect is that low EQ is not necessarily similar to EM, or even a consequence of the latter. EM is a tactic that involves reporting earnings that differ from a firm's "true earnings" utilizing the flexibility allowed by accounting standards, regardless of whether one does it with good or bad intent towards the information users (Ronen & Yaari, 2008).

EM is not necessarily bad. Also, its impact on EQ depends on how one defines the latter. In fact, EQ can have different meanings for different authors, as Dechow *et al.* (2010) find in their literature review. The authors reach no singular conclusion about what specifically is EQ, because the definition is contingent upon the decision context. They also notice that both a firm's performance measure system accuracy and its own actual performance may affect EQ. Hence, it is probably not useful to examine EQ as a singular construct. Accordingly, we consider how ESOP characteristics affect different EQ Measures, which we present in our first study.

Overall, several metrics which differ from each other have been used to represent the same construct. However, it is not our goal to define what EQ is precisely, as different EQ metrics may all be important for information users in their own way. Our concern is whether ESOP' characteristics influence these measures. Understanding how managers' private goals can affect EQ – or accounting quality overall - is a quest that was much less explored by the accounting literature, even though it is essential to a complete understanding of the determinants of good (or bad) financial reporting (Dechow *et al.*, 2010; Ball, 2003). After all, there is a direct link between the extent to which a firm's accruals/earnings can be mapped into future cash flows and discretionary accounting choices made by management (Bhattacharya *et al.*, 2013).

Evidence indicates that several problems that might affect EQ arise with management stock options, such as the manipulation of stock prices prior to options grant dates and after they become vested. This sort of manipulation usually involves EM or the strategic timing of information release by executives, and has the intention of making options strike price as low as possible (reducing stock prices at the award date), and making stock prices rise when managers acquire the rights to exercise their options (Aboody e Kasznik, 2000; Bartov & Mohanram, 2004; Bergstresser & Philippon, 2006; McAnally *et al.*, 2008).

Aspects of managers' compensation contracts such as option grant dates and vesting period, as well as their monitoring mechanisms, can help us to understand how managers time accounting accruals manipulation in order to maximize their gains with stock options and how to inhibit such behavior. We understand that studies on how these aspects relate to EQ and accounting quality overall are essential to assembling compensation contracts that reduce agency costs related to financial reporting. Hence, in our second study, we investigate how different stock option contract characteristics affect several EQ measures and the relationship between those measures, in order to analyze the impact of EM on the quality of accounting information.

Overall, we find that not only accounting policy is affected by managers' incentives when a firm adopts ESOP. Depending on ESOP designs, a firm's payout policy also changes when agents receive this kind of compensation (Lambert *et al.*, 1989; Fenn & Liang, 2001; Hall & Murphy, 2003; Kahle, 2002; Cruz & Lamounier, 2018; Zhang, 2018). This is the topic of our third study (chapter 4): "**Why Firms Adopt Dividend-Protected Executive Stock Option Plans and How Do They Affect Payout Policy? Evidence from Brazil"**.

The literature on the relationship between ESOP and payout policy is consistent regarding the fact that the adoption of ESOP leads to a reduction in dividend payments (Lambert *et al.*, 1989; Fenn & Liang, 2001; Hall & Murphy, 2003; Cruz & Lamounier, 2018) and an increase in share repurchases (Fenn & Liang, 2001; Kahle, 2002; Cruz & Lamounier, 2018).

Previous studies have adopted a simple explanation for these findings. As Lambert *et al.* (1989) discuss, optioned-managers that do not have the right to receive dividends paid during the vesting period avoid the negative impact that this kind of payout method has on the market price of stock on the ex-dividend date. A reduction in stock price lowers the total return of stock option owners if they have not yet exercised their options. Managers then substitute dividends for share repurchases, which allows them to maintain total payout levels unaltered, because it is not expected that repurchasing shares as a payout method will reduce stock prices – and options prices – (Fenn & Liang, 2001).

Like previous studies, we find that including a "dividend protection" eliminates the negative influence of ESOP on dividend payments. By including a dividend protection, firms can allow managers to receive dividends paid during the vesting period of options (Voss, 2012), which should stop the "dividend substitution". However, we find that adopting ESOP increases repurchases regardless of whether contracts are non-dividend-protected or dividend-protected, contradicting the substitution hypothesis.

We also further investigate why some companies adopt a dividend protection and others do not. Theoretically, shareholders should be indifferent between dividend payments and capital gains, because their total returns would still be the same according to Miller and Modigliani's propositions (Miller & Modigliani, 1961; Black, 1976). However, this assertion is only valid in a scenario in which there are no tax preferences.

In the Brazilian scenario, domestic shareholders favor dividend payments over capital gains due to their tax advantage, which implies that ESOP can lead managers to follow payout policies that unfavorable to shareholders, because they lead them to reduce dividend payments (Cruz & Lamounier, 2018). However, it is necessary to investigate whether most of the firm's shareholders are domestic or foreign in order to evaluate whether there is an actual agency problem regarding payout policy.

Regardless of investors' tax preferences, it is relevant to investigate whether one could structure option contracts so that managers are incentivized to follow specific payout policies instead of trying to use corporate payout in order to intervene on stock prices. Assuming the validity of this proposition, we also analyze whether firms consider their shareholders/investors tax preferences when establishing dividend-related mechanisms in their ESOP. Given that no other study has analyzed which are the factors that lead firms to adopt different dividend-related provisions in their ESOP (e.g.: dividend protection), our study aims to provide a more comprehensive understanding of how this kind of compensation relates to payout policy. Considering that the changes in payout policy generated by ESOP could be undesirable for shareholders, we understand that this is an important issue.

Considering everything we have discussed so far, we suggest that it is crucial to investigate which are the characteristics of ESOP that yield proper incentives, if there are any. Hence, we question ***how do different management stock options contract features influence managers' incentives?***

Answering this question will allow us to understand tradeoffs between different contract features that might lead to better incentives. We suppose that there are contracts that can create incentives while generating less manipulation by managers. Therefore, our *Thesis* is that: *Executive Stock Option Plans design can reduce managers' manipulative behavior.*

We answer our research question with theoretical and empirical evidence and conclude this thesis in chapter 5. In order to answer our research question, we draw important conclusions from three studies which, combined, help us to understand how stock option contracts should be structured optimally, inhibiting managers from manipulating accounting numbers and other corporate policies in order to increase their own gains. Understanding how ESOP features relate to manipulation can be beneficial to firms, as time spent on performance manipulations subtracts time from productivity, which harms long-term value.

1.1 Global Study Goals and Study Relevance

In general, managerial short-termism leads to the need for caution when building stock option contracts. In this sense, it is relevant for new studies to develop models that identify which are the ideal aspects of the contract, considering realistic factors/difficulties that are derived from empirical experience (e.g.: managers' propensity to manipulate performance metrics, manage earnings, change corporate policies etc.). In addition, empirical studies should test the propositions of these models to assess their robustness. We aim to do the latter.

Our main goal within this essay is to analyze **how different stock option contract features influence managers' incentives.** In order to reach this goal, we have conducted three different studies:

i) An analysis of theoretical arguments for building ideal ESOP and an investigation of how Brazilian Exchange Traded Firms' conform to these features;
ii) An investigation of the relationship between different ESOP characteristics and earnings quality measures; and
iii) An analysis of why firms adapt dividend-protected ESOP and how they lead to alterations in firms' payout policies.

Each one of our studies focuses on specific company policies in order to provide a comprehensive picture of how different aspects of the managers' compensation contract affect them. The first paper, "**Are Brazilian Exchange Traded Firms' Management Stock Option Plans Well Designed?**", is an inventory of the features of ESOP adopted by companies traded on B3 in the year 2020. We compare these plans' features with suggestions found in the literature regarding how to build ideal stock option contracts that deal with manipulation.

On our second paper, "**The Impact of Executive Stock Option Plans Features on Earnings Management and Earnings Quality**", we specifically analyze how management stock option contracts characteristics affect financial reporting quality by looking at its effects on several Earnings Quality measures. At last, on "**Why Firms Adopt Dividend-Protected**

Executive Stock Option Plans and How Do They Affect Payout Policy? Evidence From Brazil" we investigate changes in payout policy caused by different ESOP.

These studies have a common theme: management stock options features and their incentives for manipulative behavior. Our work focuses on the Brazilian capital market, as it has a weaker institutional setting with low shareholders rights (Djankov *et al.*, 2008; Chang *et al.*, 2018), which can exacerbate manipulations by management.

We hope that our findings can help enhancing the construction of compensation contracts by providing a comprehensive view of how different stock option contracts characteristics might affect different corporate policies. We assume that ESOP can generate both positive and negative incentives (Goldman & Slezak, 2006), which will be related to the characteristics of each contract. By analyzing how specific compensation contracts characteristics affect different aspects of a firm, we allow practitioners to analyze possible trade-offs associated with these characteristics and test the validity of theoretical arguments on ideal compensation features.

We focus on finding the ideal features of an executive stock option contract. This does not imply that this form of compensation (stock options) is superior to other alternatives (e.g. restricted stocks, matching plans or payments based on accounting earnings). It also does not imply that the insights that we extract from the literature and from our empirical findings are not applicable to other forms of compensation. Nevertheless, our study brings important contributions for firms that decide to adopt ESOP in their attempts to minimize conflicts between managers and shareholders and to create incentives for value creation.

CHAPTER 2
Are Brazilian Exchange Traded Firms' Executive Stock Option Plans Well Designed?

ABSTRACT

Our main goal is to identify ideal features of executive stock option plans (ESOP) that balance productive effort and manipulation incentives in order to analyze whether Brazilian companies conform to these. We first present a literature review of theoretical studies published in the top four financial and accounting journals according to the *Scimago Journal & Country Rank* impact factor ranking. Later, we perform a documental analysis and identify how companies traded in the Brazilian stock exchange design their ESOP. We specifically focus on contract time horizon (vesting conditions and lockup periods), strike price setting and re-setting mechanisms, dividend protection and corporate governance, as the literature suggests that these features relate to compensation incentives. We observe that most of the Brazilian companies include long-term incentives in their ESOP, which can elicit high levels of effort. However, few companies include lockups on acquired stocks, which can exacerbate manipulations at vesting dates. Most of our sample sets strike prices as the weighted average of 30 trading sessions or less before the date in which options are granted, which exposes them to potential manipulations on strike prices, as managers can try to negatively manipulate the firm's market value close to options grant dates in order to reduce exercise prices. Firms traded in the Brazilian Exchange also do not usually include mechanisms to reset options strike prices and did not react to the effects of the pandemic on stock option compensation. Most of the plans are not dividend protected, which incentivizes managers to pay smaller dividends and might generate an agency cost due to shareholders tax preferences. At last, we observe that B3 companies that adopt ESOP have good corporate governance mechanisms, which is an important aspect that might reduce manipulations and lead managers to have higher effort levels. Overall, we conclude that Brazilian companies ESOP are well designed, but there is room for improvement.

Keywords: Executive Stock Options; Manipulation; Vesting Conditions; Strike Price; Corporate Governance.

RESUMO

Nosso principal objetivo é identificar as características ideais de planos de remuneração de executivos com base em ações (ESOP) que balanceiam incentivos de esforço produtivo e de manipulação de forma a analisar se as empresas brasileiras se adequam a essas características. Primeiramente apresentamos uma revisão de estudos teóricos publicados nas top 4 revistas de finanças e contabilidade de acordo com o ranking de fator de impacto da *Scimago Journal & Country Rank*. Posteriormente, realizamos uma análise documental e identificamos como companhias negociadas na bolsa brasileira desenham seus ESOP. Focamos especificamente no horizonte temporal dos contratos (tempo de vesting e período de lockup), mecanismos para definir e redefinir o preço de exercício, proteção de dividendos e governança corporativa, pois a literatura indica que estas características se relacionam com os incentives da compensação. Observamos que a maior parte das companhias brasileiras inclui incentivos de longo prazo em seus ESOP, o que pode gerar altos níveis de esforço. Entretanto, poucas companhias incluem períodos de lockup nas ações adquiridas, o que pode exacerbar as manipulações nas datas de vesting. A maior parte de nossa amostra define preços de exercício como a média ponderada de 30 pregões ou menos antes da data em que as opções são outorgadas, o que as expõe a potenciais manipulações dos preços de exercício, visto que gestores podem tentar manipular negativamente o valor da firma próxima às datas de outorga para reduzir os preços de exercício. Empresas negociadas na bolsa brasileira também não incluem usualmente mecanismos para resetar os preços de exercício das opções e não reagiram aos efeitos da pandemia sobre a compensação por meio de opções de ação. A maior parte dos planos não tem proteção de

dividendos, o que incentiva gestores a pagar menores dividendos e pode gerar um custo de agência devido às preferências tributárias dos acionistas. Por fim, observamos que companhias da B3 que adotam ESOP têm bons mecanismos de governança corporativa, o que é um aspecto importante que pode reduzir manipulações e levar gestores a apresentarem maiores níveis de esforços. No geral, concluímos que os planos das empresas brasileiras são bem desenhados, porém, há espaço para melhoras.
Palavras-chave: Opções de Ações de Gestores; Manipulação; Período de Vesting; Preço de Exercício; Governança Corporativa.

1 Introduction

The necessity to align the interests of shareholders and managers has led many firms to adopt performance-based compensation contracts. These contracts aim to reduce agency costs by incentivizing managers to take decisions that generate long-term value for shareholders. However, performance-based compensation can also be a part of the agency problem itself, because it provides managers incentives to manipulate accounting numbers and financial reports in order to obtain higher payments (Beyer *et al.*, 2014).

Given that performance-based compensation designed to incentivize productive efforts can also elicit incentives for manipulative behavior, models based on agency theory have explored the question of how to create payment contracts that reduce or eliminate incentives for manipulation whilst stimulating managers to enhance the firm's long-term value (Acharya, *et al.*, 2000; Goldman & Slezak, 2006; Edmans *et al.*, 2012; Beyer *et al.*, 2014; Peng & Röell, 2014; Schroth, 2018; Marinovic & Varas, 2019). Shareholders also seem to be aware of the possibility of manipulation, given the complexity of compensation contracts in the real world (Marinovic & Varas, 2019). Hence, understanding how to build management compensation contracts that generate an ideal balance between manipulative and productive incentives is a relevant topic for academics and practitioners.

A specific kind of compensation method that has been associated with manipulations is Executive Stock Option Plans (ESOP). Many studies show that managers manipulate financial reports in order to increase their gains in firms that adopt this form of compensation (Baker *et al.*, 2003; Bartov & Mohanram, 2004; Bergstresser & Philippon, 2006; Kadan & Yang, 2016). However, ESOP plans are also associated with high levels of effort and can be part of an ideal compensation package when short-term information does not reflect a firm's long-term value, as long as the contract is well structured (Peng & Röell, 2014).

In this study, we review the literature on how ESOP structure affect managers' incentives in order to evaluate which features of a stock option contract are supposedly optimal in generating incentives and which corporate policies these features affect. We then test whether ESOP adopted by Brazilian Exchange traded firms satisfy the standards set by the literature on how to build contracts that yield proper incentives. Hence, ***our main goal is to evaluate how firms traded in the Brazilian stock market design their ESOP based on literature suggestions.***

We focus on the Brazilian scenario as the country has weak minority shareholder protection (Djankov *et al.*, 2008), which exacerbates the necessity to build executive compensation contracts that deal with manipulation and generates value creation incentives. This study is relevant because, as Jensen and Murphy (1990) state regarding management compensation: it is not how much you pay, but how. Hence, we do not focus on how much managers receive, but on their ESOP design, considering specific features. By investigating whether companies follow practices set by the financial literature, we can highlight potential issues in the Brazilian capital market.

In Section 2, we present our literature review on agency problems related to stock options compensation and then explore studies on ideal ESOP features. We define the desired features of stock option compensation and then proceed to compare them to the ones presented by firms traded on Brasil Bolsa Balcão (B3) (the Brazilian Stock Exchange). In sections 3 and 4 we describe our sample and present our empirical results.

Instead of performing a comprehensive literature review, we analyze theoretical articles published in the top four financial and accounting journals as measured by the *Scimago Journal & Country Rank* impact factor ranking: *Journal of Finance*; *Journal of Financial Economics*; *Review of Financial Studies*; e *Journal of Accounting Research*. We search for keywords within these journals' websites, including terms such as: "executive stock options"; "stock options"; "management stock options"; "managers stock options"; "stock options short-termism"; "managers stock options manipulation"; *etc.* We start by analyzing theoretical articles published in these papers and include cited articles and empirical studies.

Overall, we find that some of the characteristics of performance-based compensation that can influence managers' incentives suggested on the theoretical and empirical literature include: i) options vesting horizon and lockup periods; ii) mechanisms to set or reset the strike price of options; iii) dividend protection; iv) corporate governance *etc*. When analyzing whether Brazilian companies conform to the proposed ideal features, we find that there is room for improvement.

2 Literature Review

2.1 Agency Theory and Management Compensation

An agency relationship is a contract in which one or more individuals (or principals) engage(s) another person (the agent) to perform an activity in favor of the principal, and this activity usually involves granting decision power to the agent (Jensen & Meckling, 1976). The simplest models of the theory reduce the organization to only two individuals: the agent (managers) and the principal (shareholders)

Lambert (2007) indicates that the principal's role is to offer capital, to assume the business risks and to build incentives, while the agent's role is to make decisions on behalf of the principal while also assuming risks, which are not necessarily the same ones faced by principals. Normally, an agency model presents the following sequence of events: the principal selects a system for evaluating the managers' efforts, which specifies performance measures for executives, as well as the relationship between those measures and the manager's compensation (the function that ties the manager's compensation to his actions and decisions). Based on this contract, the agent will choose actions that influence corporate policies. Those actions, alongside exogenous factors, define the firms' results. The principal compensates the agent according to the established performance measures and receives the firm's residual results (after the agent is paid).

Jensen and Murphy (1990) indicate that managers' compensation policy is one of the most important aspects in a firm. They criticize the mistaken focus on "how much" managers receive, because "how" they receive is more important. The authors affirm that a high payment to a manager due to an improvement in corporate performance is not a transfer of shareholders' wealth, but a prize to compensate managers for their skills. The problem on defining "how" to pay an agent resides on the fact that there are reasons to believe that agents will not always try to maximize shareholders' utility (Jensen & Meckling, 1976).

Compensation contracts play an important role in solving agency problems because the manager's form of payment affects his expected utility, as well as his effort level within the company. The manager will choose the effort level that increases his expected utility considering his contract, which defines the metrics by which he is going to be evaluated (ex:

accounting earnings, stock prices *etc.*) and which he will try to maximize, as long as it is not too costly in terms of effort (Lambert, 2007).

ESOP aim to encourage managers to take decisions that boost the firm's performance and reflects on stocks prices, because options become more valuable when market price rises (Meek *et al.*, 2007). When the value of the firm he manages does not financially affect the agent, he tends to make decisions that enhance his own well-being in detriment of the market value of shares (Bergstresser & Philippon, 2006). Hence, options may be seen as an efficient mechanism to tie the manager's payment to his performance and, consequently, to align his and the shareholder's interests (Kato, 2005).

In order to incentivize managers to do what is in the best interest of shareholders, the compensation plan's structure should reward superior performance and penalize poor performance (Jensen & Murphy, 1990). However, this is not a simple task. The main problem with this argument is the fact that managers can manipulate performance, and firms might reward managers for poor performances if compensation contracts are not well structured. There is also the risk of punishing managers for factors that are not under their control, because exogenous factors (e.g.: an economic crisis) can affect performance-based metrics.

Overall, stock-based compensation can be a double-edged sword, inducing both beneficial effort and manipulative behavior (Goldman & Slezak, 2006). Hence, a vast theoretical literature proposes static and dynamic models that determine how to build ideal compensation contracts that yield high levels of performance whilst acknowledging that managers might manipulate their performance measure (Acharya *et al.*, 2000; Goldman & Slezak, 2006; Edmans *et al.*, 2012; Beyer *et al.*, 2014; Peng & Röell, 2014; Schroth, 2018; Marinovic & Varas, 2019). Overall, this literature indicates that compensation features can lead to different levels of effort and manipulation. In the next sections, we explore a few of these models and empirical studies in order to understand how different ESOP characteristics might affect managers' incentives.

2.2 ESOP Incentive Horizon: Vesting Period and Lockups

The construction of payment contracts is a very complex process. That explains the necessity for models that offer basic guidelines on how to build compensation plans that deal, for example, with agency problems that manifested themselves in the 2008 crisis, covering the short-term view and incentives after the fall of stock prices (Edmans *et. al*, 2012).

Peng and Röell (2014) argue that managers choose to dedicate part of their work time on productive efforts and another part finding ways to transmit a positive short-term view about the firm. They state that manipulation has real consequences and can directly harm the firm value in the long-term: the firm is paying management to spend its time supervising the company's activities, and performance manipulations deviate time from productivity.

The concept of short-termism, broadly, covers any action that increases present returns at the expense of future returns. This definition includes decisions that involve investments that yield positive Net Present Values (NPVs) or projects with immediate returns, but with negative NPVs which – through accounting manipulations – only manifest themselves after several years (such as subprime loans) (Edmans *et al.*, 2012). Due to this possibility, a significant part of actual concerns with compensation is focused in situations in which a superior short-term performance is significantly rewarded, while subsequent events show that the negative long-term results had simply been just hidden, which is widely seen in the financial services in the years leading up to the 2008 crisis (Peng & Röell, 2014).

Authors such as Holmstrom (2004) and Bhagat and Romano (2009) argue that the extension of the vesting time of stock options can prevent manipulation. Accordingly, Peng and Röell (2014) present a model of optimal compensation considering a scenario in which managers can manipulate stock prices in the short-term. In this sort of scenario, they show that short-term contracts can lead managers to waste time manipulating the market's perspective, whilst long-term incentives can assist in eliminating the losses associated with manipulation. Hence, when short-term information is not reliable (e.g. stock prices), longer payment horizons are called for.

Marinovic & Varas (2019) study optimal compensation contracts in a scenario in which managers can exert hidden effort or manipulate the firm's performance in order to increase their compensation, which might reduce firm value. The authors indicate that the optimal contract defers compensation within the managers' tenure, because it is too costly to include postretirement incentives. They indicate that an optimal contract designed to foster effort while minimizing the effects of firm value manipulation should vest at an increasing rate. Long-term incentives should be larger at the beginning of the manager's tenure and his payment should become increasingly sensitive to short-term performance. We assume that contracts with a longer vesting period (or lockups) are closer to meeting this requirement, as firms usually grant stock options once a year and, as time passes, earlier stock options grants get closer to the end of their vesting period, while new option grants ensure that managers still have long-term incentives. Contracts that mix long-term incentives with short-term incentives might also meet this requirement.

In addition, Edmans *et al.* (2012) offer a theoretical structure that reinforces these arguments, showing that the gradual vesting of stock options can be optimal in equilibrium, once the extension of the vesting period deals with the problem of manipulation in the short-term and guarantees that the manager will have sufficient equities in future periods to induce effort incentives.

Overall, there is a consensus in the financial literature that equity-based management compensation should compensate long-term results, because short-term metrics might be illusory and produce relevant distortions in managers' decisions (Bebchuk & Fried, 2010).

Empirical data on payment duration also supports the idea that long-term incentives might reduce short-termism. Gopalan *et al.* (2014) develop a measure to quantify the extent to which a firm's compensation is long-term or short-term and identify that short-term contracts are associated to higher manipulation of short-term performance measures and worse stock performance.

One final aspect we observe is that, according to Bebchuk and Fried (2010), firms should not only provide managers with longer vesting periods, but also include restrictions so that managers cannot "cash out" their equity incentives immediately after options vesting. They also argue that managers should not have a "hold-till-retirement" requirement, as it might distort their decision to retire, as well as undermine their long-term incentives close to retirement dates.

The argument regarding restrictions on "cashing out" is coherent, because there is evidence that managers have positively manipulated accounting earnings close to moments when a substantial amount of options were exercised (Bartov & Mohanram, 2004; Bergstresser & Philippon, 2006).

Based on the models presented and on empirical evidence, we argue that compensation contracts should grant greater weight to long-term incentives in order to create an ideal balance between productive effort and manipulations, and should also include restrictions so that acquired shares cannot be sold for some amount of time.

2.3 Strike Price: Setting and Resetting

Another important aspect of ESOP is their strike price (exercise price), which is the price that the stock option owner can pay for a share. A stock option provides incentives for managers to enhance market value, because as long as the stock prices are higher than the strike price, the owner of a stock option profits. Usually, strike prices are set as the market value of shares at the time of grant (Hall & Murphy, 2003). Firms might adopt other measures (e.g. a fixed price or the book value of shares) when setting their ESOP, as well as different dates. However, it is more common to use the firm's market value when setting strike prices.

Given that stock options strike price usually relates to the market value of a company at the time of grant, an issue arises. Managers can take advantage of this by momentarily reducing strike prices close to the award date (Aboody & Kaznik, 2000; Baker *et al.*, 2003).

Aboody and Kaznik (2000) show that when financial reports closely follow scheduled option grants, managers anticipate bad news, reducing stock prices and, consequently, reducing their options strike price. A positive movement in stock prices follows this strategy after the earnings release, because managers retain good news. Hence, they suggest that firms should randomize their grant dates or postpone them until earnings are released, which would mitigate this issue.

A problem with this solution is that a firm's accounting earnings can also falsely signal bad news to the market before the grant date. As Baker *et al*. (2003) show, managers negatively manipulate earnings before these dates. Hence, we suggest that possible solutions to this problem are randomizing grant dates, not utilizing the firm's market value when setting the strike price, or utilizing the weighted average of market values for long periods (over 3 months), rendering short-term manipulation attempts more difficult.

The previous solutions do not exhaust all the issues regarding options exercise prices. As Hall and Murphy (2003) state, a stock option's incentive is contingent upon the difference between the stocks market price and the options strike price. Option-based contracts offer high incentives in higher regions of outcome but provide lower levels of incentive in lower outcome ranges (Lambert, 2007). When options go "underwater" - a situation in which the firm's stock market price becomes substantially lower than the strike price of the manager's options - the manager' incentives decrease. This suggests that firms must consider exogenous factors in order to maintain managers' effort levels high. Accordingly, companies adjust compensation for market trends, even though contracts based on relative performance are rare (Jensen & Murphy, 1990; Saly, 1994). This type of consideration is particularly relevant in volatile markets such as the Brazilian one.

A mechanism that can solve this issue is the inclusion of a contractual clause that allows for the reset of options exercise price when they go underwater and incentives decline (e.g.: utilizing the current market value as the new exercise price for unvested options). Acharya *et al.* (2000) discuss the optimality of this possibility and indicate that this mechanism can be optimal when managers have little influence over it. Resetting strike prices can generate better incentives than the ones obtained by "pre-commitment" to the initial agreement.

We argue that this sort of mechanism is particularly useful in an economic crisis, leading to better incentives in the short-term after the fall of stock prices. We assume that the reset of incentives might be ideal when the market faces an economic crisis, because options can go underwater in this sort of scenario, reducing managers' incentives. Given that the 2020 crisis generated by the Covid-19 pandemic has harshly affected the Brazilian capital market and markets all around the world, we examine whether B3 firms have adjusted their strike prices in order to reset incentives.

Overall, we find that strike prices are a factor to consider when stock option compensation is structured, in order to avoid manipulations by managers and lack of incentives that might arise when managers believe that they will not be able to make stock prices surpass options strike prices.

Another relevant aspect we identify in the ESOP literature is the fact that managers' compensation scheme might affect organizational policies. The clearest example is payout policy, as we discuss in the following section.

2.4 Dividend Protection

A potential problem with ESOP relates to dividends. Dividend payments decrease share value at a 1 to 1 basis at the ex-dividend, lowering stock options total gains (Muniz, Galdi, & Damasceno, 2022). A consequence of this negative relationship between dividend payments and ex-dividend stock prices is that firms that adopt ESOP usually pay smaller dividends, as managers avoid the negative impact of this payout on stock prices at the ex-dividend date (Lambert *et al.*, 1989; Fenn & Liang, 2001).

Assuming that shareholders are not interested in dividend policy changes, an alternative to granting management stock options is forcing managers to become shareholders, since they will benefit from dividend payments (Hall & Murphy, 2003). However, firms can grant more options than shares for the same cost, and options could have a greater potential for generating incentives, as managers only profit if the firm's stock market value surpasses the strike price (Lambert, 2007).

Considering that a firm decides to implement an ESOP, including dividend protection could solve potential problems regarding dividend decreases associated with executive incentives, because this mechanism compensates managers for dividends paid during the vesting period of options (Fenn & Liang, 2001; Liljeblom & Pasternack, 2006). A dividend-protected ESOP can compensate managers for dividends paid during the vesting period of options or reduce strike prices to compensate the effect of dividends. However, dividend protection is not common (Voss, 2012).

Tax considerations in Brazil might lead shareholders to favor earnings distributions through dividends. Dividends are untaxable, while capital gains are (Cruz & Lamounier, 2018). Hence, including dividend protection could potentially be beneficial for Brazilian shareholders, as they can avoid reductions in dividend payments. Previous studies show

At last, another important aspect that can influence managers' behavior is corporate governance. In some models, corporate governance plays an important role on managers' productive and manipulative incentives and in the effectiveness of compensation contracts (Goldman and Slezak, 2006; Beyer *et al.*, 2014; Schroth, 2018; Marinovic & Varas, 2019).

2.5 Corporate Governance and ESOP

Corporate governance design is a set of mechanisms from within or outside the firm that aim to make it harder for managers to manipulate their performance in order to increase their own gains (Marinovic & Varas, 2019).

Goldman and Slezak's (2006) model shows that the equilibrium pay-for-performance sensibility of an optimal contract depends on monitoring variables. They show that firms with weaker governance should adopt lower pay-for-performance sensibility, which indicates that such firms are more susceptible to manipulative behavior and should not rely on short-term performance measures. Hence, corporate governance enhances the balance between effort and manipulation by a firm's managers.

Other models corroborate this assertion, showing that higher costs for manipulating reported earnings, resulting from a higher quality corporate governance, lead to higher firm value and lower expected levels of manipulative behavior (Schroth, 2018; Beyer *et al.*, 2014). One of the main reasons why better monitoring might lead to a better balance between manipulative and productive incentives is the fact that it makes manipulation costlier for managers, which could indicate that the manager will have higher expected utility from his productive efforts instead (Marinovic & Varas, 2019).

Empirical studies also provide evidence that corporate governance leads to less manipulation and better performance. Dechow, Sloan and Sweeney (1996) find that earnings management is prevalent on firms with weak corporate governance aspects such as a large number of dependent board of directors' members and Chief Executive Officers (CEO) who also serve as Chairman of the Board.

Overall, governance theory views Board Independence as an important factor to improving corporate governance, because the director should be an objective monitor of corporate decision-making that has insider knowledge and objectivity as an information intermediary (Krishnan, Raman, Yang, & Wu, 2011). Evidence indicates that board independence leads to smaller levels of earnings management, even though this relationship is weaker in family controlled companies (Prencipe & Bar-Yosef, 2011).

Well-governed firms also significantly overperform companies with poor corporate governance on average (Bauer *et al.*, 2008). Hence, there is a relationship between a firm's monitoring devices and its performance. This is probably explained by the fact that good corporate governance makes managers "hidden efforts" more visible (Marinovic & Varas, 2019), leading managers to be more incentivized, as they expect rewards for their efforts.

Overall, theoretical and empirical evidence provide support for the positive role of corporate governance on higher firm performance and smaller manipulation levels, indicating the higher monitoring of managers actions makes it costlier for them to manipulate performance. We expect corporate governance to affect a firm's market returns positively. Given the previous discussions and results, we presume that corporate governance qualities relate to both performance and manipulation. We assume that better corporate governance will lead to a better balance between incentives for performance and for manipulation.

Another important aspect regarding corporate governance is how it interacts with the contract vesting conditions. As we have already discussed, Goldman and Slezak's (2006) model indicates that weak corporate governance should lead to long-term compensation contracts. Long-term incentives incite better incentives for managers to perform instead of manipulating, because manipulations are not easy to sustain for long periods (Peng & Röell, 2014).

Marinovic and Varas (2019) infer relevant findings about the quality of corporate governance in their model, indicating that strong corporate governance may lead to greater short-term compensation and greater value for the firm. In their model, however, they indicate that higher corporate governance does not necessarily imply that manipulation levels will be lower. They describe this as a "paradox": better corporate governance makes short-term incentives more effective at stimulating managers, which might be optimal even if they generate greater incentives for manipulations. This happens because long-term incentives are better at dealing with manipulation incentives. However, higher monitoring (corporate governance) is better at eliciting effort in the short-term. Hence, even if manipulation persists, short-term incentives associated with a better corporate governance might lead managers to generate better results, enhancing shareholders well-being if the "real" performance offsets the costs of manipulations.

3 Methodology

3.1 Study Sample and Procedures for Data Collection

Our sample includes firms traded on B3 in the year 2020 that compensate their managers with stock options. We chose to analyze the year 2020 in order to evaluate plans that were active at the time we have conducted this study. We aim to diagnose the state of active plans, as we see no point in suggesting "corrections" in designs of ESOP that are no longer active. Considering that mechanisms to reset incentives are part of an ideal contract (Acharya *et al.*, 2000), a benefit of evaluating firms' compensation practices in 2020 is that it also provides an opportunity to identify how companies have reacted to the effects of the COVID-19 pandemic on the Brazilian stock market. If indeed firms have adapted their ESOP to account for the effects of the pandemic, it is important to examine whether these reactions were formal parts of contracts or informal decisions.

We conduct a documental analysis in order to identify how B3 companies structure their ESOP. We perform a Categorical Content Analysis to interpret and classify our data in predefined categories (Bardin, 1977). In the previous section (section 2) we analyze several studies which assist us in creating categories for firms ESOP features. After classifying companies regarding their ESOP features and displaying summary statistics for these features, we analyze whether Brazilian exchange traded companies conform to the ideal ESOP features suggested by the literature.

Most of our data is from the Economatica® database as well as from firms' financial statements. We collect information on ESOP from Reference Forms, which are obligatory for public firms in the Brazilian capital market. These forms present comprehensive information on managers' compensation plans, including the necessary data for our study. At last, we utilize data available on the B3 website regarding companies Corporate Governance Codes in order to evaluate corporate governance aspects.

When assembling our sample, we look at all the B3 traded firms available in the Economatica® database. We start with 407 firms traded in the Brazilian Exchange and identify 116 firms that have approved an ESOP at some point. We exclude 3 firms with unreliable and incomplete reference form information, 4 companies that did not implement their plans and 39 firms that have canceled their stock option compensation before 2020. Hence, our final sample constitutes of 70 firms with active ESOP in the year 2020. Some of the firms we classify as companies that have terminated their plans indicate in their forms that they still compensate managers with ESOP, but have not granted options for a long time and do not have outstanding options.

While not the focus of the present research, a relevant finding when constituting our study sample is that a substantial amount of the analyzed firms has implemented an ESOP at some point and decided to terminate it. Out of the 109 companies that have implemented their ESOP and reported reliable data, 20 (18,34%) have substituted their ESOP for other forms of stock-based compensation, while 19 (17,43%) have cancelled their ESOP and did not substitute them for other forms of stock-based compensation. Hence, only 70 (64,22%) of the companies that have implemented their ESOP has not cancelled them.

4 Results and Discussion

4.1 ESOP Vesting Conditions in the Brazilian Capital Market

In our literature review, we observe that ESOP should vest gradually (Edmans *et al.*, 2012). However, they should grant greater weight to long-term compensation within the managers' tenure in order to balance productive and manipulative incentives (Marinovic & Varas, 2019). Manipulation will not completely disappear, but it should not offset the positive effects of stock option compensation on managers' incentives.

We find that two aspects of an ESOP directly relate to the managers' incentive horizons: i) the vesting period and; ii) lockup periods. Lockups are restrictions on the sale of shares acquired through the exercise of stock options, usually set as a minimum waiting time after the exercise of options. The largest these periods (i and ii) are, the longer is the horizon of a manager's incentives.

A first feature regarding vesting conditions we analyze is whether firms include a vesting period or grant immediately exercisable options. It is common practice to set a minimum waiting time for options to become exercisable, which provides retention incentives

(Hall & Murphy, 2003). However, some firms allow options to be immediately exercisable, which might not yield long-term incentives.

In our sample, 4 companies (5,71%) grant options that are immediately exercisable. However, it should be noted that all of them include a lockup period in which stocks acquired through options cannot be sold (3 firms have a 5 year lockup and 1 has a 4 year restriction). These lockups deal with managers' long-term incentives, but we argue that this form of stock option compensation more closely resembles the incentives of restricted stocks than the incentives of "traditional" stock option plans. It does not seem like there is a clear advantage in this type of ESOP over restricted stocks, which might explain why only a small fraction of our sample adopts it. Managers might still try to manipulate performance close to the end of their stock selling restrictions.

Companies usually grant options that vest gradually. However, there is not a single pattern on how they vest. While some companies' options vest yearly in a similar proportion (e.g.: 25% per year during 4 years), other firms adopt increasing rates of vesting (e.g.; 20% in the first year; 30% in the second year and; 50% in the last year), allow options to vest all at once at some specific date (which can also be the granting date) *etc*.

Some companies also adopt different vesting periods for different grants. Considering this, we define two vesting variables. We assume that firms have a "shortest vesting period" and a "longest vesting period". A firm's shortest (longest) vesting period is the time between options grant date and its first (last) portion of exercisable options. For example, if a firm adopts a 25% per year vesting rate, its smallest vesting is one year and its longest vesting is four years. If a firm has multiple grants with different vesting conditions, we consider a firm's shortest (longest) vesting date to be the same as its smallest (largest) one. At last, if a firm's options vest all at once (e.g.: 100% of options vest in 5 years), we consider its shortest vesting period to be the same as its longest one.

We collect data on three features of vesting conditions for each company: i) options shortest vesting period; ii) options longest vesting period; and iii) acquired stocks lockup period. We consider the sum of a firm's longest vesting period and its lockup period in order to estimate manager's incentive horizon. Table 1 presents descriptive statistics of these data for 68 companies (2 companies did not present data).

Table 1: Descriptive statistics on vesting conditions and lockups (n = 68)

Variable	Mean	Std. Dev.	1st Quartile	Median (2nd Quartile)	3rd Quartile	Min	Max
Longest Vesting (years)	3.837	1.62	3	4	5	0	10
Shortest Vesting (years)	1.467	1.215	1	1	2	0	5
Lockup after Exercise (years) (1)	0.718	1.661	0	0	0.75	0	10
Shortest Vesting + Lockup (years)	2.2	1,97	1	1,665	3	0,17	14
Longest Vesting + Lockup (years)	4.555	1.848	3.375	4.5	5	1	15

(1) For two companies that do not utilize vesting date as a reference point for their lockup periods, we consider the smallest possible lockup after vesting.
Source: research data.

Managers should not only have large vesting periods, but also restrictions after the vesting of options (Bebchuk & Fried, 2010). Lockups deal with this last condition. Hence, when analyzing long-term incentives, we look at the sum of a company's longest vesting period and its lockup conditions. For short-term incentives, we look at the sum of shortest vesting period and lockups.

Overall, Brazilian companies' ESOP include incentives that last for a relatively long period. Around 75% of companies only allow acquired stocks to be sold after over 3 years and 4 months, and 50% of firms have incentives that last over 4 and a half years. Short term incentives (considering lockup periods) for 75% of companies in our sample last for at least 1 year, and at least 1 and a half years for over 50% of our sample.

Considering only the vesting period of options, ESOP incentives usually last around 4 years, a finding consistent with evidence for American companies, which usually include vesting horizons around 3 to 5 years (Gopalan *et al.*, 2014).

Despite the fact that firms usually include long-term incentives, only 27 firms (39,7%) in our sample (68 firms with vesting data) include lockups, which could incentivize managers to manipulate performance close to exercise dates.

We find that the largest incentive horizon within our sample is 15 years. While this seems to be an unusually long contract, contracts can last as long as 20 years in more developed countries (Gopalan *et al.*, 2014).

As we have discussed, long-term incentives are ideal, but they should last within the manager's tenure, because even though postretirement incentives might deter manipulation in the manager's final years in office, they do not provide sufficient effort incentives (Marinovic & Varas, 2019). Regarding postretirement incentives of ESOP within B3 companies, only one company (1,42%) includes a lockup that lasts longer than the manager's tenure. In this company, managers can only sell stocks acquired through ESOP 1 year after they leave the company. Overall, B3 companies do not include postretirement incentives in their ESOP.

4.2 Price-setting mechanisms

Table 2 displays the criteria firms utilize for setting strike prices, except for 3 firms (4,22%) that do not display this information. Most companies (52; 73,23%) utilize the weighted average of their market value when setting their strike price. This is a potential problem, because managers might try to manipulate stock prices downward if they are aware of grant dates (Aboody & Kaznik, 2000; Baker *et al.*, 2003).

We propose that firms that utilize their market value when setting strike prices should utilize the weighted average stock price of a long number of trading sessions, as this might make it more difficult for managers to use quarterly earnings in order to manipulate stock prices. Ideally, the weighted average of market values of at least three months could make short-term manipulation more difficult. Assuming 5 sessions per week, a trimester (quarter) would have around 60 sessions (64). We utilize trading sessions because most of the firms consider the number of sessions instead of the number of days when setting strike prices (usually 30, 60 or 90).

Most of the 52 firms in our sample that adopt weighted market value when setting strike prices do not meet the standard we set. Only 5 companies (7,14%) adopt periods larger than a quarter when setting their strike prices. Hence, most of the firms are potentially susceptible to stock price manipulations before grants. We notice that 3 companies (4,29%) set strike prices as the market value at the time of grant, while 29 companies (41,43%) utilize the weighted average of 30 sessions before the grant date or less. If management knows grant dates, these criteria could make strike price manipulation easier.

Regarding firms that do not utilize weighted market values, 2 (2,86%) companies allow call options to be exercised for a symbolic value of R$ 0,01 per option. Even though we suggest the utilization of fixed prices, we argue that this strike price (R$ 0,01) defeats the purpose of adopting stock options, because managers will always have positive earnings.

We note that 1 company (1,43%) also allows options to be exercised for R$ 0,01 (per 10.000 options), however, managers do not receive shares and are entitled to stock value increases. This particular tactic is more interesting than the latter, however, still exposes the firm to manipulation of stock prices prior to grant dates, as it compensates managers for share appreciations considering stock value at the grant date.

Table 2: Data on price-setting criterias (*n* = 70)

<table>
<tr><th>Main Criteria for the strike prices</th><th colspan="2">Description</th><th>Number of Firms (%)</th></tr>
<tr><td rowspan="7">Market Value (1)
62 firms (88,57%)</td><td colspan="2">Strike price set as the Market Value at the Options Grant Date</td><td>3 (4,29%)</td></tr>
<tr><td rowspan="4">Weighted Average Market Value of Trading Sessions Before the Grant Date
52 firms (74,28%)</td><td>Number of sessions ≤ 30 or less</td><td>29 (41,43%)</td></tr>
<tr><td>30 < Number of sessions ≤ 60</td><td>15 (21,42%)</td></tr>
<tr><td>60 < Number of sessions ≤ 90</td><td>3 (4,29%)</td></tr>
<tr><td>Number of sessions > 90</td><td>2 (2,86%)</td></tr>
<tr><td colspan="2">The strike price is set as the market price (or weighted average of previous sessions) at the date of a specific corporate event (e.g.: the firm's IPO or board meetings) or at a subjectively defined date.</td><td>7 (10%)</td></tr>
<tr><td colspan="2">Firms that utilize market value, but do not display which date (or period) was used to set their options strike price</td><td>3 (4,29%)</td></tr>
<tr><td rowspan="3">Fixed Value
5 firms (7,14%)</td><td colspan="2">0,01 per stock option</td><td>2 (2,86%)</td></tr>
<tr><td colspan="2">0,01 per 10000 stock options (2)</td><td>1 (1,43%)</td></tr>
<tr><td colspan="2">A specified fixed value</td><td>2 (2,86%)</td></tr>
<tr><td>Not specified
3 firms (4,28%)</td><td colspan="2">These firms do not include precise information on how their strike prices are set</td><td>3 (4,29%)</td></tr>
</table>

(1) two out of the firms that adopt market value also allow managers to exercise a fraction of their options for R$ 0,01

(2) for this company, managers have rights over share value appreciations, but do not receive shares when their call options are exercised.

Source: research data.

Other 2 (2,86%) companies have set fixed prices that were not just “symbolic”. However, information revealed in their reference forms is not clear regarding which factors have led them to adopt the defined prices.

Overall, our evidence on strike price-setting criteria indicates that firms in the Brazilian scenario are susceptible to strike price manipulations. However, we do not obtain data on whether managers are aware of grant dates, which affects this conclusion.

4.3 Strike Price Resetting and the Pandemic.

The possibility to reset strike prices could be an interesting feature of ESOP, avoiding the punishment of managers for events they do not control (such as an economic crisis) and to restore incentives (Acharya *et al.*, 2000). However, none of the firms in our sample formally includes this provision.

We also investigate whether companies have responded to the effects of the Covid-19 pandemic on stock prices and identify that only one firm (1,43%) has reacted to the effects of the pandemic by resetting how its strike price is adjusted. More specifically, this firm has reacted to how the pandemic has affected inflation indexes. This firm’s strike price was previously corrected for inflation by the IGP-M (General Price Index – Market), however, the company has decided to substitute this index by the IPCA (Consumer Price Index). The reasoning behind this substitution is that IGP-M has increased substantially during the pandemic, resulting in price corrections above 24%. We assume that this decision was coherent, because high corrections in strike prices could destroy the incentives of ESOP. Overall, we observe that ESOP by Brazilian Exchange traded firms are not pre-committed to deal with exogenous factors that might affect managers' incentives.

4.4 Strike Price Adjustment to Dividend Payments

Regarding the adjustment of strike prices for payout policies, 56 firms (78,87%) of our sample did not include dividend protection provision in their latest ESOP. It is noteworthy that 1 company (1,43%) used to include dividend protection clause in its previous ESOP, however, decided not to include one in its latest contract.

Out of the remaining 15 companies (21,42%), 14 (20%) state that they will adjust strike prices for dividend payments that were made between the grant date and the exercise date of options, while 1 (1,41%) indicates that strike prices can be adjusted for dividend payments, as long as the board of directors allows it. Our findings corroborate the assertion of Voss (2012) that most of the firms do not include dividend protection.

Muniz *et al.* (2022) observe that Brazilian companies that do not include dividend protection in their stock option plans pay lower dividends, which might create conflicts between shareholders and managers. Considering Brazilian shareholders' tax preferences, dividend reductions could be detrimental (Cruz & Lamounier, 2018). Hence, our results highlight a potential problem with how Brazilian companies set their ESOP clauses.

4.4 Corporate Governance

The literature indicates that high quality corporate governance tools should follow compensation packages in order to deal with manipulation, as monitoring weaknesses allow managers to manipulate their executive stock option gains (Goldman & Slezak, 2006; Marinovic & Varas, 2019).

We look at four specific governance features of companies that relate to how much control managers have over their plans in order to evaluate B3 companies. First, we observe how firms classify in the B3 Corporate Governance segments. B3 establishes governance rules and classifies firms according to their level of – voluntary - commitment. These rules are not mandatory by the Brazilian legislation. The highest classification for Public companies is "New Market" (NM), followed by "Level 2" (L2) and "Level 1" (L1). Firms in these three categories adopt corporate governance practices superior to the ones set by Brazilian legislation. Firms that only adopt mandatory governance rules classify in the "Traditional Market" (TM).

We also look at two dimensions of governance: i) board of directors independence (Leung *et al.*, 2014) and; ii) if a firm's CEO is also a board chairman (Prencipe & Bar-Yosef, 2011). In order to obtain proxies for these measures, we observe whether companies follow ideal clauses set by B3, which indicates that companies' governance codes should state: i) that the directors board should be mostly composed by external members and at least one third of the board members should be independent and; ii) that the CEO should not also be the board chairman. If firms do not include these criteria in their governance codes, we consider their corporate governance to be not ideal.

At last, we observe whether firms compensate only their statutory board members or also their board of director's members through ESOP. Compensating only statutory board members is ideal, given that board of director members have larger discretion over financial reporting and other corporate policies that might allow them to manipulate stock and strike prices. We obtain corporate governance data for only 68 companies of our sample. Table 3 presents data on our four measures of Corporate Governance.

Overall, firms that adopt ESOP present good governance practices. Most of the companies classify in the NM (48 firms; 70,58%), which is the highest segment according to

B3 standards. Also, only 2 companies (2,94%) do not adhere to the ruling regarding CEOs not being board of directors' chairman. At last, most of the companies (45 firms; 66,17%) only compensate their statutory board with stock options and do not compensate board of directors' members. However, 52 companies (76,47%) do not include ideal rules regarding board independence in their governance codes, which indicates that board independence is an issue on most of the companies that adopt ESOP.

Table 3: Corporate Governance data for firms that adopt ESOP (*n* = 68)

New Market	Level 2	Level 1	Traditional Market	Includes B3's Directors Board Independency Rule	CEO is not the Board Chairman	Firms that do not compensate their Board of Directors with ESOP
48	**5**	**5**	**10**	**16**	**66**	**45**
70,59%	**7,35%**	**7,35%**	**14,7%**	**23,53%**	**97,05%**	**66,17%**

* two companies of our sample did not present complete corporate governance data
Percentages consider a total of 68 companies.
Source: research data

We find that both companies in which the CEO is also the Board of Directors' Chairman compensate their directors' board with stock options. This reinforces the idea that this sort of governance weakness (CEO as Chairman of the board) might be undesirable, because in both firms CEOs have large discretion over aspects of their own compensation. Additionally, these two companies do not include B3's ideal ruling regarding Board Independence.

4 Conclusion

We perform a literature investigation to identify which are the ideal features of an ESOP in order to generate effort and reduce manipulation, and then compare these to the practices of B3 traded companies.

Overall, most of the B3 companies that adopt ESOP include long vesting periods. This is a positive aspect of these plans, as long-term incentives within the manager's tenure offset the negative impact of manipulations (Marinovic & Varas, 2010). However, most of the companies do not include restrictions on selling the acquired stocks after options exercise. This is not ideal, as restrictions after vesting deal with incentives for short-term price manipulations (Bebchuk & Fried, 2010).

Empirical evidence indicates that managers deliberately influence their own firm's market prices negatively before grant dates, as firms usually set their exercise prices based on this metric. Hence, ideally, we suggest that firms should not use market prices (or weighted average) as their strike price if managers are aware of grant dates in order to avoid manipulations. However, most of the Brazilian companies do not satisfy this suggestion and usually set their strike prices as the weighted average of a small period before grant dates.

Another aspect we find is that, contrary to theoretical arguments on the optimality of including a strike price reset mechanism (Acharya *et al.*, 2020), B3 firms generally do not pre-commit to exercise price resetting when options go underwater. Hence, in the face of the economic crisis generated by the COVID-19 pandemic, Brazilian companies did not reset ESOP incentives.

Shareholders' tax considerations are another aspect to consider when setting an ESOP. Most of the companies in our sample do not include dividend protections, which might lead managers to reduce dividend payments before their options vest, as they avoid stock-price-reductions at the ex-dividend dates. This is particularly problematic for shareholders in the Brazilian market, because dividends usually are untaxable, while capital gains are.

At last, we observe that companies that adopt ESOP generally present high quality corporate governance. Most of the companies classify in the highest corporate governance segment according to B3 classification, do not compensate their director's board members with options and do not name their CEOs as Chairman of the board. However, board independence is an issue for most companies.

Overall, we conclude that Brazilian exchange traded companies design their ESOP well. However, there is room for improvement. We also notice that a substantial amount of companies has given up on their ESOP, completely terminating stock-based compensation or substituting stock options for other forms of payments related to market value. Examining the reasons that have led these companies to abandon their ESOP is an important issue for future research. It would be interesting to investigate whether these plans have not reached their goals regarding incentivizing managers and, if so, whether their design was ideal. While we do not focus on this issue in the present paper, we notice that some companies that have cancelled their ESOP have had problems with market manipulation by managers, including frauds that have led to criminal convictions.

Regarding our research limitations, we evaluate only incentives of ESOP. Firms adopt other forms of compensation alongside ESOP that could complement the flaws in stock option compensation (or nullify their success). Additionally, this study is mostly descriptive. Hence, there is no guarantee that the ESOP features we study actually generate ideal incentives.

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CHAPTER 3
The Impact of Executive Stock Option Plans Features on Earnings Management and Earnings Quality

ABSTRACT

In this study, we analyze how executive stock option plans (ESOP) and their features affect Earnings Quality (EQ), focusing on companies traded in the Brazilian capital market. We estimate several models to identify how ESOP features such as granted options, exercisable options, incentive horizon (vesting and lockup periods) and corporate governance affect EQ proxies. Specifically, we study how ESOP features affect earnings persistence, accruals management, target earnings measures and earnings smoothness. Our work is innovative, as it provides evidence that complements theoretical studies. While, for example, authors have suggested that long-term incentives affect managers' incentives, what constitutes "long-term" is unclear. We show how long incentives should last in order to affect EQ measures. We find that the incentive horizon of ESOP mediates the impact of exercisable options on EQ. Overall, contracts that include long-term incentives (vesting and lockup periods higher than five years) are associated with higher EQ when considering measures of persistence, earnings management and earnings smoothness. However, we cannot rule out the hypothesis that these contracts lead managers to manipulate persistence and smoothness measures, as there is evidence that ESOP with higher vesting and lockup periods lead managers to report accounting losses voluntarily, which can distort these EQ measures. We also find that executives are more likely to manage accruals downward and to miss specific target earnings in dates near grants. These tactics reduce firms' market values and, consequently, stock options strike prices, increasing managers' potential earnings.

Keywords: Executive Stock Option Plans; Earnings Quality; Long-term Incentives; Corporate Governance; Manipulation.

RESUMO

Neste estudo, analisamos como os planos de opção de gestores (ESOP) e suas características afetam a qualidade dos lucros (EQ), focando em empresas negociadas no mercado de ações brasileiro. Estimamos diversos modelos para identificar como características dos ESOP como as opções outorgadas, as opções exercíveis, o horizonte dos incentivos (períodos de vesting e lockup) e a governança corporativa afetam proxies de EQ. Especificamente, estudamos como características dos ESOP afetam a persistência dos lucros, o gerenciamento de accruals, medidas de lucro alvo e suavidade dos lucros. Nosso trabalho é inovador, pois fornece evidências que complementam estudos teóricos. Embora, por exemplo, autores tenham sugerido que a compensação de longo prazo afeta os incentivos dos gestores, o que constitui "longo prazo" não é claro. Mostramos quanto tempo os incentivos devem durar para afetar as medidas de EQ. Descobrimos que o horizonte dos incentivos dos ESOP media o impacto das opções exercíveis sobre a EQ. No geral, contratos que incluem incentivos de longo prazo (com período de vesting e lockup superior a cinco anos) estão associados a mais EQ quando se consideram as medidas de persistência, gerenciamento de resultados e suavidade dos lucros. No entanto, não podemos descartar a hipótese de que esses contratos levem gestores a manipular as medidas de persistência e suavidade, pois há evidências de que ESOP com maiores prazos de vesting e lockup levam gestores a reportar prejuízos contábeis voluntariamente, o que pode distorcer essas medidas de EQ. Também descobrimos que executivos são mais propensos a gerenciar os *accruals* para baixo e a não atingir "lucros-alvo" específicos em datas próximas a outorgas. Essas táticas reduzem o valor de mercado das empresas e, consequentemente, o preço de exercício das opções, aumentando o ganho potencial dos gestores.

Palavras-chave: Planos de Opções de Ações para Gestores; Qualidade dos Lucros; Incentivos de Longo Prazo; Governança Corporativa; Manipulação.

1. Introduction

Many highlight earnings as one of the main products of accounting. Earnings can assist in the assessment of companies' performances, aid the prediction of future earnings by investors, shareholders or bondholders, and provide data for firm valuation models, as well as in many other important tasks. Hence, the concept of Earnings Quality (EQ) is fundamental in the accounting literature (Dichev *et al.*, 2013).

The accounting literature has given a lot of attention to how accounting standards (Code Law vs. Common Law) influence financial reporting practice and the quality of accounting reports (Ball, 2003). Ball (2003) indicates that this focus can lead to an incomplete and misleading view, because the incentives of the individuals responsible for the preparation of financial reports can affect accounting practices inside a given set of rules. In a similar sense, Dechow *et al.* (2010), based on their comprehensive literature review, highlight that several variables can affect EQ, but there is still a gap in the understanding of how managers' utility functions influence their decisions regarding earnings reporting and, consequently, EQ.

Given the relevance of the EQ concept and the necessity to understand how managers' incentives affect this construct, **our main goal was to identify how specific Executive Stock Option Plans (ESOP) features affect several measures of Earnings Quality**. We focus on ESOP because several studies show that this type of compensation can lead managers to manipulate financial reporting practices in order to affect stock prices (Aboody & Kasznik, 2000; Bartov & Mohanram, 2004; Bergstresser & Philippon, 2006; Meek *et al.*, 2007; McAnally *et al.*, 2008; Chan *et al.*, 2010; Kadan & Yang, 2016; among others). Hence, even though stock options can be part of an ideal compensation contract, ESOP features such as incentive horizons and corporate governance level are necessary conditions in order to enhance the balance between performance and manipulation (Peng & Röell, 2014).

ESOP can incite Earnings Management (EM), which implies that this kind of compensation can reduce EQ. However, there is not much empirical evidence on whether ESOP characteristics can mitigate the incentives for manipulating accounting numbers, and, if so, which are these characteristics. In addition, there is little evidence on how management stock option contracts characteristics relate to EQ. By analyzing a sample of companies that adopt management stock options, we present empirical evidence on how ESOP characteristics affect the following measures: Earnings Persistence, Earnings Smoothness, Earnings Management (discretionary accruals) and target beating measures.

Many authors have proposed theoretical models that investigate how managers' short-term and long-term incentives relate to manipulative behavior (Edmans *et al.*, 2012; Peng & Röell, 2014; Varas, 2017; Zhu, 2017; Marinovic & Varas, 2019). Overall, these models suggest that including long-term incentives is ideal in order to reduce or eliminate manipulations. However, empirical evidence on how long contracts should last in order to reduce manipulations and enhance EQ is limited.

Considering that one of the ways in which a manager can try to manipulate the market price of shares is through EM (Bergstresser & Philippon, 2006; Chan *et al.*, 2010), it is possible to hypothesize that the horizon of incentives can also impact EQ measures. Accordingly, in this study we find novel evidence on how ESOP contract horizons affect managers' incentives and how these incentives affect EQ.

We first focus on the manipulation of stock market value close to the year when options vesting period ends. We observe that including longer vesting periods is an important aspect of option compensation contracts that enhances Earnings Persistence for companies that have large sums of exercisable options within a certain year. We also find evidence that companies that do not adopt long-term incentives are more likely to perform a big bath in the year that precedes a large sum of options becoming exercisable, while this behavior is significantly smaller for companies that include long-term incentives. At last, another positive EQ aspect associated with longer incentive horizons is higher Earnings Smoothness (earnings are more efficient at smoothing cash flow volatility), suggesting risk aversion by managers compensated by long-term contracts.

Even though long-term incentives seem to be associated with higher EQ when considering the Persistence, Discretionary Accruals and Earnings Smoothness models, we find that firms that include long-term incentives are more likely to miss specific earnings benchmarks in years that precede larger sums of vested options. This result indicates that EQ is smaller for firms that include long-term incentives when analyzing target beating metrics and highlights the difficulty of defining EQ, because its definition is contingent upon the decision context in which earnings are utilized (Dechow *et al.*, 2010).

Another aspect we observe is that large options grants in a certain year exacerbate manipulations in the previous year. This is consistent with previous studies that show that managers perform manipulations in order to reduce stock prices in the year that precedes large grants (Aboody & Kasznik, 2000; Baker *et al.*, 2003; McAnally *et al.*, 2008). This tactic aims to reduce options strike price (exercise price), leading to higher gains when managers exercise options. Our findings show that larger grants are associated with negative discretionary accruals on the previous year (artificial reporting of smaller earnings). We additionally observe that firms are also more likely to miss several target earnings measures in the prior year in order to reduce strike prices, which the market interprets as a red flag regarding a company's future prospects (Graham *et al.*, 2005). At last, we also find conclusive evidence that discretionary accruals play an important role on missed earnings benchmarks, which is a novel contribution.

Our study is relevant because it shifts the focus on factors related to normative questions to the impact of the financial reporter's incentives on EQ (Ball, 2003), allowing a new understanding about the theme. Furthermore, by focusing on a sample of companies that compensate managers through stock options, we provide insights on how different ESOP features can assist on understanding managers' behaviors, allowing the evaluation of whether a contract's structure can lead to manipulations that incite EM and/or reduce EQ.

In the context of Brazilian companies, there is an understanding gap on the possibility that ESOP might lead executives to manage earnings in order to raise their gains. Few studies have examined this possibility. Silveira (2006), for example, finds that there is no evidence of higher levels of earnings management by Brazilian firms that pay executives through this method. However, this study does not approach relevant aspects of stock options that might incentivize managers to manipulate accruals. As we find in our study, when examining the impact of ESOP on EM, it is relevant to account for aspects of ESOP such as the number of granted options or the number of exercisable options in the year that follows the accounting reports release, as well as features such as corporate governance and contract time-length. By addressing these aspects, our study corroborates to a more comprehensive analysis of the impact that ESOP have on EM and EQ in the Brazilian market.

Overall, the present study contributes to the accounting literature and to the literature on corporate finance by providing additional empirical evidence on how ESOP characteristics influence the way managers make corporate decisions. Our study is justified by the fact that understanding the effect of ESOP on EQ is important for both academics and practitioners. By better understanding these relationships, individuals can have a clearer view on how to construct ideal forms of compensating managers and about the reliability of accounting reports. Nevertheless, there is still a lot of ground to cover on this topic, mainly when considering emergent countries, as is the case of Brazil.

2 Theoretical Framework

2.1 Earnings Quality

Given the various purposes for which accounting earnings are used, the literature on EQ has generated broad disagreements on how to define and measure this concept. The vast list of candidate measures that try to capture this construct illustrates this issue (Dichev *et al.*, 2013). Dechow *et al.* (2010) highlight that EQ in the literature is affected not only by a firm's accounting system accuracy for measuring its earnings, but also by its actual fundamental performance, which implies that different metrics may be representing different constructs. Based on their review of the literature, they have categorized EQ proxies in three groups: i) properties of earnings; ii) investors' responsiveness to earnings and; iii) external indicators of distortions in earnings (Dechow *et al.*, 2010).

Considering that our study explores EQ metrics that can be directly influenced by managers' actions, we will focus only in the first category (properties of earnings). This category includes metrics of: i) earnings persistence; ii) abnormal accruals, iii) earnings smoothness, iv) target beating and, iv) asymmetric timeliness and timely loss recognitions. However, it should be noted that timeliness measures (iv) will not be analyzed in our study, because, just like measures of investors' responsiveness to earnings (e.g. Earnings Response Coefficient), they rely on market returns. Hence, a few problems arise: the reliability of these measures assumes market efficiency at interpreting and reacting to new accounting information, which might be not realistic and; omitted variables that affect investor's reactions can impair models that predict stock returns (Dechow *et al.*, 2010).

Even though omitted variables might also affect the remaining proxies of EQ related to properties of earnings, we expect market return-related metrics to be less reliable, because they are affected by a larger number of unobserved factors that are not related to managers' efforts or manipulations, such as political issues, economic crises *etc.*. Hence, we focus on Earnings Persistence, Earnings Smoothness, Accruals and Target Beating measures.

Persistence is a term related to the predictive abilities of variables. Earnings persistence is a metric that is usually associated with EQ, because investors view earnings with higher persistence as more sustainable, more permanent and less transitory (Li, 2019). In this sense, earnings persistence captures the extent to which changes in the current period earnings will occur again in the future, which extends to earnings components (Francis & Smith, 2005).

Many studies decompose earnings in accruals and cash flows in order to analyze the persistence of these components. Sloan (1996) was the first to suggest that the magnitude of accruals could influence earnings persistence negatively. In general, results in the literature corroborate this hypothesis, indicating that accruals are less persistent than operating cash flows (Sloan, 1996; Xie, 2001; Richardson *et al.*, 2005; Takamatsu & Favero, 2013; Cupertino *et al.*, 2012; among others). Therefore, earnings composed by higher accruals are less persistent and, thus, have lower quality (Dechow *et al.*, 2010).

The main explanation for the smaller persistence of accruals normally is EM. In line with this statement, Xie (2001) demonstrates that the lower earnings persistence of accruals is explained by its discretionary component (abnormal accruals), which derives from the manipulation of accounting numbers. This occurs because, although accruals aim to allow financial reports to present adjustments that more adequately reflect the operations of a firm and must follow standards, there is a degree of subjectivity in their estimation that allows managers to distort reported results (Chan *et al.*, 2010). When accounting earnings suffer adjustments of a discretionary nature, they can become distant from the reality of a firm's business, presenting larger profits, for example (Chan *et al.*, 2006).

Given that managers can alter accounting earnings through discretion, an alternative metric that allows the evaluation of a firm's EQ is the portion of Discretionary Accruals (DA), which derive from discretionary financial reporting choices by managers. Several models in the literature were developed in order to decompose the abnormal part of accruals, allowing the identification of EM, such as, for example, the Jones model (Jones, 2001), the Modified Jones Model (Dechow *et al.*, 1995) and the Performance Matching model (Kothari, 2005; Kothari *et al.*, 2016). In general, these models allow for the identification of the discretionary component of accruals, which is associated with lesser EQ and considered an EM proxy.

Another measure of EQ is Earnings Smoothness, which relates to the smoothing of random fluctuations in cash flows through accruals accounting and is normally the standard deviation of earnings scaled by the standard deviation of cash flows (McInnis, 2010; Dechow *et al.,* 2010). Hence, this measure relates to whether earnings estimated through the accrual accounting system are more informative about a firm's performance than its cash flows. A lower ratio indicates higher earnings smoothness, which suggests that a firm's earnings is less volatile, because it smooths transitory cash flows.

Smoothness can intimately relate to a form of EM named Earnings Smoothing. Earnings Smoothing aims to reduce the volatility of a firm's reported profits by inflating low earnings and deflating high earnings, allowing a firm to present stable profits, with no excessive fluctuation from its average economic income (Ronen & Yaari, 2008).

In the literature there is disagreement regarding whether smooth earnings are a desirable property of accounting earnings (McInnis, 2010). However, based on a series of interviews performed with 400 executives from the United States, Graham *et al.* (2005) state that managers seek to smooth earnings, even if it can harm firm value. They seek to keep earnings predictable and to avoid establishing earnings standards that are too high to maintain. Thus, managers can utilize Earnings Smoothing to achieve higher persistence, which reveals that there can be an interaction between EQ proxies.

While Earnings Persistence and Earnings Smoothness are usually associated with high EQ, managers might achieve them through Earnings Smoothing, which is normally associated with low EQ, as it is a form of EM. This indicates that persistence and smoothness can be ambiguous measures of EQ and exemplifies the complexity of establishing a universal definition of this construct.

Regarding the relationship between smoothing and EQ, Dechow *et al.* (2010) highlight that the smoothing of transitory cash flows can increase persistence and earnings informative ability, which can enhance EQ. However, they warn that the practice of smoothing permanent changes in cash flows can have the adverse effect of reducing timeliness and earnings' informative ability, which impairs EQ. Another important aspect of the relationship between these proxies of EQ is the fact that persistence achieved through earnings smoothing can have the adverse effect of hiding a firm's real earnings volatility. Nevertheless, one should not analyze persistence and smoothness without considering the effects of EM.

At last, it there is evidence that firms inflate earnings through EM in order to beat specific target measures (Mindak *et al.*, 2016). Given this scenario, unusual clustering in earnings distributions that are slightly above certain targets (e.g. last year earnings) are indicative of low EQ, as they signal that earnings were inflated just enough so that these benchmark measures would be "beaten" (Dechow *et al.*, 2010). Consequently, the proxies that try to capture this sort of behavior categorize as "target beating" measures.

Some studies show that few companies report small losses and many firms report small profits, which results in a "kink" around zero in the distribution of earnings (Hayn, 1995; Burgstahler & Dichev, 1997; Dechow *et al.*, 2003). Burgstahler and Dichev (1997) indicate that this concentration is due to EM. Hence, a common but controversial interpretation of this distribution is that firms with earnings that are a little inferior to the "zero target" manipulate their results just enough so that they can show small profits and avoid market punishment (Dechow *et al*., 2010). Therefore, small profits or the tendency to avoid small losses is a target beating measure associated to low EQ. However, as we argue in the next section, depending on their compensation contracts, managers might actually miss these targets on purpose in order to enhance their gains (McAnally *et al.* (2008). We explore whether EM plays a role for firms that miss these benchmarks and how ESOP affect these measures.

Overall, the exposed measures are not similar, even though they seek to represent the same construct. This is because the EQ concept is ambiguous, given the many possible uses of financial reports (Ball, 2003). Considering that stock option programs increase the incentives for managers to manipulate reported earnings (Bergstresser & Philippon, 2006), one can assume that these measures will be different for firms that possess this type of compensation. Furthermore, different kinds of stock option contracts might incite higher manipulation incentives (Edmans *et al.*, 2012; Peng & Röell, 2014; Gopalan *et al.*, 2014), which can have different impacts in different metrics of accounting EQ. Peng and Röell (2014), for example, compare tradeoffs that are involved when management compensation is tied to short and long-term contracts. They show that payments based solely on short-term incentives incite manipulations by managers that are wasteful for the firm. Hence, in cases in which manager can manipulate their evaluation measures in the short term, long-term incentives are necessary in order to enhance EQ.

In the next sections, we present several considerations based on agency theory for the understanding of incentive problems brought by ESOP, as well as a brief review of empirical and theoretical studies in order to develop our hypotheses that relate ESOP and EQ.

2.2 Agency Theory and Options-Based Compensation

Jensen and Murphy (1990) indicate that compensation policy is one of the most important aspects of a firm. The authors criticize the wrong focus on “how much” managers receive, because it is more important to focus on “how” they receive. They justify this statement by affirming that high payments to a manager that enhances corporate performance do not represent a transfer of shareholders’ wealth, but a premium for the manager’s skills.

The problem of defining “how” to pay an agent resides on the fact that, as Jensen and Meckling (1976) state, there are reasons to believe that agents (managers) are not always going to seek to maximize principals’ (shareholders’) utilities. The authors highlight that the necessity to align the interests of agents and principals, so that the first ones seek to maximize the latter’s utilities, is a very general problem within firms.

A manager’s expected utility is directly affected by his compensation, which is influenced by the payment plan established by the principal and his own efforts within the firm (Lambert, 2007). Lambert (2007) states that the manager will choose the effort level that maximizes his expected utility based on the contract developed by the principal, which highlights the importance of developing a compensation scheme that yields good incentives. A common problem when defining compensation contracts is the choice of a proxy that adequately represents the manager’s effort. Principals usually structure payment plans in order to incentivize managers to enhance certain performance metrics, such as accounting earnings, sales revenues, operational goals or other performance measures in which shareholders are interested. However, contracts can have undesired effects, stimulating manipulations instead of creating incentives for real effort (Peng & Röell, 2014; Marinovic & Varas, 2019).

The concern with creating incentives for managers to act in order to create value for their firms has led to the dissemination of compensation contracts based on companies’ market values in the 1990s, mostly in the form of stock and stock options (Hall & Murphy, 2003; Bergstresser & Philippon, 2006). However, the incentives that stock-based compensation brings on the short-term when contracts are not well structured are problematic. In these cases, Peng and Röell (2014) state that this form of payment can incentivize managers to try to manipulate the market's expectations regarding stock prices in the short-term in order to increase their own options value. The authors also affirm that this kind of manipulation can be harmful for long-term value creation.

Overall, even though ESOP aim to enhance a firm's market value by incentivizing managers to care about stock prices, they may also bring a set of problems, because managers can also be incentivized to manipulate the stock's market value. Accordingly, some empirical studies reveal that compensating managers through ESOP can lead them to manipulate financial reports (Aboody e Kasznik, 2000; Bartov & Mohanram, 2004; Bergstresser & Philippon, 2006; McAnally, *et al.*, 2008).

Aboody and Kasznik (2000) suggest that CEOs paid through stock options manage investors' expectations in the period prior to stock options' grant dates, anticipating the release of bad news and postponing good news. The authors present the hypothesis that managers seek to reduce stock value near the grant date, which reduces their options exercise price and allows them to obtain higher gains in the future, when good news are finally released. Their findings are consistent with this hypothesis and show that CEOs of firms that possess a fixed date for grants opportunistically release voluntary reports of their income forecasts in order to maximize their compensation.

The findings of this study indicate that managers can utilize financial reports in order to maximize their gains with the exercise of their options. In this sense, some authors have analyzed the possibility that managers paid through stock options utilize accounting reports in order to manipulate investors' reactions, adopting Earnings Management (EM) for that purpose (Baker *et al.*, 2003; Bartov & Mohanram, 2004; Bergstresser & Philippon; Silveira, 2006; Meek *et al.*, 2007; Chan *et al.*, 2010). Considering that managers are pressured to increase the market value of firms, EM could be an objective proxy for managers' propension to mislead the market with the intent of increasing their personal wealth in the short term (Chan *et al.*, 2010).

Exploring the hypothesis that ESOP could incite EM, Baker *et al.* (2003) observe that firms whose CEOs are granted stock options present accounting earnings that are negatively managed in the period prior to stock options grant date. This is an indicative that executives manage accounting earnings in order to reduce the exercise price of their options, allowing them to have more elastic gains in the future.

Considering that managers try to negatively manipulate the exercise price of their options, it is natural to assume that they will also manage earnings positively close to the date in which a significant portion of their options become vested, which is consistent with evidence in the literature (Bartov & Mohanram, 2004; Bergstresser & Philippon, 2006).

Although the previous studies do not exhaust the possible devices that can be used by managers to increase their gains with the exercise of their stock options, it is clear that this form of payment generates incentives for them to try to manipulate their exercise price negatively (close to the grant date) and to positively manipulate the market value of stocks when options become exercisable. These tactics allow managers to obtain larger gains. However, they do not necessarily yield shareholders good long-term returns and can affect the reliability of financial reporting. This reveals that ideal compensation contracts must present a solution to mitigate these manipulation attempts, increasing the incentives for managers to work towards shareholders' long-term interests. We try to offer empirical evidence on whether specific management stock option contract characteristics might reduce this sort of undesired behavior, leading to higher EQ.

Given the possibility of manipulation when the manager's compensation is tied to stock prices, many theoretical models have been proposed in order to analyze how to build an ideal contract (Goldman e Slezak, 2006; Edmans, Gabaix, Sadzik, & Sannikov, 2012; Beyer, Guttman, & Marinovic, 2014; Peng e Röell, 2014; Dutta, & Fan, 2014; Varas, 2018; Marinovic & Varas, 2019 among others). Based on these models and in empirical studies, we present some hypotheses about the possible impacts of different executive stock option contracts characteristics on EQ and EM.

2.3 Hypotheses on Earnings Quality and Management Stock Options

2.3.1 Hypotheses on Earnings Persistence

The necessity to build compensation plans that deal with the problem of managers manipulating performance measures has led many authors to propose theoretical models in the search for the ideal characteristics of contracts. One of the aspects commonly cited in studies is the length of incentives. The horizon of the incentives granted by a management stock option compensation plan depends on the vesting conditions of contracts, which might vest immediately, in one year, in two or more years, constantly over time (e.g.: 25% per year during four years) etc. (Cadman *et al.*, 2012). Longer vesting times are associated with long-term incentives, while option grants that completely vest immediately or in a short period are associated with short-term incentives. Nevertheless, contracts might include a mix of short and long-term incentives.

In a theoretical scenario in which the manager can inflate current earnings at the expense of long-term performance, in order to reduce or to eliminate manipulation, a firm's long-run returns must influence the manager's compensation (Edmans *et al.*, 2012). The model of Edmans *et al.* (2012) indicates that for the complete elimination of manipulation by managers, the firm's performance should influence manager's compensation even after his retirement. An intuitive insight from this model is that ESOP should grant long-term incentives in order to avoid short-termism by managers. This implies that a manager's compensation should be sensitive to a firm's long-term performance for manipulation incentives to decrease.

Additionally, Peng and Röell (2014)'s model shows that a manager's payment horizon must be longer when short-term information is not reliable. Considering that stock prices can be manipulated, and that EM might be one of the mechanisms utilized by managers to influence the market, contracts that include long-term incentives in their mix could be preferable in order to reduce manipulations associated with ESOP short-term based incentives. Hence, the authors show that allowing long-term incentives shifts part of the incentive pay from the short term to the long term, leading to better effort choices. Accordingly, Marinovic and Varas (2019) study ideal contracts and conclude that under the possibility of manipulation, CEOs' optimal contracts involve a mix of short and long-term incentives.

Considering that stock options can bring incentives for manipulation by managers, one can presume that contracts based on short-term metrics will lead to more manipulation and EM by managers than contracts that include long-term incentives, because, as Peng and Röell (2014) state, on the long run the "truth" will come out. Given the difficulty to sustain manipulations for long periods, these contracts can lead to smaller incentives for managers to try this sort of practice. Accordingly, Gopalan *et al.* (2014) suggest that incentives that last longer lead to lower positive discretionary accruals levels.

Given that managers whose contracts are based exclusively on the short-term should present higher manipulation incentives, we presume that this kind of contract will be associated with lower earnings persistence, after all, discretionary accruals (or EM) are one of the main explanations for earnings that are not persistent (Xie, 2001). Hence, we suppose that contracts that yield long-term incentives (contracts that include options that take longer to vest), mixed with short-term incentives or not, should lead to higher earnings persistence and higher accruals persistence. To test this premise, we develop the following hypotheses:

H1: **Firms that include long-term incentives in their ESOP will present more persistent earnings than those that do not.**

H2: **Firms that include long-term incentives in their ESOP will present more persistent accruals than those that do not.**

Although we expect short-term-based stock option contracts to incentivize managers to manipulate accounting information, reducing EQ, we also investigate some issues related to the timing of manipulation. We review empirical studies in order to obtain insights regarding this issue.

2.3.2 Hypotheses on Discretionary Accruals

Aboody and Kasznik (2000) analyze a sample of 2039 stock option grants to CEOs by 572 firms between 1992 and 1996, focusing on firms that had scheduled grant dates. They propose that managers anticipate the release of bad news to the market through voluntary reports released prior – but close - to the grant date. They also suggest that managers delay good news. These manipulations on the timing of information disclosure allow CEOs to have options with smaller exercise prices at the date of grant and higher sale prices at their vesting time. The results presented by the authors not only lead to the conclusion that CEOs try to manipulate the market through voluntary disclosures, but also lead to the belief that the market and the analysts are influenced by those attempts of manipulation.

From the results presented by Aboody and Kasznik (2000), one can assume that knowing the grant date of stock options makes managers attempt to manipulate the market in order to obtain higher gains. Considering this premise, Baker *et al.* (2003) test the hypothesis that managers negatively manage their earnings close to the stock options grant date in order to reduce their stock options exercise price. Analyzing a sample of 168 firms listed on the Wall Street Journal annual compensation survey during the period of 1992 to 1998, they find results consistent with this hypothesis and reveal that, options granted to managers in the current year affect discretionary accruals negatively in the previous year. In order to identify whether this happens similarly in an emerging country like Brazil, we have developed the following hypothesis:

H3: The level of executive stock options granted in the year following accounting earnings release affects current year Discretionary Accruals negatively.

Given the expectation that managers will manipulate accounting negatively before the stock options grant date, one can assume that managers will positively manage earnings close to the date in which options vesting period ends. Accordingly, Chan *et al.* (2010) observe that managers of firms with higher Discretionary Accruals present higher levels of exercisable options than firms that have smaller levels of inflated earnings.

Bartov and Mohanram (2004) observe that positive abnormal earnings in the period prior to the exercise of options turn into bad performances in the period after the options exercise, which is due to the reversion of inflated earnings. The authors conclude that senior executives manage earnings to increase their gains.

Accordingly, Bergstresser and Philippon (2006) observe that the levels of EM were higher in firms on which CEOs presented stock price-related compensation. High accruals are coincident with periods on which there is a higher number of exercised options. The results of this study reveal that ESOP bring an incentive for the opportunistic manipulation of accounting earnings by executives.

These findings are consistent with the hypothesis that managers paid through stock options find themselves pressured to raise the market value of stocks close to the date when their options vesting period ends. Considering this premise, we have developed our fourth study hypothesis:

H4: The number of exercisable executive stock options in the year following accounting earnings release affects current year Discretionary Accruals positively.

If we do not reject hypothesis 4, there will be evidence that managers try to maximize their compensation through earnings management, which does not necessarily imply the maximization of shareholders' interests. Even for long-term contracts, the proximity to the vesting date of options can bring incentives for managers to manipulate their payment metrics. However, contracts that include options that vest in the long-term incentivize managers to spend less time and resources on manipulations related to short-term incentives (Peng, & Röell, 2014). Hence, we argue that contracts based exclusively on short-term incentives will yield higher levels of earnings management and present the following hypothesis:

H5: The positive effect of the level of exercisable executive stock options on Discretionary Accruals will be higher for firms that do not present long-term contracts.

2.3.3 Hypotheses on Target Earnings

In the last section, we have presented our third hypothesis, which indicates that stock options granted in the year following the accounting earnings release affect prior year discretionary Accruals negatively. This hypothesis assumes that managers expect negative market reactions in response to lower earnings. However, it raises an interesting question: how much do managers have to deflate earnings for stock prices to go down? An intuitive answer to this question is that managers will try to report earnings that do not meet specific targets just before large option grants. This intuition is quite simple, because, as we have discussed, when managers do not meet or beat target measures such as analysts' forecasts, previous year earnings or the "zero earnings target" (they present a loss), bad market reactions are expected (Graham *et al.*, 2005; Gleason & Mills, 2008; McAnally *et al.*, 2008; Dechow *et al.*, 2010; Mindak *et al.*, 2016). Hence, slightly not beating these measures could also indicate low EQ.

Based on the premise that managers will try to reduce their stock options exercise price, McAnally *et al.* (2008) study a sample of firms that adopt fixed date stock option grants and find that they are more prone to missing earnings targets when larger options grants are expected. They also find that EM plays a role in missed targets. We test whether this behavior occurs in the Brazilian capital market for different target measures.

H6a: larger executive stock options grants in the year following the accounting earnings release increase the probability that a firm will miss the "zero earnings" target.

H6b: larger executive stock options grants in the year following the accounting earnings release increase the probability that a firm will miss its last year earnings.

Overall, these hypotheses are quite intuitive. Considering that managers might desire to reduce their stock options exercise price, failing to meet earnings benchmarks might be a very effective measure, because it creates uncertainty regarding a firm's prospects and might be interpreted as a signal of deeper problems at a firm (Graham *et al.*, 2005).

Other than these measures, target-beating behavior also occurs when firms utilize EM to beat analysts' expectations, because market returns tend to be negative when firms do not meet or beat analysts' consensus forecasts (Gleason & Mills, 2008). However, given the limited data for the Brazilian capital market – especially for the subsample of firms that have adopted ESOP, we do not test whether firms intentionally miss these forecasts in order to increase their ESOP-related gains. In the next section, we present our last hypothesis, which deals with the relationship between executive stock option contract characteristics and Earnings Smoothness.

2.3.4 Hypothesis on Earnings Smoothness

The last measure of EQ that we analyze is Earnings Smoothness. This measure, estimated as the standard deviation of earnings scaled by the standard deviation of cash flows (Dechow *et al.*, 2010; McInnis, 2010), indicates how much of a firm's cash flow volatility is smoothed by earnings. If a firm's earnings are less volatile than its cash flows, this ratio will be smaller, indicating that earnings are smoother. Overall, managers state that they might desire smooth earnings because they find it more interesting to sacrifice potential long-term value than to present earnings that are too volatile (risky) or hard to maintain in the long-term (Graham *et al.,* 2005).

Some studies suggest that the existence of an ESOP and the structure of option contracts could create incentives for managers to smooth earnings (Grant *et al.*, 2009). Grant *et al.* (2009) find that risk-taking incentives might lead CEOs to try to reduce a firm's "apparent" risk through earnings smoothing in order to appeal to institutional investor preferences. Additionally, Shu and Thomas (2015) find that higher holding of options by managers leads to higher smoothing of past earnings, because managers try to reveal information that might help investors to predict future earnings or in order to hide the firm's past earnings volatility.

As previously discussed, manipulation is very common in the real world (Aboody & Kasznik, 2000; Baker et al. 2003; Bartov & Mohanram, 2004; Bergstresser & Philippon, 2006; Peng & Röell, 2014; Biggerstaff *et al.*, 2015; Marinovic & Varas, 2019; among others). Hence, we have discussed that manipulation incentives should be higher when management stock option contracts rely solely in short-term incentives (Peng & Röell, 2014).

Long-term incentives are supposed to deal with the problem of manipulation. However, optimal contracts do not necessarily lead to zero manipulation, because it might be too costly to do so (Marinovic & Varas, 2019). Nevertheless, the term "manipulations" is not always pejorative, as it applies also to cases in which the manager seeks to signal the truth to the market (Peng & Röell, 2014). Long-term contracts eliminate the losses associated with manipulation. However, they expose the agent to extra risks when long-term volatility is high or if the agent is risk averse. Hence, managers with long-term contracts might desire to smooth earnings in order to signal the firm's average earnings, excluding the effect of transitory cash flows. They might also desire to reduce earnings volatility, because it can be associated with a higher risk by institutional investors. Nevertheless, we suggest that:

H7: Firms that include LT incentives in their ESOP will present smoother earnings.

Our hypothesis follows a simple intuition: managers with long-term incentives will try to signal their firm's real average earnings by manipulating accruals in order to exclude the effect of transitory changes in cash flows. This tactic has the advantage of keeping earnings predictable and reducing investors' perception of volatility and risk.

3 Methodology

3.1 Study Sample and Data

The study sample is composed by public firms traded on the Brazilian capital market (Brasil Bolsa Balcão - B3), excluding financial firms. We exclude these firms because they are required to adopt specific accounting practices, which do not allow for the estimation of standard EM Models.

We collect accounting data from the Economatica® database and information regarding manager's compensation (contracts vesting conditions, number of granted and exercisable options, etc.) from Reference Forms available at the Comissão de Valores Mobiliários (CVM) website, which is the Brazilian Securities and Exchange Commission. When necessary, we also collect data from the firm's financial reports. Considering the limitation regarding stock option and corporate governance variables, our study's time window is 2010 to 2020.

We utilize the whole sample to estimate EM (equation 10). However, we focus only on firms that adopt ESOP when investigating how different contracts affect EQ measures, in order to isolate the effect of different contract characteristics. Our initial sample includes 407 firms that were active on the Economatica® database in the year 2021. We exclude 131 firms that were not active in B3 for at least 3 years during our sample period (2010 to 2020) or did not include data for our models. Additionally, we exclude 54 financial companies. After all exclusions, our final sample includes 222 non-financial firms.

All 222 companies are included when estimating the Earnings Management model (eq. 10), however, only a subsample of 82 companies has included stock options at some point between 2010 and 2020 and had available data regarding stock option variables for at least one of our remaining models. We consider only companies that have active ESOP as firms that compensate their managers with ESOP. Our data analysis shows that many companies have approved option plans, but have never granted options. We treat these firms as companies that do not adopt ESOP.

3.2 Research Design

3.3.1 Testing Hypotheses on Earnings Persistence

In order to obtain some insight on the hypotheses related to earnings persistence (H1 and H2), we include ESOP-related variables and control variables to standard Earnings Persistence (α_1) models, which are derived from the work of Sloan (1996). We first present these models (equations 1 and 3) and later explain how we adapt them to test our hypotheses through equations 6 and 7.

The relationship between future earnings (E_{t+1}) and current earnings (E_t) in the classical model is given by equation 1, in which v_{t+1} is the error term. Following Dechow and Ge (2006), we estimate earnings as net income ($NetInc_t$) scaled by average assets (A_t), as stated in equation 2.

$$E_{i,t+1} = \alpha_o + \alpha_1 E_{i,t} + v_{t+1} \quad (1)$$

$$E_{i,t} = \frac{NetInc_{i,t}}{\left(A_{i,t} + A_{i,t-1}\right)\frac{1}{2}} \quad (2)$$

$$E_{i,t+1} = \alpha_o + \gamma_1 AC_{i,t} + \gamma_2 CF_{i,t} + v_{t+1} \quad (3)$$

We also include variables to equation 3 in order to control for differences in the persistence of different earnings components (Sloan, 1996; Takamatsu & Favero, 2013). In this equation, CF_t is the cash flow component of earnings scaled by average assets and AC_t are accruals scaled by average assets.

Following Kothari *et al.* (2016), accruals are estimated through equation 4, in which ΔCA_t indicates the change in current assets and $\Delta Cash_t$ the change in the cash component of current assets. Hence, the first part of the equation is the change in non-cash current assets. The second part of the equation is the change in current liabilities (ΔCL_t) net of the change in short-term debt (ΔSTD_t)**.** Unlike Sloan (1996), we do not exclude the change in income taxes payable (ΔTP_t), given that we adopt net income as the earnings measure. At last, depreciation and amortization expenses (DEP_t) are also excluded. Hence, we estimate CF_t as earnings minus accruals, following equation 5. We divide these terms by average assets in order to maintain consistency with our previous definition of accruals.

$$AC_{i,t} = \frac{\Delta CA_{i,t} - \Delta Cash_{i,t}}{(A_{i,t} + A_{i,t-1})x\frac{1}{2}} - \frac{\Delta CL_{i,t} - \Delta STD_{i,t}}{(A_{i,t} + A_{i,t-1})x\frac{1}{2}} - \frac{DEP_t}{(A_{i,t} + A_{i,t-1})x\frac{1}{2}} \quad (4)$$

$$CF_t = E_t - AC_t \quad (5)$$

Our first hypothesis is that firms that include long-term incentives in their ESOP will present more persistent earnings than those that do not. We test this hypothesis by estimating equation 6, in which we include variables related to ESOP incentives according to H1 and H2. We display how to estimate these variables in Table 1.

$$E_{i,t+1} = \alpha_o + \alpha_1 E_{i,t} + \alpha_2 ExOp_{i,t} + \alpha_4 ExOp_{i,t} LT_{i,t} + v_{t+1} \quad (6)$$

$$E_{i,t+1} = \alpha_o + \gamma_1 AC_{i,t} + \gamma_2 CF_{i,t} + \gamma_3 LT_{i,t} + \gamma_4 ExOp_{i,t} + \gamma_5 ExOp_{i,t} LT_{i,t} + v_{t+1} \quad (7)$$

Hypothesis 1 indicates that earnings persistence should be higher for companies that include long-term incentives ($LT_{i,t}$), which indicates that this feature should lead to higher future earnings. In order to test this hypothesis, our first step is identifying what constitutes "long-term". We follow Cadman *et al.* (2012) and focus exclusively on the dimension of the management stock option contracts that influences the horizon of incentives. We define several specifications of our long-term incentives variable ($LT_{i,t}$), considering that companies have two temporal components to their stock-option incentives: i) vesting periods and ii) lockup periods. The vesting period indicates the interval after the stock option grant date in which managers cannot exercise their rights to buy stock. The lockup period [1]on the other hand indicates how long a manager must retain stocks acquired through the exercise of options. We assume that the incentive horizon of options is a sum of these two temporal elements.

The $LT_{i,t}$ dummy indicates whether a firm's stock option grants contain long-term incentives. We utilize several specifications of what constitutes "long-term" based on the sum of the vesting and lockup periods. This approach has the advantage of identifying how long incentives should last in order to affect persistence and other EQ measures. We detail this approach in Table 1.

In equations 6 and 7, $ExOp_{i,t}$ refers to a firm's amount of exercisable management stock options in a certain period scaled by its number of circulating shares at the start of the year. We expect that $ExOp_{i,t}$ will negatively affect future earnings, considering that a high number of

[1] In order to simplify the reporting of our results, we might utilize the term "vesting period" as similar to the end of the "vesting + lockup" period.

exercisable options can incentivize managers to manipulate earnings in the current exercise in order to increase their gains (Bergstresser & Philippon, 2006). The expectation of a negative impact is due to the reversal of accruals (Bartov & Mohanram. 2004).

Table 1: Description of Independent Variables in equations 6 and 7

Variable Name (Abreviation)	**Source**	**Formula**	**Expected Impact on** $E_{i,t+1}$
Long-Term Incentive $(LT_{i,t})$	Developed by the Authors (Based on H1 and H2)	Dummy that assumes value 1 for firms with active ESOP that include long-term incentives. We specify several specifications of this dummy, considering that ESOP include long-term incentives when the sum of their options vesting period and the acquired shares lockup period is longer than "n" (2, 3, 4, 5 or 6 years).	+
Exercisable Options $(ExOp_{i,t})$	Developed by the Authors (Based on H1 and H2)	$\frac{Exercisable\ Options_{i,t}}{Outstanding\ Shares_{i,t}}$ Exercisable options: Number of options that can be exercised during a certain year divided by the firm's total outstanding shares. Includes options exercisable at the beginning of the year and those that become exercisable during the year.	-
$(ExOp_{i,t}LT_{i,t})$	Developed by the Authors (Based on H1 and H2)	Interaction between $ExOp_{i,t}$ and $LT_{i,t}$	+

Source: Elaborated by the authors.

The $LT_{i,t}$ dummy interacts with exercisable options $(ExOp_{i,t})$ in both equations. Controlling for this interaction is relevant, as the $LT_{i,t}$ dummy specifications indicate how long it takes options to become exercisable. By studying how several specifications of $LT_{i,t}$ interact with $ExOp_{i,t}$, we are able to better understand how the vesting period of options affect manipulative incentives and earnings persistence. The main benefit of this approach is that it does not require a previous conception of what "long-term" is, and allows us to infer this from the data. Hence, we are able to test H2 in a more comprehensive manner.

After estimating equations 6 and 7 for all companies that adopt stock options, we divide companies between two subsamples: firms that adopt long-term incentives and those that do not. We utilize statistical results regarding the $ExOp_{i,t}LT_{i,t}$ interaction in order to identify the best long-term $(LT_{i,t})$ specification.

We then estimate equations 8 and 9 in order to obtain more insight on the relationship between past and future earnings for these subsamples, as well as the role of $ExOp_{i,t}$. This allows us to test H2 through equation 9 by comparing the persistence of accruals for both subsamples. Estimating equation 9 for these subsamples also enhances the robustness of our H1 test.

$$E_{i,t+1} = \alpha_o + \alpha_1 E_{i,t} + \alpha_2 ExOp_{i,t} + v_{t+1} \ (8)$$

$$E_{i,t+1} = \alpha_o + \gamma_1 AC_{i,t} + \gamma_2 CF_{i,t} + \gamma_3 ExOp_{i,t} + v_{t+1} \ (9)$$

When a model includes lags of its dependent variable, it is expected that endogeneity might affect results, especially in short panels that contain a short time interval and a large number of observations (Barros *et al.*, 2020). In order to control for this potential problem, we estimate all equations in this section through the Arellano-Bover/Blundell Bond estimator (Arellano & Bover, 1995; Blundell & Bond, 1998).

The Arellano-Bover/Blundell Bond estimator, like the Arellano-Bond estimator, (Arellano & Bond, 1991), includes the differences of original regressors as instruments and uses the Generalized Method of Moments (GMM). However, it also augments the Arellano-Bond model (known as difference GMM model) by assuming that the first differences of instrument variables are not correlated with fixed effects, which yields more instruments (Roodman, 2009). Hence, Arellano-Bover/Blundell Bond estimator, also known as system GMM, improves model efficiency.

3.3.2 Testing Hypotheses on Discretionary Accruals

In order to measure EM, we focus on discretionary accruals (abnormal accruals). We estimate discretionary accruals ($DA_{i,t}$) through an augmented version of the Jones (1991) modified model (Dechow, Sloan, & Sweeney, 1995), which includes net income such as in Kothari, Leone and Wasley (2005). We also follow adaptations made by Kothari *et al.* (2016) regarding firm and year-specific effects. In equation 10, ΔREV_t is the change in revenues, ΔAR_t is the change in net receivables and PPE_t is gross property plant and equipment. All items are scaled by average assets.

$$AC_{i,t} = \beta_{0i} + \phi_{ac} AC_{i,t-1} + \beta_1 \frac{1}{\left(\frac{A_{i,t} + A_{i,t-1}}{2}\right)} + \beta_2 \left(\Delta REV_t - \Delta AR_t\right) + \beta_3 \, PPE_t + \beta_4 E_{i,t} + v_{i,t} \quad (10)$$

The adaptations made by Kothari *et al.* (2016) regarding firm and year-specific effects that could lead to model misspecification are summarized in three steps: i) in every year, variables in our model are differenced from their cross sectional mean; ii) for every firm, the deviation from the cross sectional mean is differenced from the corresponding deviation in the previous year and; iii) for every firm-year, discretionary (abnormal) accruals are estimated as the firm-year residual subtracted by the firm's mean value of residuals across all years. After following these steps, we obtain discretionary accruals ($DA_{i,t}$).

Accounting for firm and year fixed effects in this manner corrects for possible model misspecifications such as firms being misclassified as having abnormally large accruals due to operational decisions or growth, an issue that persists when the model is estimated by industry-year due to firms deviating from their own industry in order to differentiate themselves (Kothari *et al.*, 2016; Owens *et al.*, 2017).

As Kothari *et al.* (2016) show (and so do our results), discretionary accruals ($DA_{i,t}$) are significantly correlated with the autoregressive term (lagged accruals). We also expect $E_{i,t}$ and $(\Delta REV_t - \Delta AR_t)$ to be possibly endogenous, as the simultaneity between these variables might lead to model misspecifications. Hence, we also utilize the Systemic GMM in order to estimate equation 10.

Our hypotheses three to five (H3, H4 and H5) relate to the effect of ESOP on $DA_{i,t}$, which is associated with lower EQ. We test these hypotheses by estimating equation 11. Table 2 presents the formulas for estimating variables in this equation.

We expect that Granted Options ($GrOp_{i,t+1}$) will have a negative impact on the current year discretionary accruals, because the expectation that options will be granted in the next year should incentivize managers to send bad signals to the market in the current exercise in order to reduce the strike price of their new options (Baker *et al.*, 2003). Negative discretionary accruals deflate earnings, which explains why they can negatively influence market reaction.

$$DA_{i,t} = \beta_{0i} + \phi_{da}DA_{i,t-1} + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1}LT_{i,t} + \beta_5 Independence_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnSales_{i,t} + \varepsilon_{i,t} \quad (11)$$

Our fourth hypothesis (H4) indicates that $ExOp_{i,t+1}$ will positively affect discretionary accruals, as they should lead managers to inflate earnings. This hypothesis presumes that managers will try to send positive signals to the market when they expect a large portion of their options to become exercisable in the next year, which can be done through earnings management (Bergstresser & Philippon, 2006). We also hypothesize (H5) that the effect of $ExOp_{i,t+1}$ on EM will be lower for firms that possess long-term incentives ($LT_{i,t}$). Hence, we control for the interaction of these variables in the model. We follow the same rationale utilized for the Earnings Persistence model regarding the ideal long-term specification (see previous section).

Table 2: Description of Independent Variables in equation 11

Variable Name (Abreviation)	**Source**	**Formula**	**Expected Impact on** $DA_{i,t}$
$GrOp_{i,t+1}$	Developed by the Authors (based on H3)	$\frac{Granted\ Options_{i,t}}{Outstanding\ Shares_{i,t}}$	Negative
$ExOp_{i,t+1}$	Developed by the Authors (based on H4)	$\frac{Exercisable\ Options_{i,t}}{Outstanding\ Shares_{i,t}}$ Exercisable options: Number of options that managers can exercise during a certain year (t). Includes options exercisable at the beginning of the year and those that become exercisable during the year.	Positive
$LT_{i,t}$	Developed by the Authors (based on H5)	Dummy that assumes value 1 for firms with active ESOP that include long-term incentives. We specify several specifications of this dummy, considering that ESOP include long-term incentives when the sum of their options vesting period and the acquired shares lockup period is longer than “n” (n = 2, 3, 4, 5 or 6 years).	?
$ExOp_{i,t}LT_{i,t+1}$	Developed by the Authors (based on H5)	Interaction between $ExOp_{i,t}$ and $LT_{i,t}$.	-
$Independency_{i,t}$	Prencipe & Bar-Yosef (2011).	$\frac{Number\ of\ Independent\ Members_t}{Total\ number\ of board\ Members_t}$	Negative or not significant
Size of Sales ($lnSales_{i,t}$)	Lemma, *et al.* (2018)	$Natural\ Logarithm\ of\ Sales\ Revenue_t$	?
Leverage ($LEV_{i,t-1}$)	Baker *et al.*, 2003; Prencipe & Bar-Yosef (2011).	$\frac{Total\ Liabilities_{t-1}}{Total\ Assets_{t-1}}$	Positive

Source: Elaborated by the authors.

An important feature of firms that might affect effort and manipulations associated with ESOP is corporate governance mechanisms, as these tools make it costlier for managers to manipulate earnings (Beyer *et al.*, 2014; Marinovic & Varas, 2019). Hence, we follow Prencipe & Bar-Yosef (2011) and include board independence ($Independence_{i,t}$) in order to identify how corporate governance affects discretionary accruals.

Leverage ($LEV_{i,t}$) and Size of Sales ($lnSales_{i,t}$) are included as control variables. Leverage is included in order to represent incentives to avoid possible violations of debt covenants related to earnings, and are estimated as the long-term debt at the beginning of the year scaled by total assets (Baker *et al.*, 2003). We expect this variable to positively affect discretionary accruals. Firm size is the natural logarithm of sales at the beginning of the year (Lemma *et al.*, 2018). Lemma *et al.* (2018) find that this variable negativebly affects discretionary accruals for a sample of American companies, but this relationship turns into a positive one for a group of companies composed by firms from several different countries (including Brazil). Hence, we do not have a clear expectation regarding its impact within our sample.

As we find that $DA_{i,t}$, is also affected by past realizations of itself and presume the existence of simultaneity between $DA_{i,t}$, and variables $LEV_{i,t-1}$ and $lnSales_{i,t}$, equation 11 is also estimated via Systemic GMM (Arellano & Bover, 1995; Blundell & Bond, 1998).

3.3.3 Testing the Hypothesis on Target Earnings

Our sixth hypothesis indicates that larger stock option grants in the year following the accounting earnings release increases the probability that a firm will miss: i) the "zero earnings target"; and ii) last year earnings. In order to test this hypothesis we utilize an adapted version of the model of McAnally and Srivastana (2008). The dependent variable in this model is a dummy for firms that barely miss these targets ($Miss_{i,t}$), which is explained by ESOP variables and control variables. Equation 10 is a logistic regression of $Miss_{i,t}$ on stock management stock option grants and some independent variables. McAnally and Srivastana (2008) indicate that the dependent variable takes value 1 for firms that barely miss these measures. We define the criteria for identifying these firms next.

$$Miss_{i,t} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1} LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t} \quad (12)$$

Following previous literature, we identify two common proxies of slightly missed earnings benchmarks:

i) ***Miss_Zero,*** which identifies firms that miss positive earnings by reporting losses of no more than 2% of their lagged market value and;

ii) ***Miss_PriorYr***, which identifies firms that present small earnings declines that are no larger than 1% (McAnally & Srivastana, 2008; Burgstahler & Dichev 1997).

We estimate two models for companies that miss the "zero target" (***Miss_Zero***): a) a model that considers yearly earnings - **Miss_Zero_Year** and; b) a model that considers quarterly earnings - **Miss_Zero_Quarter**.

We also attempt to estimate models considering yearly earnings and quarterly earnings for ***Miss_PriorYr.*** However, zero companies in our sample have missed their prior year earnings by only 1% or less considering yearly earnings and just three considering quarterly earnings. Hence, we are unable to estimate traditional models on ***Miss_PriorYr.***

Since there is not a clear reasoning on the percentages utilized in those metrics (**Miss_Zero** and **Miss_PriorYr)**, we adapt these measures considering the effect of Earnings Management (which we estimate through equation 10). We assume that it is relevant to analyze whether companies would have met (not missed) these target measures had they not managed earnings downwards. Hence, in our study we adapt Miss_Zero and Miss_PriorYr and create two new measures:

iii) ***Miss_Zero (DA),*** which identifies firms that would have positive earnings if negative discretionary accruals were excluded and;

iv) ***Miss_PriorYr (DA),*** a dummy for companies that miss last year earnings due to the effect of discretionary accruals on current and past earnings.

Table 3: Description of Independent Variables in equation 12

Variable Name (Abreviation)	**Source**	**Formula**	**Expected Impact on** $Miss_{i,t}$
Miss_Zero_Year	McAnally & Srivastana (2008); Burgstahler & Dichev (1997)	Dummy that takes value 1 for firms that report yearly losses of no more than 2% of their lagged market value.	Dependent
Miss_Zero_ Quarter	McAnally & Srivastana (2008); Burgstahler & Dichev (1997)	Dummy that takes value 1 for firms that report quarterly losses of no more than 2% of their lagged market value. We consider the last quarter of the year.	Dependent
Miss_Zero (DA)	Developed by the Authors	Dummy that takes value 1 for firms that would have positive yearly earnings without the effect of negative discretionary accruals. We estimate discretionary accruals as described in section 3.3.2.	Dependent
Miss_PriorYr (DA)	Developed by the Authors	Dummy that takes value 1 for companies that miss last year earnings due to the effect of discretionary accruals on current and past earnings.	Dependent
$GrOp_{i,t+1}$	Developed by the Authors (based on H6a and H6b)	$\frac{Granted\ Options_{i,t}}{Outstanding\ Shares_{i,t}}$	Positive
$ExOp_{i,t}$	Developed by the Authors	$\frac{Exercisable\ Options_{i,t}}{Outstanding\ Shares_{i,t}}$ Exercisable options: Number of options that managers can exercise during a certain year (t). Includes options exercisable at the beginning of the year and those that become exercisable during the year.	Negative
$LT_{i,t}$	Developed by the Authors	Dummy that takes value 1 for firms with active ESOP that include long-term incentives. We specify several specifications of this dummy, considering that ESOP include long-term incentives when the sum of their options vesting period and the acquired shares lockup period is longer than "n" (n = 2, 3, 4, 5 or 6 years).	?
$ExOp_{i,t}LT_{i,t}$	Developed by the Authors	Interaction between $AvgExOp_{i,t}$ and $LT_{i,t}$	?
Corporate Governance ($CG_{i,t}$)	Developed by the Authors	We test two metrics for this variable and include the one that yields the best fit for each model. 1 - Board Independence (see table 2) ($Independence_{i,t}$) 2 - CEO/Chairman Duality ($CeoChairman_{i,t}$)	-
Firm Size ($lnAssets_{i,t}$)	McAnally *et al.* (2008)	Log of total assets.	-
Leverage ($LEV_{i,t-1}$)	Adapted from McAnally *et al.* (2008)	$\frac{Total\ Liabilities_{t-1}}{Total\ Assets_{t-1}}$	-

Source: Elaborated by the authors.

We assume that these two specifications are less arbitrary than the previous one in order to evaluate whether earnings management plays a role on missing specific targets, as it directly considers the effect of discretionary accruals on missing these benchmarks. However, there is also the possibility that firms utilize real activities management in order to miss those targets, which might limit our results.

In order to test H6, we look at Granted Options. We expect this variable to be associated with a higher chance that firms will miss earnings targets. We include Assets Size and Leverage as control variables (McAnally *et al.* (2008). We also include Corporate Governance ($CG_{i,t}$) as an underlying factor that might affect $Miss_{i,t}$ proxies. We test two alternative measures: CEO/Chairman duality ($CeoChairman_{i,t}$) and Board Independence ($Independence_{i,t}$) and maintain the proxy that generates the best fit for each specification of $Miss_{i,t}$.

3.3.4 Testing the Hypothesis on Earnings Smoothness

Our eightieth hypothesis states that Firms that include $LT_{i,t}$ incentives in their ESOP will present smoother earnings. We estimate smoothness ($SMOOTH_{i,t}$) as the standard deviation of earnings scaled by assets divided by the standard deviation of cash flows from operations scaled by assets ($\sigma CFO_{i,t-t+4}$) (Dechow *et al.*, 2010; McInnis, 2010), as shown in equation 13. However, in order to facilitate the interpretation of outcomes, we multiply $SMOOTH_{i,t}$ by -1 so that higher values will indicate smoother earnings (Lang *et al.*, 2012). For standard deviations, we use at least three years of data and five years maximum (Baik *et al.*, 2019).

$$SMOOTH_{i,t-t+4} = -\left(\frac{\sigma E_{i,t-t+4}}{\sigma CFO_{i,t-t+4}}\right) \qquad (13)$$

When testing H7, we control for other factors that might affect a firm's earnings smoothness. We follow Lang *et al.* (2012)'s study on the determinants of earnings smoothness and estimate their model including ESOP variables according to equation 14. Table 4 reports how to estimate variables in this model.

$$\begin{aligned} SMOOTH_{i,t,t+4} = {} & \beta_0 + \phi_{Smooth} SMOOTH_{i,t,t+4} + \beta_1 LT_{i,t,t} + \beta_2 AvgExOp_{i,t,t+4} + \beta_3 AvgExOp_{i,t,t+4}\, LT_{i,t,t} \\ & + \beta_4 Sales\ Growth_{i,t,t+4} + \beta_5 Loss\%_{i,t,t+4} + \beta_6 AvgCFO_{i,t,t+4} + \beta_7 Size_{i,t} + \beta_8 Lev_{i,t} + \beta_9 MKB_{i,t} \\ & + \beta_{10} OpLev_{i,t} + \beta_{11} OpCycle_{i,t} + \beta_{12} Independency_{i,t} + \beta_{13} STDSales_{i,t,t+4}\, v_{i,t} \qquad (14) \end{aligned}$$

In order to confirm H7, we expect the $LT_{i,t}$ group dummy to positively impact smoothness, indicating higher smoothing of cash flows thought the accruals-based earnings estimation. However, we also observe whether the interaction between $LT_{i,t}$ and the Average of Exercisable Options ($AvgExOp_{i,t,t+4}$) is significant in order to test H7, as the effect of incentive horizon might interact with the scope of exercisable options. Additionally, we control whether the Average of Granted Options ($AvgGrOp_{i,t,t+4}$) and Corporate Governance proxies affect earnings smoothness.

The control variables included in this model are Leverage ($Lev_{i,t}$), Average Cash Flow from Operations ($AvgCFO_{i,t,t+4}$), Sales Volatility ($STDSales_{i,t,t+4}$), Sales Growth ($Sales\ Growth_{i,t,t+4}$), the Percentage of Losses ($Loss\%_{i,t,t+4}$), Market-to-Book ($MKB_{i,t}$), Operational Cycle ($OpCycle_{i,t}$), Operational Leverage ($OpLev_{i,t}$) and $Size_{i,t}$. Lang *et al.* (2012) and Baik *et al.* (2019) present comprehensive detail on the rationale behind the inclusion of each one of these variables. Since our main goal is to focus on ESOP variables, we do not elaborate further into the rationale behind their inclusion.

Table 4: Description of Independent Variables in equation 14

Variable Name (Abreviation)	**Source**	**Formula**	**Expected Impact (1) on** $SMOOTH_{i,t,t+4}$
Average Granted Options ($AvgGrOp_{i,t+4}$)	Developed by the Authors	$\sum_{t=1}^{5} \frac{Granted\ Options_{i,t}}{Outstanding\ Stock_{i,t}} x \frac{1}{t}$ For averages, we use at least three years of data and five years maximum.	?
Average Exercisable Options ($AvgExOp_{i,,t+4}$)	Developed by the Authors	$\sum_{t=1}^{5} \frac{Exercisable\ Options_{i,t}}{Outstanding\ Stock_{i,t}} x \frac{1}{t}$ For averages, we use at least three years of data and five years maximum.	?
($LT_{i,t}$)	Developed by the Authors (based on H7)	Dummy that assumes value 1 for firms with active ESOP that include long-term incentives. We specify several specifications of this dummy, considering that ESOP include long-term incentives when the sum of their options vesting period and the acquired shares lockup period is longer than "n" (2, 3, 4, 5 or 6 years).	+
($AvgExOp_{i,t+4}LT_{i,t}$)	Developed by the Authors (based on H7)	Interaction between $AvgExOp_{i,t}$ and $LT_{i,t}$	+
Board Independence $Independence_{i,t}$	Developed by the Authors	$\frac{Number\ of\ Independent\ Members_t}{Total\ number\ of board\ Members_t}$	?
Firm Size ($lnAssets_{i,t}$)	Lang *et al.* (2012); Baik, *et al.* (2019)	Log of total assets.	-
Leverage ($LEV_{i,t-1}$)	Lang *et al.* (2012); Baik, *et al.* (2019)	$\frac{Total\ Liabilities_{t-1}}{Total\ Assets_{t-1}}$	+
Losses ($Loss\%_{i,t,t+4}$)	Lang *et al.* (2012); Baik, *et al.* (2019	The proportion of years on which a firm experiences a loss over the last three to five years.	-
Sales Volatility ($STD\ Sales_{i,t,t+4}$)	Lang *et al.* (2012); Baik, *et al.* (2019)	Standard deviation of Sales Revenue over the last three to five years.	-
Market-to-book ($MKB_{i,t-1}$)	Lang *et al.* (2012); Baik, *et al.* (2019)	$\frac{Market\ Value_{t-1}}{Book\ Value_{t-1}}$ We exclude negative values, as they are affected by a negative book value.	-
Operational Cycle ($OpCycle_{i,t}$)	Lang *et al.* (2012); Baik, *et al.* (2019)	We estimate the log of days of a firm's operational cycle. The number of days is estimated as: $\frac{360}{\left(\frac{Sales\ Revenue\ _t}{Receivables_t}\right)} + \frac{360}{\left(\frac{Cost\ of\ Products\ Sold_t}{Inventory_t}\right)}$	-
Sales Growth ($SG_{i,t,t+4}$)	Lang *et al.* (2012); Baik, *et al.* (2019)	The average Sales Revenue Growth of at least three years and five years maximum.	-
Operational Leverage ($OpLev_{i,t}$)	Lang *et al.* (2012); Baik, *et al.* (2019)	$\frac{Property, Plants\ and\ Equipment_t}{Average\ Assets}$	-
Average Cash Flow from Operation ($AvgCFO_{i,t,t+4}$)	Lang *et al.* (2012); Baik, *et al.* (2019)	The average Cash Flow from operations of at least three years and five years maximum	+

(1) Expected impact for control variables rely on the findings of Baik *et al.* (2019).
Source: Elaborated by the authors.

While Lang *et al.* (2012) and Baik *et al.* (2019) have been the first ones to estimate the previous model, they do not account for possible sources of endogeneity. Variables in this model generated simultaneously with $SMOOTH_{i,t,t+4}$ include Leverage, Average Cash Flow from Operations, Sales Volatility, Sales Growth and the Percentage of Losses. Additionally, past earnings smoothness also affects future smoothness (as we find when estimating equation 14). Hence, we once again utilize the Systemic GMM model in order to control for these possible sources of endogeneity.

4 Results and Discussion

4.1 Earnings Persistence Models

In Table 5, we display summary statistics of our persistence model variables. It should be noted that we exclude observations with unusually large numbers of $\boldsymbol{ExOp_{i,t}}$ and $\boldsymbol{GrOp_{i,t}}$, as we find that most cases in which the numbers of exercisable options in a certain year exceeds 10% of a company's total outstanding options, data is probably affected by share splits, wrong data reporting (e.g.: expired options shown as still active) or other factors. Some companies presented stock option programs that were larger than their outstanding stocks before the exclusion of these outliers.

Table 5: Summary statistics of Earnings Persistence models.

Variables	Obs.	Min.	Max	Median	Mean	Std. Dev.
$\boldsymbol{E_{i,t}}$	530	-0.7079	0.3661	0.0276	0.0215	0.0980
$\boldsymbol{AC_{i,t}}$	476	-0.4430	12.8801	0.1759	0.3418	0.7174
$\boldsymbol{CF_{i,t}}$	476	-12.7463	0.3990	-0.1465	-0.3223	0.7279
$\boldsymbol{ExOp_{i,t}}$	530	0.00	0.0885	0.0012	0.0057	0.0114
Vesting (years) (1)	530	0.00	10	4.00	3.42	1.82
Vesting + Lockup (years) (1)	530	0.00	13.00	4.00	4.04	1.91

This table includes 82 companies, however, since our panel is unbalanced and some observations are removed when estimating the GMM model due to the inclusion of lagged variables, the number of groups and observations might differ depending on the specification of variables and instruments.
(1) We present data on the longest vesting or vesting + lockup period for each company, as firms might adopt different time incentives for different grants.
Source: Elaborated by the authors.

On average, companies have incentives (vesting+lockup) that last around 4.04 years, which is very close to the median (4 years). When ignoring the lockup period, we observe that incentives (vesting period) is on average 3.42 years. This result is consistent with findings for companies traded on the S&P on options vesting periods, as most companies cluster around 3 to 5 years vesting horizons (Gopalan *et al.*, 2014). However, Gopalan *et al.* do not report data on lockup periods.

The smallest Vesting + Lockup period is 0 years, which indicates that some firms grant immediately exercisable options. On the other hand, the maximum incentive horizon lasts 13 years. This demonstrates that companies might present a huge temporal incentive differences according to how their ESOP are structured. While 13 years seem to be a relatively long vesting + lockup period, in more economically developed countries stock option incentives might last as long as 20 years (Gopalan *et al.*, 2014).

We ought to highlight that all of our statistical models consider the vesting + lockup period, as we find that accounting for the lockup period enhances statistical results. From here on, we utilize the term "vesting period" as similar to the "vesting + lockup period", unless otherwise stated.

In order to evaluate which is the desirable long-term incentive horizon of an ESOP regarding its effect on earnings persistence, we estimate several specifications of equation 6 and 7, which we display in Tables 6 and 7. By analyzing the statistical results for the $\boldsymbol{ExOp_{i,t}LT_{i,t}}$ interaction , we find better statistical results when considering that the ideal long-term incentive is higher than 5 years[2] (LT>5). The LT > 6 model also generates qualitatively similar results, however, we assume that this specification treats some of the firms that should have been classified as $\boldsymbol{LT_{i,t} = 1}$ as $\boldsymbol{LT_{i,t} = 0}$, which explains why $\boldsymbol{ExOp_{i,t}}$ is not significant in this model.

Table 6: Models on Earnings Persistence – Equation 6
The table presents dynamic panel-data estimation based on a two-step system GMM. Only firms that adopt ESOP compose the sample.

$$\boldsymbol{E_{i,t+1} = \alpha_o + \alpha_1 E_{i,t} + \alpha_2 ExOp_{i,t} + \alpha_4 ExOp_{i,t}LT_{i,t} + v_{t+1}\ (6)}$$

Variables	Long-term dummy specification (LT = Vesting + Lockup period)				
	LT > 2	LT > 3	LT > 4	LT > 5	LT > 6
$\boldsymbol{E_{i,t}}$	0.4676*	0.4791*	0.4533*	0.4961*	0.4916*
$\boldsymbol{LT_{i,t}}$	0.0151	0.0004	0.0035	-0.0139	-0.0214
$\boldsymbol{ExOp_{i,t}}$	-0.4825	-0.0262	-0.7218	-0.6109***	-0.5451
$\boldsymbol{ExOp_{i,t}LT_{i,t}}$	0.3293	-0.2107	1.26164	1.8589*	1.98*
Constant	-0.0003	0.01253	0.0121***	0.015**	0.0149**
AR(1)	Z= -1.34	Z= -1.39	Z= -1.41	Z= -1.42	Z= -1.43
AR(2)	Z= 0.49	Z= 0.49	Z= 0.54	Z= 0.56	Z= 0.56
Sargan Test (Chi²)	28.22*	34.05*	35.80*	35.94*	35.41*
Hansen Test (Chi²)	7.89	8.20	8.34	8.02	6.58
Dif-Hansen (Chi²)	0.281	1.87	4.45	3.44	7.55
Wald Test (Chi²)	186.86*	120.06*	118.60*	237.12*	295.01*
Obs.	439	439	439	439	439
Groups	76	76	76	76	76
Instruments	11	11	11	11	11

*Significant at 1%; ** Significant at 5%; *** significant at 10%.
AR(1) and AR(2) report the Arellano-Bond test for first and second order correlation between the error terms. The Sargan and Hansen Tests report whether instruments are exogenous. The Dif-Hansen statistics indicates whether the Systemic GMM is valid.
Source: Elaborated by the authors.

We find that for firms that possess long-term incentives (vesting + lockup > 5 years) exercisable options positively affect future earnings. The interaction between exercisable options and the long-term dummy ($\boldsymbol{ExOp_{i,t}LT_{i,t}}$) surpasses the negative effect of $\boldsymbol{ExOp_{i,t}}$. This suggests that earnings are more persistent for firms that adopt a combination of vesting+lockup that surpasses five years when they have exercisable options in the previous year. Considering data for our sample, $\boldsymbol{LT_{i,t}}$ is equal to 1 within the LT>5 model for companies that have vesting + lockup periods of at least five and a half years (5.5 years), which accounts for 17.52% percent of our observations.

Further analyzing the results of equation 6, Table 7 also presents estimates of equation 7. By examining the separate effects of the accruals and cash flow components of earnings on future profits, we control whether differences in these earnings components might affect the relationships we study. Once again, the LT>5 model stands out. It should be noticed that, in

[2] We have tested whether models were enhanced by considering that the $\boldsymbol{LT_{i,t}}$ dummy equals 1 for companies that include incentives that are higher (>) than "n" years (2, 3, 4, 5 and 6 years) or higher than or equal to (≥) "n" years and find that results are enhanced when considering the first specification (>).

order to understand how ESOP with different time horizons affect future earnings, the negative impact of $\boldsymbol{LT_{i,t}}$ on future earnings should be combined with the negative coefficient of $\boldsymbol{ExOp_{i,t}}$ and positive impact of the $\boldsymbol{ExOp_{i,t}LT_{i,t}}$ interaction. These coefficients suggest that earnings are less persistent for firms with longer incentive horizons and fewer $\boldsymbol{ExOp_{i,t}}$. However, as the number of $\boldsymbol{ExOp_{i,t}}$ increases, earnings become more persistent for those companies compared to firms that do not include long-term incentives (assuming LT>5).

Considering the results for the $\boldsymbol{LT_{i,t}}$ dummy, we split our sample between firms that adopt incentives higher than 5 years and those that do not. We estimate equations 8 and 9 for these subsamples. We display results in table 8.

Table 7: Models on Earnings Persistence – Equation 7

The table presents dynamic panel-data estimation based on a two-step system GMM. Only firms that adopt ESOP compose the sample.

$$\boldsymbol{E_{i,t+1} = \alpha_o + \gamma_1 AC_{i,t} + \gamma_2 CF_{i,t} + \gamma_3 LT_{i,t} + \gamma_4 ExOp_{i,t} + \gamma_5 ExOp_{i,t}LT_{i,t} + v_{t+1}} \quad (7)$$

Variables	**Long-term dummy specification (LT = Vesting + Lockup period)**				
	LT > 2	**LT > 3**	**LT > 4**	**LT > 5**	**LT > 6**
$\boldsymbol{CF_{i,t}}$	0.6460*	0.6263*	0.6466*	0.6577*	0.6408*
$\boldsymbol{AC_{i,t}}$	0.6382*	0.6255*	0.6515*	0.6591*	0.6443*
$\boldsymbol{LT_{i,t}}$	0.0075	-0.0029	0.792	-0.0192***	-0.0282
$\boldsymbol{ExOp_{i,t}}$	-0.6723	-0.1439	-0.8160***	-0.0613***	-0.538
$\boldsymbol{ExOp_{i,t}LT_{i,t}}$	0.6447	0.0117	1.5483*	2.090*	2.1647*
Constant	0.0024	0.0102	0.0052	0.1	0.0096
AR(1)	Z= -1.61	Z= -1.65***	Z= -1.74***	Z= -1.73***	Z= -1.77***
AR(2)	Z= 0.52	Z= 0.49	Z= 0.55	Z= 0.56	Z= 0.54
Sargan Test (Chi²)	47.34*	48.21*	49.71*	50.9*	50.52*
Hansen Test (Chi²)	10.88	11	10.32	10.47	10.33
Dif-Hansen (Chi²)	10.66	10.66	9.59	8.46	8.99
Wald Test (Chi²)	209.11*	138.89*	209.11*	412.46*	471.62*
Obs.	439	439	439	439	439
Groups	76	76	76	76	76
Instruments	18	18	18	18	18

*Significant at 1%; ** Significant at 5%; *** significant at 10%.

AR(1) and AR(2) report the Arellano-Bond test for first and second order correlation between the error terms. The Sargan and Hansen Tests report whether instruments are exogenous. The Dif-Hansen statistics indicates whether the Systemic GMM is valid.

Source: Elaborated by the authors.

Table 8 shows that not only the persistence coefficients for earnings, cash flows and accruals are larger for the subgroup that adopts long-term compensation, but also that $\boldsymbol{ExOp_{i,t}}$ has a different impact on future earnings for both subgroups. While $\boldsymbol{ExOp_{i,t}}$ positively affects the persistence of earnings for firms with longer contracts, it affects future earnings negatively for companies that only adopt short-term stock option contracts. Considering that investors view persistence as an indicative of less transitory earnings (Li, 2019), long-term incentives seem to be a desirable feature of ESOP in order to enhance EQ.

A possible interpretation to our findings is that less persistence is associated with short-termism as shorter contracts might exacerbate myopic behavior, decreasing the quality of earnings according to earnings persistence models and enhancing short-term profits. This explanation conforms to theoretical models on the negative effect of larger incentive horizons on manipulations (Edmans *et al.*, 2012; Peng & Röell, 2014; Marinovic & Vaas, 2019).

While longer incentives are associated with higher persistence, especially for companies that have larger amounts of exercisable options, it is unclear whether companies that adopt smaller vesting + lockup periods in their compensation present less persistent earnings due to higher short-term manipulation or higher incentives for investing in projects that yield higher returns on the short run.

Table 8: Models on Persistence by $LT_{i,t}$ subsamples.
The table presents dynamic panel-data estimation based on a two-step system GMM. Only firms that adopt ESOP compose the sample. We divide the sample into two groups: firms that have incentive horizons (lockup + vesting period) longer than 5 years and those that do not.

$$E_{i,t+1} = \alpha_o + \alpha_1 E_{i,t} + \alpha_2 ExOp_{i,t} + v_{t+1} \quad (8)$$
$$E_{i,t+1} = \alpha_o + \gamma_1 AC_{i,t} + \gamma_2 CF_{i,t} + \gamma_3 ExOp_{i,t} + v_{t+1} \quad (9)$$

Variables	Groups by Long-term Dummy (5 years)			
	$LT_{i,t} = 0$	$LT_{i,t} = 0$	$LT_{i,t} = 1$	$LT_{i,t} = 1$
$E_{i,t}$	0.4563***	-	1.213*	-
$AC_{i,t}$	-	0.4937*	-	1.0168*
$CF_{i,t}$	-	0.4738*	-	1.1572*
$ExOp_{i,t}$	-0.3874***	-0.4609***	1.0651**	0.6762**
Constant	0.0172*	0.012	-0.031**	0 .0038
AR(1)	Z= -1.52	Z= -0.93	Z= -1.27	Z= -1.63
AR(2)	Z= -0.09	Z= -0.91	Z= 0.94	Z= 0.28
Sargan Test (Chi²)	61.45*	293.51*	0.13	9.89
Hansen Test (Chi²)	2.75	45.39	0.14	0.940
Dif-Hansen (Chi²)	1.32	45.00	0.00	0.963
Wald Test (Chi²)	36.50*	47.83*	1876.01*	94.66*
Obs.	368	368	59	59
Groups	67	67	16	16
Instruments	7	58	5	14

*Significant at 1%; ** Significant at 5%; *** significant at 10%.
AR(1) and AR(2) report the Arellano-Bond test for first and second order correlation between the error terms. The Sargan and Hansen Tests report whether instruments are exogenous. The Dif-Hansen statistics indicates whether the Systemic GMM is valid.
Source: Elaborated by the authors.

Overall, results in this section lead us to not reject H1 and H2, as companies that include long-term incentives (LT>5) present more persistent earnings and accruals. In the next section, we analyze how short-term contracts affect discretionary accruals, as discretionary accounting choices directly represent manipulations of accounting reports and possibly reduce earnings quality.

4.2 Discretionary Accruals Models.

In order to test hypotheses 3, 4 and 5, we first estimate discretionary accruals following the Kothari *et al.* (2016) model (see section 2.3.2) for the whole sample of B3 companies that have presented data for estimating equation 10. Table 9 reports results estimated though a Systemic GMM regression.

After obtaining the differenced residuals, which are our Discretionary Accruals proxy, we are able to investigate how ESOP features affect earnings management. We test H3, H4 and H5 though equation 11 and report findings on Table 10. We observe that the LT>5 model also stands out for our Discretionary Accruals model. This corroborates the evidence obtained from our persistence models that suggests that ESOP incentives should last longer than five years in order to affect EQ.

In all of the estimated models, controlx variables behave similarly, except for the Size of Sales, which positively affected discretionary accruals in the LT>2 and LT>3 models and negatively impacted abnormal accruals in the remaining specifications. However, as we observe that the LT>5 and LT>6 models present a better fit, we interpret that a higher Size of Sales is associated with smaller abnormal accruals. This finding is similar to what Lemma, *et al*. (2018) observe for American companies.

As expected, previous year discretionary accruals ($\boldsymbol{DA_{i,t-1}}$) has a negative impact on current year accruals. This is associated with accruals reversion (Kothari *et al.*, 2016), and illustrates the necessity of controlling for endogeneity we have previously discussed (Barros *et al.*, 2020). It is interesting to notice that accruals reversion confirms Peng and Röell's statement that "in the long run the truth will come out, even if in the short run stock price can be manipulated" (Peng & Röell, 2014, p. 489).

Table 9: Model on Discretionary accruals.
The table presents dynamic panel-data estimation based on a two-step system GMM. All non-financial firms traded on B3 with available data are included in our sample.
We treat $AC_{i,t-1}$, $(\Delta REV_t - \Delta AR_t)$ and $E_{i,t}$ as endogenous.

$$\boldsymbol{AC_{i,t} = \beta_0 + \phi_{ac} AC_{i,t-1} + \beta_1 \frac{1}{\left(\frac{AT_{i,t}+AT_{i,t-1}}{2}\right)} + \beta_2\ (\Delta REV_t - \Delta AR_t) +\ \beta_3\ PPE_t + \beta_4 E_{i,t} + v_{i,t}\ (10)}$$

$AC_{i,t-1}$	0.279261*
$Reverse\ Assets\ (\boldsymbol{\beta_2})$	416487.2*
$(\Delta REV_t - \Delta AR_t)$	-1.64155***
$PPE_{i,t}$	-1.448913
$E_{i,t}$	0.1684543*
$Constant$	.0082766
AR(1)	Z= -1.10
AR(2)	Z= 1.02
Sargan Test (chi²)	0.18
Hansen Test (chi²)	4.29
Dif-Hansen Test (chi²)	3.70
Wald Test (chi²)	X^2 = 10098.72*
Observarions	2097
Groups	222
Instruments	17

*Significant at 1%; ** Significant at 5%; *** significant at 10%.
AR(1) and AR(2) report the Arellano-Bond test for first and second order correlation between the error terms. The Sargan and Hansen Tests report whether instruments are exogenous. The Dif-Hansen statistics indicates whether the Systemic GMM is valid.
Source: Elaborated by the authors.

Another variable that has met theoretical expectations based on financial literature is Leverage. In all reported models, leverage has positively impacted discretionary accruals. The possibility of violating debt covenants play a decisive role on this relationship (Baker *et al.*, 2003), because inflating earnings through EM can reduce the debt-to-asset ratio.

Board Independence negatively affects discretionary accruals in all models. This finding indicates that higher board independence reduces the probability that a manager might manipulate earnings upward through discretionary choices regarding accruals. Other than reducing positive accruals manipulation, Prencipe and Bar-Yosef (2011) find that independence also reduces the absolute value of discretionary accruals, which suggests that the monitoring role of board independence reduces both positive and negative manipulation of accruals. While we do not estimate a model for the absolute value of $DA_{i,t}$, our results should be interpreted by assuming the possibility that the negative effect of independence on this variable might not be related to downwards earnings manipulation.

Regarding ESOP variables, in all $\boldsymbol{DA_{i,t}}$ models a larger grant of options in the following year negatively affects discretionary accruals, corroborating H3. This is consistent with previous literature and shows that managers manipulate stock prices downward in a year that precedes large grants in order to decrease strike prices (Aboody & Kasznik, 2000; Baker *et al.*, 2003). However, this finding is novel for the Brazilian context, and shows that even in an emerging market such managers utilize accounting discretion to reach their own goals. It should be noted that data on whether grants are scheduled or not are not widely available for Brazilian countries. Hence, we are unable to identify whether randomizing grants might alleviate downward manipulations prior to grants.

Table 10: Models on Discretionary Accruals – Equation 9

The table presents dynamic panel-data estimation based on a two-step system GMM. Only firms that adopt ESOP compose the sample.

We treat $DA_{i,t-1}$, $Leverage_{i,t}$ and $Sales_{i,t}$ as endogenous.

$$DA_{i,t} = \beta_{0i} + \phi_{da}DA_{i,t-1} + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t+1} + \beta_4 ExOp_{i,t+1}LT_{i,t} + \beta_5 Independency_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnSales_{i,t} + \beta_6 LEV_{i,t-1}\, \varepsilon_{i,t} \quad (11)$$

Variables	Long-term dummy specification (LT = Vesting + Lockup period)				
	LT > 2	LT > 3	LT > 4	LT > 5	LT > 6
$\boldsymbol{DA_{i,t-1}}$	-0.135**	-0.138**	-.06168	-0.1221***	-0.1168***
$\boldsymbol{LT_{i,t+1}}$	0.1602	0.194	.17203	-0.1294	-0.3579**
$\boldsymbol{ExOp_{i,t+1}}$	12.7669	-17.5904	-50.2273**	-44.0423*	-41.2352*
$\boldsymbol{ExOp_{i,t+1}LT_{i,t+1}}$	-51.6334	-22.81	22.9189	34.9004**	31.5129**
$\boldsymbol{GrOp_{i,t+1}}$	-29.0987*	-28.601*	-27.0275*	-25.2681*	-26.1821*
$\boldsymbol{Sales_{i,t}}$	0.2324**	0.2569**	-0.2076	-0.2534**	-0.2603**
$\boldsymbol{Leverage_{i,t}}$	1.6462*	1.7195*	1.4448***	1.7483*	1.7345*
$\boldsymbol{Independency_{i,t}}$ (1)	-0.5871***	-0.6531***	-1.684***	-0.6560***	-0.7205**
Constant	2.8742***	3.2139**	3.2737**	3.3124**	3.3945**
AR(1)	Z= -5.02*	Z= -4.91***	Z = -4.78*	Z= -5.05*	Z= -5.06*
AR(2)	Z= -0.55	Z= 0.61	Z = 0.14	Z= -0.11	Z= -0.21
Sargan Test (Chi²)	101.86*	101.31*	96.56*	99.70*	101.49*
Hansen Test (Chi²)	39.57	40.27	39.50	41.46	40.43
Dif-Hansen (Chi²)	37.26	37.25	38.88	37.17	37.51
Wald Test (Chi²)	39.94*	32.98*	26.88*	29.25*	31.78*
Obs.	389	389	389	389	389
Groups	72	72	72	72	72
Instruments	41	55	39	42	42

*Significant at 1%; ** Significant at 5%; *** significant at 10%.

AR(1) and AR(2) report the Arellano-Bond test for first and second order correlation between the error terms. The Sargan and Hansen Tests report whether instruments are exogenous. The Dif-Hansen statistics indicates whether the Systemic GMM is valid.

(1) We have tested whether CEO/Board Chairman duality is a better proxy for corporate governance in the DA model, but this variable was not significant.

Source: Elaborated by the authors.

Contrary to our expectation stated in H4, $\boldsymbol{ExOp_{i,t+1}}$ negatively affects previous years discretionary accruals ($\boldsymbol{DA_{i,t}}$). We assumed that the proximity to a large portion of options vesting period (or the end of lockups) would incite managers to manage earnings upward, but our findings suggest that managers with short-term compensation might perform a big bath in the year that precedes a large vesting of options. This could explain why earnings are less persistent for these companies, as shown in section 4.1.

This finding is not consistent with the study of Bartov and Mohanram (2004), as they observe an increase in abnormal earnings in the period prior to the exercise of options, which reverses into bad performances in the following year. However, our result complements the findings of Bergstresser and Philippon (2006), as they observe that earnings management is higher in periods on which a higher number of options exercise occurs. Hence, managers might manipulate earnings downward in the prior year and upwards when options are exercisable. This tactic allows managers to hold good news for the following year.

The finding on $\boldsymbol{ExOp_{i,t+1}}$ also nullifies our fifth hypothesis (H5), which states that the positive effect of the level of $\boldsymbol{ExOp_{i,t+1}}$ on $\boldsymbol{DA_{i,t}}$ would be smaller for companies that adopt long-term contracts. However, it is interesting to notice that the negative effect of $\boldsymbol{ExOp_{i,t}}$ on $\boldsymbol{DA_{i,t}}$ is indeed smaller for companies that adopt long-term incentives (LT>5). This suggests that, by incentivizing long-term oriented decisions, contracts that last longer than five years seem to reduce incentives for accruals manipulation. This finding is consistent with theoretical arguments that including longer incentives in contracts lead managers to waste less effort and time on manipulations that relate to short-term incentives (Peng, & Röell, 2014). It also corroborates empirical evidence on the positive effect of shorter-duration executive compensation on incentives for short-term performance manipulation (Gopalan *et al.*, 2014).

4.3 Target Earnings Models.

In H6a and H6b, we propose that granted options positively affect the probability that managers will miss specific earnings benchmarks, as they try to negatively influence strike prices. We focus on four measures of missed earnings ($Miss_{i,t}$): $\boldsymbol{Miss\_Zero\_Quarter}_{i,t}$; $\boldsymbol{Miss\_Zero\_Year}_{i,t}$; $\boldsymbol{Miss\_Zero\ (DA)}_{i,t}$ and; $\boldsymbol{Miss\_PriorYr\ (DA)}_{i,t}$), which we describe in section 3.3.3.

Firstly, we analyze which variables lead companies to report accounting losses - miss "positive earnings" - willingly. We use several specifications of this variable to test the validity of H6a. We first focus on how variables affect ***Miss_Zero_Quarter***, which is a dummy for companies that slight miss their previous year quarterly earnings. Table 11 display Results for this variable.

In all specifications of the $\boldsymbol{Miss\_Zero\_Quarter}_{i,t}$ models we estimate, we find companies are more likely to slightly miss their previous year quarterly earnings if a larger option grant happens in the next year. This corroborates with H6 and shows that managers might miss their company's previous year quarterly earnings benchmark in order to decrease their options strike price. Other ESOP variables are not significant in our $\boldsymbol{Miss\_Zero\_Quarter}_{i,t}$ model.

Regarding the $\boldsymbol{Miss\_Zero\_Year}_{i,t}$ model, future options grants do not significantly affect the probability that companies will miss this target, however, we observe that the $\boldsymbol{ExOp_{i,t}LT_{i,t}}$ interaction is significant and positively affects the chance that managers might slightly miss their previous yearly earnings. Once again, the LT>5 model seem to better capture how ESOP incentive horizons might affect EQ. In Table 12 we report findings on $\boldsymbol{Miss\_Zero\_Year}_{i,t}$.

The positive impact of $\boldsymbol{ExOp_{i,t}LT_{i,t+1}}$ on the probability that $\boldsymbol{Miss\_Zero\_Year}_{i,t}$ will be equal to 1 could suggest that long-term option contracts might lead managers to also manipulate earnings downward close to the date when their options become vested. Corroborating with this assertion, our reports on Table 13 for the $\boldsymbol{Miss\_Zero\ (DA)}_{i,t}$ model indicate that the $\boldsymbol{ExOp_{i,t}LT_{i,t}}$ variable positively affects the probability that companies might report losses that would have been profits if not for the effect of earnings (accruals) management.

Table 11: Random Effects logistic regressions on *Miss_Zero_Quarter*
In this table, we present Random Effects Logit regressions for the probability that $\boldsymbol{Miss\_Zero\_Quarter}_{\ i,t}$ will be equal to 1. For Random Effects models (RE), we present coefficients followed by marginal effects on the dependent variable under parenthesis **(bold)**.

$$\boldsymbol{Miss\_Zero\_Quarter}_{\ i,t} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1} LT_{i,t+1} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t}\ (12.a)$$

Variables	Long-term dummy specification (LT = Vesting + Lockup period)				
	LT > 2	**LT > 3**	**LT > 4**	**LT > 5**	**LT > 6**
	RE	**RE**	**RE**	**RE**	**RE**
$\boldsymbol{LT}_{i,t}$	-0.5726	0.3714	0.4689	0.0692	0.4227
	(-0.0404)	**(0.0261)**	**(0.0327)**	**(0.0048)**	**(0.0299)**
$\boldsymbol{ExOp}_{i,t+1}$	3.5312	-5.5306	-8.7208	-9.6295	2.5135
	(0.2493)	**(-0.3890)**	**(-0.6088)**	**(-0.6789)**	**(0.1782)**
$\boldsymbol{ExOp}_{i,t}\boldsymbol{LT}_{i,t+1}$	-7.011	4.9182	15.4889	19.1777	-89.5633
	(-0.4951)	**(0.3459)**	**(1.0814)**	**(1.3522)**	**(-6.3495)**
$\boldsymbol{GrOp}_{i,t+1}$	39.8826***	39.5742***	37.9066***	42.9205***	38.0294***
	(2.8164)	**(2.7838)**	**(2.646)**	**(3.0262)**	**(2.696)**
$\boldsymbol{Independence}_{i,t-1}$	1.2729	1.5544	1.6191	1.43678	1.4311
	(0.0899)	**(0.1093)**	**(0.113)**	**(0.1013)**	**(0.1014)**
$\boldsymbol{Size}_{i,t-1}$	-0.1738*	-0.2132*	-0.2144*	-0.2035*	-0.2037*
	(-0.0122)	**(-0.0150)**	**(-0.0149)**	**(-0.0143)**	**(-0.0144)**
$\boldsymbol{Leverage}_{i,t-1}$	-0.1876	-0.8104	-0.7517	-0.5111	-0.487
	(-0.0132)	**(-0.0570)**	**(-0.0524)**	**(-0.0360)**	**(-0.0345)**
Constant	N/A (1)	N/A (1)	N/A (1)	N/A (1)	N/A (1)
Observations	341	341	341	341	341
Groups	50	50	50	50	50
Wald (Chi²)	70.83*	66.35*	66.30*	67.55	69.35*
Hausman (Prob>Chi²)	0.9934	0.5799	0.4682	0.3672	0.4906
Rho = 0 (p-value)	0.039**	0.023**	0.025**	0.02**	0.026**
AIC	206.2164	206.4455	205.4955	206.5333	206.4836
BIC	236.8714	237.1005	236.1506	237.1883	237.1387

*Significant at 1%; ** Significant at 5%; *** significant at 10%.
(1) We exclude the constant from Random Effects models as this specification yields better results regarding the Wald statistic and variable coefficients. The constant was not significant when included**.**
The pseudo R² is not reported for random effects and fixed effects logit models.
Source: Elaborated by the authors.

By analyzing our novel findings on the effect of $\boldsymbol{ExOp}_{i,t}\boldsymbol{LT}_{i,t+1}$ on $\boldsymbol{Miss\_Zero}\ (\boldsymbol{DA})_{\ i,t}$ combined with our previous results on how $\boldsymbol{ExOp}_{i,t}\boldsymbol{LT}_{i,t+1}$ affects discretionary accruals, we corroborate theoretical arguments that, while longer incentives might reduce manipulations, it is not realistic to expect that it can be completely eliminated (Marinovic & Varas, 2019). Our discretionary accruals show that $\boldsymbol{ExOp}_{i,t}\boldsymbol{LT}_{i,t+1}$ (LT>5) reduces negative accruals manipulation, however, this interaction increases the probability that a manager might utilize discretion in order to report a loss.

A possibly counterintuitive finding is the effect of CEO/Chairman duality on $\boldsymbol{Miss\_Zero}\ (\boldsymbol{DA})_{\ i,t}$. While this variable is associated with lesser corporate governance quality, it negatively affects the probability that managers might intentionally report losses through earnings manipulation, which is normally associated with lower EQ. However, one possible interpretation of this finding is that Chairman/CEOs of companies that adopt ESOP might avoid reporting losses so that they do not damage their own reputation, as executives assume that the market interprets missed target earnings as a bad signal (Graham *et al.*, 2005). Hence, CEO/Chairman duality increases the probability that companies will beat the zero earnings target when the considering the effect of discretionary accruals, which also indicates lower EQ.

Table 12: Random Effects logistic regressions on *Miss_Zero_ Year*
In this table, we present Random Effects (RE) and Pooled (PO) Logit regressions for the probability that $\boldsymbol{Miss\_Zero\_Year}_{\ i,t}$ will be equal to 1. For Random Effects models (RE), we present coefficients followed by marginal effects on the dependent variable under parenthesis **(bold)**.

$$\boldsymbol{Miss\_Zero\_Year}_{\ i,t} = \beta_0 + \ \beta_1 GrOp_{i,t+1} \ + \ \beta_2 ExOp_{i,t+1} \ + \beta_3 LT_{i,t} + \ \beta_4 ExOp_{i,t+1} LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} \ + \ \beta_7 lnA_{i,t-1} + \ \varepsilon_{i,t} \ (12.b)$$

Variables	Long-term dummy specification (LT = Vesting + Lockup period)				
	LT > 2	LT > 3	LT > 4	LT > 5	LT > 6
	RE	RE	PO	PO	RE
$\boldsymbol{LT}_{i,t}$	-0.4732	0.6155	1.018***	0.0293	-2.4892
	(-0.0181)	**(0.0235)**	**(0.0313)**	**(0.0008)**	**(-0.0933)**
$\boldsymbol{ExOp}_{i,t}$	-75.4181	-183.4691	-63.3026	-88.7598	-31.9218
	(-2.895)	**(-7.0307)**	**(-1.7901)**	**(-2.5111)**	**(-1.1974)**
$\boldsymbol{ExOp}_{i,t}\boldsymbol{LT}_{i,t}$	85.4379	195.1061	85.9086	138.0188***	109.9849***
	(3.2803)	**(7.4766)**	**(2.4294)**	**(3.9047)**	**(4.1257)**
$\boldsymbol{GrOp}_{i,t}$	-1.6522	-7.5586	-8.9692	18.4978	8.7150
	(-0.0634)	**(-0.2896)**	**(-0.2536)**	**(0.5233)**	**(0.3269)**
$\boldsymbol{CeoChairman}_{i,t-1}$	-1.0232	-1.0854	-1.134	-1.8011	-1.5848
	(-0.0392)	**(-0.0415)**	**(-0.0215)**	**(-0.0282)**	**(-0.0594)**
$\boldsymbol{Size}_{i,t-1}$	-0.2207*	-0.2673*	-0.2621*	-0.2131*	-0.2365*
	(-0.0084)	**(-0.0102)**	**(-0.0074)**	**(-0.0060)**	**(-0.0089)**
$\boldsymbol{Leverage}_{i,t-1}$	0.3252	.1936	0.456	0.3095	0.2896
	(0.0124)	**(0.0074)**	**(0.0128)**	**(0.0087)**	**(0.0108)**
Constant	N/A(1)	N/A(1)	N/A(1)	N/A(1)	N/A(1)
Observations	557	557	557	557	557
Groups	81	81	-	-	81
Wald (Chi²)	73.83*	77.02*	187.16*	190.55*	70.53*
Hausman (Prob>Chi²)	0.9939	(2)	-	-	0.7707
Goodness of fit (p-value)	-	-	0.6347	0.2780	-
Area under ROC curve	-	-	0.6999	0.6160	-
Sensitivity (cutoff =0. 0,0395)	-	-	72.73%	59.09%	-
Specificity cutoff =0. 0,0395))	-	-	62.06%	56.26%	-
Rho = 0 (p-value)	0.078***	0.095***	0.152	0.171	0.067***
AIC	197.8785	194.7148	187.8399	187.8447	193.51
BIC	232.4591	229.2953	218.0978	218.1026	228.0905

*Significant at 1%; ** Significant at 5%; *** significant at 10%.
(1) We exclude the constant from Random Effects and Pooled models as this specification yields better results regarding the Wald statistic and variable coefficients. The constant was not significant when included**.**
(2) For the **LT > 3** model, convergence was not achieved for the fixed effects model and data was not able to meet the asymptotic assumptions for the Hausman test..
The pseudo R^2 is not reported for random effects and fixed effects logit models.
Source: Elaborated by the authors.

Our finding on corporate governance is consistent with evidence on the effect of CEO/Chairman duality on earnings management prevalence (Dechow, Sloan, & Sweeney, 1996). It also corroborates theoretical arguments the necessity to reduce pay-for-performance sensibility in companies that have weaker governance mechanisms (Goldman & Slezak, 2006).

Table 13: Time series logistic regressions on *Miss_Zero (DA)*
In this table, we present Time Series Logit regressions for the probability that ***Miss_Zero (DA)*** will be equal to 1. For Fixed Effects specifications (FE), we present coefficients followed by odds ratio under parenthesis *(italic)*, as it is not possible to compute marginal effects for this model. For Random Effects models (RE), we present coefficients followed by marginal effects on the dependent variable under parenthesis **(bold)**.

$$\boldsymbol{Miss\_Zero\ (DA)_{i,t}} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1} LT_{i,t} + \beta_5 CeoChairman_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t} \ (12.c)$$

Variables	Long-term dummy specification (LT = Vesting + Lockup period)				
	LT > 2	LT > 3	LT > 4	LT > 5	LT > 6
	FE	FE	FE	RE	RE
$\boldsymbol{LT_{i,t}}$	0.4036	1.024	17.1767	-0.8003	-0.575
	(1.4972)	*(2.7846)*	(2.88e+07)	**(-0.0543)**	**(-0.0392)**
$\boldsymbol{ExOp_{i,t}}$	-67.0032	-11.8236	-7.7503	0.1721	4.6395
	(7.96 e-30)	*(7.33e-06)*	(.0004)	**(0.0117)**	**(0.3165)**
$\boldsymbol{ExOp_{i,t}LT_{i,t}}$	91.4643	38.6646	-5.6097	81.6479*	74.8399**
	(5.28 e+39)	*(6.19e+16)*	*(.00366)*	**(5.5434)**	**(5.1056)**
$\boldsymbol{GrOp_{i,t}}$	78.3725**	69.8028**	64.1538***	36.3337**	35.3339***
	(1.09 e+34)	*(2.07e+30)*	*(7.27e+27)*	**(2.4668)**	**(2.4104)**
$\boldsymbol{CeoChairman_{i,t-1}}$	-.84607	-0.8673	-1.4249	-2.0895***	-2.1103***
	(0.429)	*(0.42)*	*(0.2405)*	**(-0.1419)**	**(-0.1439)**
$\boldsymbol{Size_{i,t-1}}$	1.4685**	1.5162**	1.3634**	-0.2365*	-0.2386*
	(4.3427)	*(4.5550)*	*(3.9094)*	**(-0.016)**	**(-0.0163)**
$\boldsymbol{Leverage_{i,t-1}}$	-0.5334	-0.8509	-0.6737	1.1756	1.1633
	(0.5865)	*(0.4270)*	*(0.5097)*	**(0.0798)**	**(0.0794)**
Constant	N/A (1)	N/A (1)	N/A (1)	N/A (2)	N/A (2)
Observations	209	209	209	556	556
Groups	29	29	29	81	81
Wald (Chi²)	N/A	N/A	N/A	85.71*	86.79*
LR (Chi²)	19.37*	19.67*	22.66*	N/A	N/A
Hausman (Prob>Chi²)	0.0223**	0.000*	0.0286**	0.1266	0.9999
Rho = 0 (p-value)	0.002*	0.000*	0.000*	0.000*	0.000*
AIC	142.3764	142.0731	139.0832	317.1661	318.6738
BIC	165.7727	165.4694	162.4796	351.7322	353.24

*Significant at 1%; ** Significant at 5%; *** significant at 10%.
(1) The Fixed Effects model does not generate the constant coefficient for all firms.
(2) We exclude the constant from Random Effects models as this specification yields better results regarding the Wald statistics and variable coefficients. The constant was not significant when included**.**
The pseudo R^2 is not reported for random effects and fixed effects logit models.
Source: Elaborated by the authors.

In the $\boldsymbol{Miss\_Zero\ (DA)_{i,t}}$ model, larger option grants in the following year also increase the probability that managers will utilize discretion in order to report losses. Hence, in 2 out of the 3 Miss_Zero models, H6a was not rejected.

At last, table 14 reports findings on the $\boldsymbol{Miss\_PriorYr\ (DA)_{i,t}}$ model. Based on the results, we also do not reject H6b, as we find that $\boldsymbol{GrOp_{i,t+1}}$ also positively affects the probability that companies might utilize discretionary accruals in order to miss their prior yearly earnings. Our dependent variable in this model is the probability that managers have utilized discretionary accruals in order to miss their prior year reported earnings. It is relevant to point out that our model considers manipulations in time t and t-1. When considering just the effect of discretionary accruals on year t earnings, results are not significant.

Table 14: Time series logistic regressions on *Miss_Prior (DA)*
In this table, we present pooled logit regressions (PO) for the probability that ***Miss_Zero (DA)*** will be equal to 1. We present coefficients followed by marginal effects on the dependent variable under parenthesis **(bold)**.

$$\boldsymbol{Miss\_Prior}\ (\boldsymbol{DA})_{i,t} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1}LT_{i,t} + \beta_5 Independence_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t}\ (12.d)$$

Variables	Long-term dummy specification (LT = Vesting + Lockup period)				
	LT > 2	LT > 3	LT > 4	LT > 5	LT > 6
	PO	PO	PO	PO	PO
$\boldsymbol{LT}_{i,t}$	0.0431	-0.0983	-0.0296	-0.2364	0.0045
	(0.0083)	**(-0.0193)**	**(0.0058)**	**(-0.0442)**	**(0.0008)**
$\boldsymbol{ExOp}_{i,t+1}$	-46.9852	3.3082	-1.4947	-4.042	-3.9572
	(-9.1344)	**(0.6440)**	**(-0.2910)**	**(-0.7864)**	**(-0.7701)**
$\boldsymbol{ExOp}_{i,t+1}\boldsymbol{LT}_{i,t}$	48.2678	-5.2056	1.7656	11.141	10.146
	(9.3838)	**(-1.0133)**	**(0.3437)**	**(2.1675)**	**(1.9746)**
$\boldsymbol{GrOp}_{i,t+1}$	26.4383***	24.0396***	23.6998***	25.4816***	24.8126***
	(5.1399)	**(4.6798)**	**(4.614)**	**(4.9575)**	**(4.8291)**
$\boldsymbol{Independence}_{i,t}$	0.3232	0.2888	0.2853	0.2731	0.2786
	(0.0628)	**(0.0562)**	**(0.0555)**	**(0.0531)**	**(0.0542)**
$\boldsymbol{Size}_{i,t-1}$	-0.0677**	-0.0605**	-0.063*	-0.0606*	-.0629*
	(-0.0131)	**(-0.0117)**	**(-0.0122)**	**(-0.0118)**	**(-0.0122)**
$\boldsymbol{Leverage}_{i,t-1}$	-0.3315	-0.3044	-0.3337	-0.3511	-.3428
	(-0.0644)	**(-.0592)**	**(-0.0649)**	**(-0.0683)**	**(-0.0667)**
Constant (2)	N/A	N/A	N/A	N/A	N/A
Observations	487	487	487	487	487
Groups	N/A	N/A	N/A	N/A	N/A
Wald (Chi²)	100.73*	100.33*	100.21*	100.50*	100.36*
Goodness of fit (p-value)	0.3956	0.3931	0.3899	0.3866	0.3882
Area under ROC curve	0,5505	0.5495	0.5514	0.5552	0.5503
Sensitivity (cutoff =0.2669)	42.31%	41.54%	43.85%	40.77%	40.77%
Specificity (cutoff =0.2669)	61.06%	66.67%	62.75%	63.87%	63.31%
Rho = 0 (p-value)	0.497	0.498	0.498	0.498	0.498
AIC	571.9753	573.1119	573.4411	572.8532	573.1632
BIC	601.2932	602.4298	602.759	602.171	602.4811

*Significant at 1%; ** Significant at 5%; *** significant at 10%.
(2) We exclude the constant from as this specification yields better results regarding the Wald statistics and variable coefficients. The constant was not significant when included**.**
The pseudo R^2 is not reported for pooled models that do not include a constant.
Source: Elaborated by the authors.

4.4 Earnings Smoothness Models

Our last hypothesis (H7) relates to the effect of ESOP incentive horizon on earnings smoothness. We assume that earnings will be smoother for companies that include long-term incentives. In Table 15 we present several specifications of equation 14 according to the $LT_{i,t}$ dummy. As previously mentioned, we have transformed the smoothness ratio so that higher values indicate smoother earnings.

The model that presents the best fit regarding temporal incentives is the LT>5 specification, as none of the control variables are significant in previous models (LT>2, LT>3 and LT>4). This finding corroborates our previous results on vesting + lockup periods being larger than 5 years generating different incentives.

Table 15: Models on Earnings Smoothness – Equation 14
The table presents dynamic panel-data estimation based on a two-step system GMM. Only firms that adopt ESOP compose the sample.

$$SMOOTH_{i,t,t+4} = \beta_0 + \phi_{Smooth}SMOOTH_{i,t,t+4} + \beta_1 LT_{i,t,t} + \beta_2 AvgExOp_{i,t,t+4} + \beta_3 AvgExOp_{i,t,t+4}\, LT_{i,t} + \beta_4 AvgGrOp_{i,t+4} + \beta_5 Sales\ Growth_{i,t,t+4} + \beta_6 Loss\%_{i,t,t+4} + \beta_7 AvgCFO_{i,t,t+4} + \beta_8 Size_{i,t} + \beta_9 Lev_{i,t} + \beta_{10} MKB_{i,t} + \beta_{11} OpLev_{i,t} + \beta_{12} OpCycle_{i,t} + \beta_{13} Independency_{i,t} + \beta_{14} STDSales_{i,t,t+4}\, v_{i,t} \quad (14)$$

Variables	Long-term dummy specification (LT = Vesting + Lockup period)				
	LT > 2	LT > 3	LT > 4	LT > 5	LT > 6
$SMOOTH_{i,t-1,t+3}$	0.7691*	0.7659*	0.773*	0.7878*	0.7897*
$LT_{i,t}$	0.001	0.0379	-0.0821	-0.2615**	-0.3108**
$AvgExOp_{i,t,t+4}$	-18.7856***	-18.4103***	-11.8075	-11.5906	-6.3553
$AvgExOp_{i,t}LT_{i,t.t+4}$	10.5642	9.9168	2.4961	31.5167**	36.1581***
$AvgGrOp_{i,t,t+4}$	34.1095*	31.9642**	33.6928**	6.7827	10.0520
$Independence_{i,t}$	0.4423*	0.4586	0.4179***	0.4444**	-0.0315
$Size_{i,t}$	-0.0272	-0.0270	-0.0177	-0.02394	-0.0315
$MKB_{i,t}$	0.0011	0.0205	0.0243	-0.0031	0.0002
$Lev_{i,t}$	0.2768	0.0345	0.0757	0.2507	0.2542
$STDSales_{i,t}$	-0.7234	-.8346	-1.241	0.9314	0.8407
$AvgCFO_{i,t}$	0.6950	-0.8012	-0.9859	-1.4034	-1.1604
$AvgSG_{i,t}$	0.4164	0.4293	0.4711	-1.186***	-1.1238
$Losses\%_{i,t}$	-0.4018	-0.4171	-0.3519	-0.8543***	-0.8633***
$OpCycle_{i,t}$	0.0017	-0.0125	-0.0124	-0.0021	0.0012
$OpLev_{i,t}$	-0.0377	-0.0079	-0.0651	0.1857	0.1927
Constant	-0.0123	0.167	0.1202	0.2689	0.2885
AR(1)	Z= -2.25**	Z= -2.24**	Z= -2.23**	Z= -2.01**	Z= -2.04**
AR(2)	Z= 0.75	Z= 0.75	Z= 0.74	Z= 0.77	Z= 0.71
Sargan Test (Chi²)	41.79	42.25	42.02	45.71*	44.69*
Hansen Test (Chi²)	30.87	32.01	31.40	16.60	16.15
Dif-Hansen (Chi²)	24.59	24.94	24.59	9.07	7.90
Wald Test (Chi²)	71713.65*	2727.51*	980.00*	1531.81*	1815.84*
Obs.	381	381	381	381	381
Groups	69	69	69	69	69
Instruments	51	51	51	39	39

*Significant at 1%; ** Significant at 5%; *** significant at 10%.
AR(1) and AR(2) report the Arellano-Bond test for first and second order correlation between the error terms. The Sargan and Hansen Tests report whether instruments are exogenous. The Dif-Hansen statistics indicates whether the Systemic GMM is valid.
We treat $SMOOTH_{i,t-1}$, $Leverage_{i,t}$ and $Sales_{i,t}$ as endogenous.
Source: Elaborated by the authors.

We utilize the LT>5 model in order to test H8. To investigate whether long-term ESOP generate smoother earnings, we analyze the combined effect of $\boldsymbol{LT_{i,t}}$, $\boldsymbol{AvgExOp_{i,t}LT_{i,t.t+4}}$ and $\boldsymbol{AvgExOp_{i,t.t+4}}$. Only the latter is not significant in our estimation. However, even considering the effect of $\boldsymbol{AvgExOp_{i,t.t+4}}$ on earnings smoothness, our results interpretation is qualitatively similar. As the coefficient for $LT_{i,t}$ is negative and for $\boldsymbol{AvgExOp_{i,t}LT_{i,t.t+4}}$ is positive, we interpret that firms that include longer contracts present smoother earnings if the average of exercisable options is higher. This interpretation holds even if one considers the – not significant - negative effect of $\boldsymbol{AvgExOp_{i,t.t+4}}$.

This finding is partially consistent with our 8th hypothesis, as it shows that longer contracts can lead companies to have smoother earnings under certain conditions (higher

$\boldsymbol{AvgExOp_{i,t.t+4}}$). If earnings smoothness is a desired attribute companies that include long-term incentives should adopt larger stock option programs, while companies that do not adopt incentives that last longer than five years should adopt smaller ESOP. This interpretation is consistent with the study of Shu and Thomas (2015), as they show that higher holding of option by managers will lead them to smooth past earnings as they try to keep earnings predictable for investors or try to hide earnings volatility. However, we show that this effect only holds for companies that adopt long-term incentives.

While longer contracts (LT>5) associated with larger programs (larger $\boldsymbol{AvgExOp_{i,t.t+4}}$) incite managers to present smoother earnings, our previous results show that managers with long-term contracts are also more likely to present losses in the year that is followed by a large number of options be coming exercisable. As we show in our $\boldsymbol{Miss\_Zero}$ $(\boldsymbol{DA})_{i,t}$ model, negative manipulation of accruals play an important role in these reported losses, as companies would have presented positive net income if not for the effect of earnings management.

Overall, this indicates that, while smoothness is normally associated with EQ, it is possible that managers artificially this measure (via earnings smoothing) in companies with large option programs that include long-term incentives. This would suggest that, by reporting losses in certain years, earnings standard deviation might decrease while cash flows volatility remains unaltered. This would artificially enhance a company's earnings smoothness, while in reality earnings are not so efficient at smoothing transitory cash flows. As accruals reversion is expected, future earnings might become less smooth and earnings quality could decrease. However, it is not clear whether presenting losses would actually reduce earnings volatility.

It is interesting to notice that average granted options have positively affected earnings smoothness in three of our models at the 5% significance level. We do not consider this clear evidence of the effect of $AvgGrOp_{i,t+4}$ on smoothness, as these models do not present a good fit for remaining variables. However, considering how granted options have negatively affected Discretionary Accruals and positively affected the probability that companies might miss several earnings benchmarks in our previous models, it would not surprising if earnings smoothness was positively affected by $AvgGrOp_{i,t+4}$. By inciting managers to manipulate earnings negatively (especially accruals) in the previous year, a larger number of granted options in a certain year could artificially decrease earnings volatility. This explanation would be similar to our interpretation for the $\boldsymbol{AvgExOp_{i,t}LT_{i,t.t+4}}$ results.

In all of our models, board independence also enhances smoothness. While this finding shows that better corporate governance enhances EQ, it is interesting to remember that board independence has affected accruals negatively. Consequently, it is not possible to assert that the higher smoothness is not artificial.

While we find that long-term incentives and board independence increase smoothness, we cannot rule out the possibility that managers achieve higher smoothness through earnings management.

5 Conclusion

In this study, we present a comprehensive analysis of how ESOP affect Earnings Quality measures. By focusing on a sample of optioned-managers we were able to not only identify how ESOP affect EQ, but also whether different features of stock option contracts (time length and corporate governance) play a moderating role on possible manipulations of earnings that might decrease EQ proxies.

Firms whose management stock option include incentives that last longer than five years present earnings and accruals that are more persistent, and earnings persistence increases as a larger number of options become exercisable. On the other hand, larger amounts of exercisable options reduce earnings persistence for companies that do not include long-term incentives.

Discretionary Accruals manipulation is also smaller for companies with long-term incentives, however, managers whose ESOP include long-term incentives might utilize EM in order to miss their previous year earnings in the year that precedes the end of their vesting period. This illustrates how even contracts that address longer horizons are not able to completely eliminate manipulations by managers.

Another positive EQ aspect associated with longer contracts is earnings smoothness, which might relate to managers' risk aversion, as they desire to avoid possible negative market reactions to their companies' cash flow volatility. However, we find some evidence that long-term contracts might incite earnings smoothing, which indicates that smoothness might be artificial.

While longer contracts deal with possible manipulations associated with exercisable options, we find that large option grants also elicit manipulative efforts, as executives manage accruals downward close to large grant dates and are more likely to report losses or miss their previous year's earnings in order to reduce strike prices.

Since data on whether grants are scheduled or randomized is limited for companies traded in the Brazilian capital market, we do not investigate whether randomization of grant dates might reduce this sort of downward manipulation tactics. We suggest that future research address whether this feature might reduce the manipulations we report.

Overall, our study relates longer ESOP incentive-horizons to higher earnings quality as measured by persistence, discretionary accruals and smoothness. However, we cannot rule out the possibility that earnings management might play a role on higher persistence and smoothness for companies that adopt long-term incentives, as they are more likely to report losses intentionally. While smoothing transitory cash flows might increase persistence, smoothing permanent cash flows can impair timeliness (Dechow *et al.*, 2010). This once again highlights the difficulty of assessing earnings quality.

The interpretation of our findings has a few restrictions. Due to the limited data for Brazilian companies and the reduced sample of companies that have adopted stock options in our sampling interval, we are unable to control for the effects of industries in our models, as their inclusion has generated singular matrixes, which do not allow the estimation of models. We also did not address some measures of EQ. However, we have tried to focus on measures directly affected by managers' decisions. Future research might also evaluate how the features we have studied affect other EQ measures, which will certainly enhance our understanding of how to build ideal compensation contracts. Furthermore, new studies might also evaluate the impact of different compensation types, such as performance-based compensation and restricted stocks.

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CHAPTER 4:
Why Firms Adopt Dividend-Protected Executive Stock Option Plans and How Do They Affect Payout Policy? Evidence from Brazil.

ABSTRACT

We investigate how executive stock option plans (ESOP) that are non-dividend-protected (NDPESOP) and dividend-protected (DPESOP) affect dividends and share repurchases, and try to understand why companies decide to include a dividend protection. Our sample includes 211 companies traded in the Brazilian stock market. Utilizing Random Effects Tobit models, we find that NDPESOP lead managers to reduce dividend payments, as they try to avoid the negative impact of dividends distributions on stock prices at the ex-dividend date, which reduces their stock option gains. The relationship between DPESOP and dividends is not significant, which implies that the inclusion of a dividend protection nullifies managers' dividend-reduction incentives associated with NDPESOP, as dividends no longer reduce stock option gains under dividend protection. Regarding the impacts of ESOP on share repurchases, both NDPESOP and DPESOP positively affect buybacks similarly. We interpret this finding as managers exploiting the signaling effect in order to increase stock prices and, consequently, their stock option gains. At last, we estimate a pooled logit model to understand why some companies adopt dividend protection. We find novel evidence that more profitable companies, firms with better corporate governance (higher board independency), and those with foreign controllers, are more likely to include dividend-protection. Firms that have adopted ESOP more recently are also more prone to including dividend-protection, which might relate to firms incorporating recent results from agency theory studies.

Keywords: Executive Stock Options; Dividend Protection; Dividends; Share Repurchases.

RESUMO

Investigamos como planos de opção de executivos (ESOP) sem proteção de dividendos (NDPESOP) e com proteção de dividendos (DPESOP) afetam dividendos e recompras de ação, e tentamos entender por que companhias decidem incluir uma proteção de dividendos. Nossa amostra inclui 211 empresas negociadas no mercado acionário brasileiro. Utilizando modelos Tobit com efeitos aleatórios, identificamos que NPDESOP levam gestores a reduzir pagamentos de dividendos, pois estes tentam evitar o efeito negativo das distribuições de dividendos sobre os preços das ações na data ex-dividendos, que reduz seus ganhos com opções. A relação entre DPESOP e os dividendos não é significativa, o que implica que a inclusão de uma proteção de dividendos anula os incentivos de redução de dividendos dos gestores associados com NDPESOP, pois os dividendos não reduzem os ganhos com opções sob a proteção de dividendos. Com relação ao impacto dos ESOP sobre as recompras de ação, tanto NDPESOP quanto os DPESOP afetaram positivamente as recompras de forma similar. Interpretamos esse achado como reflexo de gestores estarem explorando o efeito de sinalização para aumentar o valor das ações e, consequentemente, seus ganhos com opções. Por fim, estimamos modelos logit com dados empilhados para entender por que algumas empresas adotam proteção de dividendos. Encontramos evidências seminais de que empresas mais rentáveis, firmas com melhor governança corporativa (maior independência do conselho) e aquelas com controladores estrangeiros são mais propensas a incluir proteção de dividendos. Firmas que adotaram ESOP mais recentemente também são mais propensas a incluir uma proteção de dividendos, o que pode estar relacionado com o fato de firmas estarem incorporando resultados recentes de estudos sobre teoria da agência.

Palavras-chave: Opções de Ações dos Gestores; Proteção de Dividendos; Dividendos; Recompras de Ação.

1 Introduction

The financial literature on Executive Stock Option Plans (ESOP) shows that optioned-executives try to maximize their personal gains, or reduce their losses, by altering the composition and characteristics of their firm's Payout Policy. With few exceptions, studies show that ESOP affect dividend payments negatively (Lambert *et al.*, 1989; Jolls, 1998; Fenn & Liang, 2001; Hall & Murphy, 2003; Cuny *et al.*, 2007; Cruz & Lamounier, 2018; Muniz *et al.*, 2022) and share repurchases positively (Fenn & Liang, 2001; Kahle, 2002; Cuny *et al.*, 2007; Zhang, 2018; Cruz & Lamounier, 2018).

These findings are quite intuitive and rely on two premises: i) with few exceptions, stock option owners do not have the right to receive dividends that are paid before they exercise their options, which can only be done after their vesting period (Voss, 2012) and; ii) dividend payments affect stock prices negatively at the ex-dividend date (Fenn & Liang, 2001). Given these premises and the fact that stock prices usually decrease in a one to one basis when dividends are paid (Black, 1976), it is rational for managers to avoid paying dividends when their firms adopt ESOP, because their total short-term returns rely only on stock prices. Additionally, Fenn & Liang (2001) argue that ESOP lead managers to substitute dividend payments for share repurchases, as this payout form does not reduce stock prices.

Considering that problems may arise due to changes in payout policy caused by ESOP, it could be interesting for shareholders to adopt mechanisms to mitigate managers' incentives to alter this policy. A common solution proposed in the literature to avoid payout policy changes when firms adopt ESOP plans is the inclusion of a "dividend protection" mechanism to compensate managers for stock price reductions caused by dividends (Lambert *et al.*, 1989; Fenn & Liang, 2001; Kahle, 2002; Cuny *et al.*, 2009). Dividend protection compensates stock option beneficiaries for dividends paid in the vesting period of their options if they exercise them (Fenn & Liang, 2001; Hall & Murphy, 2003). Given that dividend protection offsets the reduction in stock prices caused by dividends, managers should no longer have incentives to change their payout policy.

Our study contributes to the literature on the relationship between management compensation and payout policy by investigating whether the inclusion of dividend protection in executive stock option contracts removes the incentives to alter dividend policy that are normally associated with non-dividend-protected ESOP (NDPESOP). We also investigate whether this protection mechanism also affects share repurchases, as there is not much evidence on the effect of Dividend-Protected ESOP (DPESOP) on repurchases. At last, we analyze why some companies adopt dividend protection and others do not, a question not previously investigated in the financial literature. ***Overall, our goal is to analyze why firms adopt dividend-protected and non-dividend-protected ESOP and how these plans affect spending on share repurchases and dividend payments.***

We observe that two particular problems arise when ESOP affect payout. Firstly, evidence shows that total payout levels (dividends plus repurchases) are negatively affected by outstanding stock options held by management (Fenn & Liang, 2001; Cuny *et al.*, 2009; Cruz & Lamounier, 2018), which implies that the reduction in dividend payments might be not completely offset by share repurchases. Cuny *et al.* (2009) indicate that this reduction in total payout potentially increases the free cash flow problem. Free cash flow is cash flow that exceeds a firm's necessity for investments in projects that have positive net present values, and becomes a problem because managers can spend this excess on low-return projects, or waste it (Jensen, 1986). According to Jensen (1986), a firm's payout policy can be a potential solution to the free cash flow problem, because it is better to spend the excess cash flow on share repurchases and dividend payments than on projects with returns that are lower than the shareholders' cost of capital.

In this paper, we find that the dividend-reducing behavior observed in firms that adopt non-Dividend-Protected ESOP (NDPESOP) does not occur in companies that include Dividend-Protected ESOP (DPESOP). However, we also find that that adopting a DPESOP or a NDPESOP has a similar positive effect on share repurchases, which contradicts the hypothesis that dividends are replaced by share repurchases due to lack of dividend protection (Fenn and Liang, 2001) and indicates that ESOP might lead managers to utilize share repurchases in order to enhance their stock value.

A second problem concerning reductions in payout relates to the Clientele Effect (Miller & Modigliani, 1961), which implies that shareholders can favor dividend payments or capital gains (associated with share repurchases) depending on their tax preferences. For investors in the Brazilian capital market, for example, dividends are favorable over capital gains when considering the country's tax legislation (Cruz & Lamounier, 2018). In Brazil, corporate dividends are nontaxable, whilst capital gains on stocks are taxable for companies and at the individual level. However, in other countries, such as the United States, dividends are less tax favorable. This indicates that the changes in payout policy commonly related to NDPESOP incentives might be problematic for Brazilian shareholders, as adopting a NDPESOP usually leads to smaller levels of dividend payments and higher repurchases.

Despite there being no other study that has investigated the factors that lead firms to adopt dividend protection, there is evidence that controller shareholders' tax preferences might influence a firm's dividend policy, and that these preferences could differ for domestic or foreign shareholders depending on their countries' tax legislation (Jeon *et al.*, 2011). Hence, controlling shareholders' tax preferences regarding payout methods could affect the possibility that a firm that adopts ESOP will include a dividend protection clause. These tax preferences might vary depending on whether the controller is domestic or foreign.

Considering the previous argument, we present evidence on whether controlling shareholders' tax preferences play a significant role in the inclusion of dividend protection. The Brazilian capital market is a good benchmark to test our hypothesis regarding why firms adopt dividend protection. For Brazilian companies, given the tax considerations previously mentioned and the clientele effect, we expected that the possibility that ESOP are dividend-protected would be larger for firms with domestic controllers. However, to our surprise, Brazilian controllers are less likely to include dividend protection, and foreign controllers are more likely to include this provision. We find that because dividend protection leads to higher dividend payments, it is more likely to be included in companies that have higher monitoring as measured by board independence and foreign overview. We also find that more profitable companies and newer plans are also more likely to include this mechanism, as practitioners gradually incorporate evidence from the agency literature.

We contribute to the financial literature by investigating how ESOP features affect share repurchases, as most of the studies focus on how this form of compensation affects dividends. Our study is also justified by that fact that, even though studies have explored the effects of dividend-protected ESOP (DPESOP) on payout policy, there is a knowledge gap on why certain firms adopt dividend protection and others do not. The addition of this sort of protection can be helpful when shareholders prefer dividend payments to other payout forms and capital gains.

2 Hypothesis Development and Related Literature

2.1 Payout Policy: Theoretical Considerations

There are several questions regarding dividend policy that do not have obvious answers. Black (1976, p. 8) has described this as the "dividend puzzle": the harder one looks at the dividend picture, the more it feels like its pieces do not fit together. Two of the main questions are "why do firms pay dividends?" and "why do investors pay attention to dividends?". One of the reasons why these questions are part of a hard puzzle is the fact that some of their answers seem contradictory. However, the answers to the second question might be explanations to the first one and these answers relate to why firms repurchase shares, which is another method of payout.

Despite of the complexity of the dividend the puzzle, the picture is constantly becoming clearer with literature developments. In order to explain how our study contributes to understanding the payout picture, we briefly present earlier developments in the literature and then shift our focus to how managers' incentive packages have been included in this discussion, as well as investors tax preferences.

One of the earliest studies on dividend policies is the work of Miller and Modigliani (1961). They have shown that in a perfect market with rational investors and without uncertainty, dividend policy is irrelevant to a firm's value, because the price of a stock is a reflection of its net expected cash flows, regardless of how shareholders receive them. In this kind of scenario, there would be no reason for a firm to adopt any specific dividend policy – which also applies to repurchases. However, this scenario differs from real life markets, where both uncertainty and market imperfections persist.

When uncertainty is considered, dividends seemingly influence stock prices, however, this does not contradict dividend irrelevance. The signaling hypothesis explains the effect of dividends on stock prices: dividends convey important information regarding managers' expectations about future cash flows to shareholders (Miller & Rock, 1985). Hence, a company might adopt a specific dividend policy in order to convey information to investors when its stock prices do not correctly reflect managers' expectations. However, under uncertainty, stock prices are still a function of net expected cash flows, and not dividend policy – the same applies to repurchases.

As for when market imperfections are considered, understanding why a firm might adopt a certain payout policy becomes a more nuanced discussion. Some market imperfections (e.g. brokerage fees and taxes) make it more desirable for investors to buy shares from firms that adopt a certain dividend policy. These market imperfections generate a "clientele effect": "each firm is assumed to have a body of stockholders who find its dividend policy optimal" (Elton & Gruber, 1970, p. 68).

One of the implications of the clientele effect is that tax considerations could make it more desirable for investors to buy stocks from a firm that adopts a specific dividend policy. In Brazil, for example, domestic investors do not pay taxes for their dividends, whilst capital gains from selling stocks are taxed (Cruz & Lamounier, 2018). Hence, Brazilian investors, theoretically, should desire higher dividend payments.

In the United States and in other countries, tax considerations lead to different expected clienteles than in the Brazilian scenario, because capital gains are tax-favorable over dividends in these countries. However, even considering these tax preferences, shareholders might desire higher dividend payments, which initially seems contradictory. The reason why investors might desire higher payments relates to agency theory. Studies that consider agency problems as a motivation for dividend payments assume that the distribution of earnings could be desirable to shareholders because it inhibits insiders from diverting these resources for their personal well-being (La Porta *et al.*, 2000). Hence, there is not necessarily a contradiction: agency and clientele considerations on why firms pay dividends are both pieces of the full dividend puzzle.

The desire to reduce agency costs might explain why some firms pay dividends or repurchase shares, reducing the free cash flow problem (Jensen, 1986). However, a specific set of considerations based on agency models indicates that managers might also alter payout policy in order to increase their compensations (Lambert *et al,*, 1989; Jolls, 1998; Fenn & Liang, 2001; Kahle, 2002; Chan *et al.*, 2010), which indicates that a firm's payout policy can potentially be an agency cost by itself.

Considering the clientele effect, this potential becomes clearer: if a manager adopts a payout policy that is not tax-favorable to the firm's shareholders, investors might not get their maximum potential cash flows. It has been argued that NDPESOP lead managers to alter payout policy and that these changes might be detrimental to shareholders (Cruz & Lamounier, 2018). However, are shareholders unaware of this possibility or do firms adopt these plans considering their tax preferences? We discuss these issues in the following sections and develop our hypotheses.

2.2 ESOP, dividend protection, dividends and repurchases

In order to explain how ESOP relate to the dividend picture, we first ought to explain how this mechanism works. A stock option gives its beneficiary the right to purchase the firm's stock for a predefined price, which is the exercise price (or strike price). Usually, the owner of a stock option must wait a certain period (a vesting period) before being able to exercise his right. If the option is not dividend-protected, the owner does not receive any of the dividends paid before he exercises his buying right (Hall & Murphy, 2003).

A seminal work in the field that relates ESOP and payout policy is the study of Lambert *et al.* (1989). They study how the adoption of ESOP affects dividend policy in USA firms. Considering that dividend payments negatively affect a firm's stock prices on a 1 to 1 basis (Black, 1976; Voss, 2012), Lambert *et al.* (1989) show that the adoption of a NDPESOP will reduce a firm's dividend payments, because managers avoid a negative impact on prices. This happens because managers do not receive dividends before exercising their options and because the gap between the exercise price and the market value is reduced when dividends are paid, lowering their gains. Other authors present similar findings (Jolls, 1998; Fenn & Liang, 2001; Kahle, 2002; Cruz & Lamounier, 2018).

The reduction on stock prices caused by dividends does not contradict dividend irrelevance theory (Miller & Modigliani, 1961), because stockholders' total returns remain unaltered. Another important aspect is that this study assumes that managers do not consider that dividends can positively affect stock prices, contradicting intuitions based on dividend signaling theory studies, which indicate that higher dividend payments might positively affect stock prices by conveying new information to investors (Miller & Modigliani, 1961; Bhattacharya, 1979; Miller & Rock, 1985). Nevertheless, empirical evidence suggests that managers do not consider the signaling effect and reduce dividends anyway. We test this and hypothesize that:

H1a: The adoption of a NDPESOP negatively affects the level of dividend payments.

Based on the work of Lambert *et al.* (1989), many other studies analyze several other implications based on agency theory regarding how ESOP affect payout policy. Fenn and Liang (2001) extend this work by hypothesizing that ESOP will lead managers to substitute dividend payments for share repurchases, because this form of payout does not theoretically affect stock prices negatively and allows managers to maintain total payout levels unaltered when dividend payments are reduced. Accordingly, their findings reveal that ESOP affect dividend payments negatively and share repurchases spending positively. The results of Lambert *et al.* (1989) and Fenn and Liang (2001) are part of a consensus in the literature that analyzes how ESOP impact payout policy.

A common argument in the literature is that dividend-protection might eliminate managers' incentives to reduce dividend payments, however, this mechanism is not very common (Fenn & Liang, 2001; Voss, 2012). The argument is simple: by allowing a manager to receive dividends paid in the vesting period of his stock options, dividend protection offsets the negative effect of price reductions caused by dividend payments. Hence, if a firm adopts a DPESOP, there is no reason for managers to alter the firm's dividend policy. Accordingly, studies present empirical evidence that firms with DPESOP pay higher dividends than those that adopt NDPESOP (Liljeblom & Pasternack, 2006; Zhang, 2018; Muniz *et al.*, 2022). Given these considerations, complement our first hypothesis:

H1b: The adoption of a DPESOP does not affect the level of dividend payments.

Other than the reduction in dividend payments, another consequence caused by NDPESOP is the increase of the level of share repurchases relative to the firm's market value. Theoretically, share repurchases compensate the reduction in dividend payments when stock options are not dividend-protected (Fenn & Liang, 2001). We test this statement by analyzing the following hypothesis:

H2a: NDPESOP positively affect the level of share repurchases.

The validity of hypotheses 1a, 1b and 2a should not be novel based on theoretical arguments. However, it is unclear whether DPESOP will lead to increases in share repurchases. Fenn and Liang (2001) argue that ESOP will lead managers to substitute dividends for share repurchases, because the latter should not affect stock option values. However, they do not control for the effect of dividend protection.

We propose an alternative explanation for the higher levels of share repurchase spending on firms that adopt ESOP that does not relate to the lack of dividend-protection. We suggest that optioned-managers might explore the signaling effect associated with share repurchases announcements, as they are usually interpreted by the market as an indication that firms are underpriced (Chan *et al.*, 2010; Voss, 2012). Managers could also use share repurchases in order to influence short-term stock prices, as they could spend free cash flow on shares. Hence, we argue that, even though ESOP that are not dividend-protected will not have incentives to alter their firms' dividend payouts (as stated in H1), they could lead to an increase on share repurchases spending. In sum, we complement H2 stating that:

H2b: DPESOP positively affect the level of share repurchases.

Liljeblom and Pasternick (2006) have found evidence that contradicts the previous hypothesis, indicating that dividend-protected options do not affect share repurchases. However, we examine whether results are similar in the Brazilian context and under a different research design. It should be noted that it is important to analyze whether ESOP are "implicitly dividend-protected", because other mechanisms can also offer similar incentives such as, for example, the repricing of options when large dividend changes occur (Farre-Mensa *et al.*, 2014).

A question that needs further explanation is whether investors are aware of the possibility that NDPESOP plans could reduce dividends and increase share repurchases. Under Brazilian law number 9.249 of 1995, there are no taxes for dividend payments for Brazilian investors, while capital gains are taxable. According to the clientele effect (Miller & Modogliani, 1961), this should lead Brazilian shareholders to prefer dividends over share repurchases. In the next section, in order to understand this issue, we develop hypotheses for why some firms might adopt dividend protection.

2.3 Why do firms adopt dividend protection?

There is a possibility that firms that utilize NDPESOP could adopt payout policies that are unfavorable to Brazilian domestic investors, as they usually pay lower dividends, which are tax favorable over capital gains in the country (Cruz & Lamounier, 2018). However, there has been no evidence on whether these investors are shareholders in those firms. Considering the clientele effect, domestic investors should cluster around firms that adopt dividend protection. Controlling shareholders' tax preferences should also influence the adoption of dividend protection.

Evidence in the literature indirectly supports our premise. Jeon *et al.* (2011) have examined the relationship between foreign stock ownership and payout policy in the South Korean market and identified that foreign investors prefer firms that pay higher dividends, given their tax preferences. As domestic investors in Korea prefer capital gains over dividends (considering Korea's tax legislation), foreign ownership was positively and significantly associated with higher dividend payments.

Liljeblom and Pasternack (2006) present evidence that a firm's shareholders tax preferences can also influence its repurchase decisions. They find that higher foreign ownership is a determinant of repurchases, which reflects the different tax treatments of domestic and foreign investors. This provides further evidence that shareholders control a firm's payout policy considering their own country's tax legislation and reinforces the hypothesis that they might influence the decision to adopt dividend-related clauses in managers' compensation contracts.

There seems to be a direct relationship between a firm's payout policy composition and its shareholders nationality. Considering this relationship, we suggest that controlling shareholders' preferences might play an important role on determining whether a firm will adopt dividend protection on its ESOP. We argue that, for Brazilian companies, domestic controllers are more likely to adopt dividend-protected contracts, since dividends are tax-favorable for them. Hence, we test the following hypothesis:

H3: having domestic controllers increases the probability that dividend protection will be included in an ESOP.

Unlike hypotheses 1 and 2, our third hypothesis includes an uncommon dependent variable, given that little evidence on which factors lead a firm to adopt dividend protection in its ESOP. Our results indicate whether the alterations on payout policy caused by an ESOP adoption are a reflection of controlling shareholders' tax preferences.

We also look for other possible explanations for why firms might include dividend protection in their compensation contracts. Firstly, we look at corporate governance, because evidence indicates that companies with better firm-level governance are more likely to pay higher dividends, mainly on countries with low shareholders rights (Chang *et al.*, 2018), which is the case in Brazil (Djankov *et al.*, 2008; Chang *et al.*, 2018). In firms with higher governance, shareholders can utilize dividend payments in order to reduce the amount of cash available to managers, avoiding the possibility of expropriation (Jiraporn *et al.*, 2011). Hence, these firms might be more inclined to adopt a dividend-protection clause in their ESOP in order to avoid possible dividend reductions.

H4: Higher Corporate Governance increases the probability increases the probability that a dividend protection will be included in an ESOP.

Another important aspect that might lead firms to adopt this clause is whether the firm is a consistent dividend-payer or not. Dividend paying firms and nonpayers have different characteristics (Jiraporn *et al.*, 2011), as the first ones are larger and more profitable than the latter (Fama & French, 2001; DeAngelo *et al.*, 2006). Dividend payers can also be consistent (pay dividends every year) or inconsistent. Consistent payers are more likely to present higher cash flows than inconsistent payers (Cuny *et al.*, 2009). Hence, we assume that if firms that consistently pay dividends adopt an ESOP, they are more likely to include dividend protection, as this provision is more likely to affect these companies than inconsistent payers (Canil, 2017).

H5: Consistent dividend paying firms that compensate managers through stock options are more likely to adopt dividend protection than inconsistent payers are.

In the following section, we present our study sample, and the statistical tools utilized in order to evaluate our hypotheses.

3 Methodology

3.1 Study Sample and Data

Our sample includes public companies traded at Brasil Bolsa Balcão (B3). We obtain Information regarding financial variables from the Economatica® database. The initial sample includes 407 firms available at this database in the year 2020. We eliminate 187 companies that did not present data regarding variables in our study during 2010 to 2020. After the exclusion of outliers (see section 3.2.1), we are left with 220 companies. We also exclude 9 companies that present negative Market-to-Book from our main sample, as we discuss in the next section. The remaining 211 companies compose the sample for testing H1 and H2.

We obtain information on repurchases and managers' compensation in Reference Forms, which is a document that every public firm must report in the Brazilian market. It contains details regarding managers' stock-based compensation and displays comprehensive information regarding repurchase programs. Since repurchases and management stock option variables are only available for the period after 2010, our window of analysis is from 2010 to 2020.

When testing H3, H4 and H5, we study a subsample of companies that have adopted ESOP. Out of the initial 407 companies, we find that 111 firms have adopted ESOP. However, we focus on firms that have adopted ESOP during 2010 to 2020 due to restrictions on corporate governance data, which is only available after 2010. Out of the 49 firms that have adopted an ESOP in this period, 45 had available data for all variables in equation 3.

3.2 Research Design

3.2.1 Effects of DPESOP and NDPESOP on dividends and repurchases

In order to test our first and second hypotheses, we estimate equations 1 and 2, which include common variables in the payout literature (Dittmar, 2000; Fenn & Liang, 2001; Kahle, 2002; Cuny *et al.*, 2009; Canil, 2017). Overall, we adapt Fenn and Liang (2001)'s pooled data model for panel data estimation, considering the limited number of observations in the Brazilian capital market. In equation 1, Dividend Payout ($DP_{i,t}$) is the dependent variable whilst Repurchase Payout ($RP_{i,t}$) is the dependent variable for equation 2. Dividend payout is the total cash paid in dividends in year t scaled by the firm's market value at the beginning of the year. Repurchase payout is the total share repurchase expenditures in year t scaled by the firm's market value at the beginning of the year. On Table 1 we display how we measure our independent variables and their expected effects on the payout variables.

$$\boldsymbol{DP_{i,t}} = \beta_0 + \beta_1 NDPESOP_{i,t} + \beta_2 DPESOP_{i,t} + \beta_3 TOP1_{i,t} + \beta_4 MKB_{i,t-1} + \beta_5 SIZE_{i,t-1} + \beta_7 VOL_{i,t} + \beta_8 \, LEV_{i,t-1} + \beta_9 \, FCF_{i,t} + u_{it} \text{ (1)}$$

$$\boldsymbol{RP_{i,t}} = \beta_0 + \beta_1 NDPESOP_{i,t} + \beta_2 DPESOP_{i,t} + \beta_3 TOP1_{i,t} + \beta_4 MKB_{i,t-1} + \beta_5 SIZE_{i,t-1} + \beta_7 VOL_{i,t} + \beta_8 \, LEV_{i,t-1} + \beta_9 \, FCF_{i,t} + u_{it} \text{ (2)}$$

Models 1 and 2 include censored dependent payout variables, because a firm must decide to pay dividends and/or to repurchase shares as well as the extent of the expenditure on these forms of payout, which indicates that these variables have a "lower limit" at zero. We consider this limiting when deciding for an adequate statistical model in order to study the relationship between our variables (Tobin, 1958). Hence, we estimate Random Effects Tobit regressions (Panel Data) for our whole sample models.

Table 1: Description of Independent Variables in equations 1 and 2.

Variable Name (Abreviation)	**Source**	**Formula**	**Expected Impact on Dependent Variable**	
			DP	**RP**
Dividend-Protected ESOP (DPESOP)	Developed by the Authors	Dummy that takes value 1 for firms that compensate managers through a Dividend-Protected ESOP and 0 otherwise. (1)	Not Significant (H1b)	+ (H2b)
Non-Dividend-Protected ESOP (NDPESOP)	Developed by the Authors	Dummy that takes value 1 for firms that compensate managers through a Non-Dividend-Protected ESOP (1)	- (H1a)	+ (H2a)
Market-to-Book (MKB)	Fenn & Liang (2001); Liljeblom & Pasternack, (2006); Cuny *et al.* (2009).	$\frac{Market\ Value_{t-1}}{Book\ Value_{t-1}}$	-	-
Firm Size (SIZE)	Fenn & Liang (2001); Cuny *et al.* (2009)	$Natural\ Logarithm\ of\ Assets_{t-1}$	+	+
Leverage (LEV)	Fenn & Liang (2001); Cuny *et al.* (2009)	$\frac{Total\ Debt_{t-1}}{Assets_{t-1}}$	-	-
Earnings Volatility (VOL)	Adapted from Fenn & Liang (2001)	Standard Deviation of EBITDA, considering at least 3 and maximum 5 years	-	-
Free Cash Flow (FCF)	Fenn & Liang (2001); Cuny *et al.* (2009)	$\frac{EBITDA_{t-1} - CAPEX_{t-1}}{Assets_{t-1}}$	+	+
Shareholder Concentration (TOP1)	Hahn *et al.* (2010); Iquiapaza *et al.* (2008); Cruz & Lamounier (2020)	Percentage of Ordinary Shares Held by the Main Controlling Shareholder	+	-

(1) We consider only companies that have granted executive stock options as firms that compensate their managers with ESOP. Our data analysis shows that many companies have approved option plans, but have never granted options. We treat these firms as companies that do not adopt ESOP.
Source: Elaborated by the authors.

We follow Fenn and Liang (2001) and take a closer look at observations whose share repurchases exceed 5% of the firm's market value. We notice that these companies usually overstate their repurchasing numbers due to the fact that they merge different information on the share acquisition field of their reference forms (e.g.: companies include new issued shares in the acquisition field) and decide to exclude these observations.

The independent variables regarding ESOP in equations 1 and 2 are dummies for firms that include non-dividend-protected executive stock option plans ($NDPESOP_{i,t}$), and companies that adopt a dividend-protected ESOP plan ($DPESOP_{i,t}$). We also include the following control variables: market-to-book ($MKB_{i,t-1}$), firm size ($SIZE_{i,t-1}$), earnings volatility ($VOL_{i,t}$), leverage ($LEV_{i,t-1}$), free cash flow ($FCF_{i,t}$) and the concentration of the biggest shareholder ($TOP1_{i,t}$).

We estimate market-to-book ($MKB_{i,t-1}$) for our panel data models as the firm's beginning of the year market value scaled by its book value. The rationale for including this variable relates to the signaling hypothesis, which states that a firm can utilize its payout policy in order to send a signal regarding its future profitability to the market (Miller and Modogliani, 1961; Miller & Rock, 1985; Voss, 2012). In order to send a signal, undervalued firms (with lower MKB) will display higher levels of dividend payments and repurchases.

An important aspect regarding this variable is that companies present negative MKB if the book value of their shares is negative. Even though these companies present lower levels of MKB, they are not undervalued – after all, their market value clearly surpasses their book value. We consider this when estimating our models and exclude negative MKB companies from some of our specifications.

In order to test the free cash flow hypothesis, we include Free Cash Flow ($FCF_{i,t}$). This hypothesis assumes that managers with substantial free cash flow can utilize repurchases and dividends in order to avoid low-return investments, reducing agency costs (Jensen, 1986).

We include leverage ($LEV_{i,t-1}$) in order to test the optimal leverage ratio hypothesis, which indicates that firms can repurchase shares in order to alter their capital structure when their leverage ratio is below their target level (Dittmar, 2000). This is possible because repurchasing shares reduces the total equity book value. Hence, leverage should have a negative impact on share repurchases. Additionally, given the possibility of financial distress, firms that have high levels of debt are more likely to present lower levels of share repurchases and dividend payments (Fenn & Liang, 2001).

Other variables that are expected to influence both DP and RP similarly are firm size ($SIZE_{i,t-1}$) and earnings volatility ($VOL_{i,t}$). We expect larger firms to have more stable cash flows, allowing them to have higher levels of payout and firms with higher earnings volatility to have lower levels of payout due to their financial constraints, which might make it harder for them to sustain large cash distributions (Fenn & Liang, 2001; Canil, 2017).

At last, we include $TOP1_{i,t}$ as a control variable, which is the share concentration of the biggest shareholder. Given the evidence in Brazilian studies (Hahn *et al.*, 2010; Iquiapaza *et al.*, 2008; Cruz & Lamounier, 2018), we expect that this variable will affect payout in our sample, even though it is not commonly utilized in the international literature on payout determinants. Given that Brazilian shareholders control most of the companies traded at B3, we expect that TOP1 will affect dividends positively and repurchases negatively, which is a reflection of the tax favorability of dividends over capital gains (Cruz & Lamounier, 2018).

3.2.2 Firm characteristics that explain dividend protection.

In order to test H3, H4 and H5, we focus only on firms that have adopted ESOP. We estimate equation 3 through a Logit model on the probability that a firm will include dividend protection in its ESOP [P($DPESOP_{\text{i}} = 1$)]. Given that no other study has analyzed the determinants of this mechanism, we develop a model based on intuitive arguments for why a firm might (not) include this provision in its ESOP. We estimate a pooled Logit model given that different firms adopt ESOP in different years. We report marginal effects in order to identify how the independent variables affect the probability that $DPESOP_i$ equals 1. Table 2 presents variables for equation 3. Instead of presenting variable sources (authors) such as in Table 1, we present the rationale behind included variables, as we develop a new model.

$$P(DPESOP_i = 1) = \frac{1}{1+e^{-(\beta_0+\beta_1 DOM_i+\beta_2 CDP_i + \beta_3 SIZE_i + \beta_4 CG_i + \beta_5 LEV_i + \beta_6 ROA_i + u_i)}} \quad (3)$$

Table 2: Description of Independent Variables in equation 3

Variable Name (Abreviation)	**Formula**	**Rationality for inclusion.**	**Expected Impact on P(DPESOP=1)**
Domestic Controller (Dom)	*Dummy* that takes value 1 for companies that have Domestic (Brazilian) controllers.	The percentage of domestic shareholders influences the probability that dividend decisions will conform to their tax preferences (Jeon *et al.*, 2011; Liljeblom & Pasternack, 2006). Given that this data is not widely available for Brazilian companies, we utilize a dummy to indicate whether controllers are domestic or not in the year an ESOP is approved. Considering Brazilian tax legislation, dividends are favorable over capital gains. Hence, Brazilian controllers might include a dividend protection in order to avoid dividend reductions associated with unprotected ESOP.	+ (H3)
Consistent Dividend Paying Firms (CPF)	*Dummy* that equals 1 for firms that pay dividends every year in the sampling period	We test whether these companies are more likely to consider the effects of dividend reductions caused by NDPESOP.	+ (H5)
Corporate Governance (CG)	$\frac{Number\ of\ Independent\ Members_t}{Total\ number\ of\ board\ Members_t}$	Board independence is associated with higher dividend payments (Sharma, 2011). We argue that higher governance lead companies to adopt dividend protection as it incentivizes managers to follow adequate payout policies.	+
Year	We transform the year of adoption as follows: 2010 = 1; 2011 =2; 2012 =3; 2013=4;…; 2020 = 10	We test whether the year of adoption influences the likelihood that a company will include a dividend protection on its ESOP. We assume that the market gradually adapts to research findings on agency problems associated with NDPESOP, as the summary statistics analysis shows that firms were more likely to include this mechanism in more recent years.	+
Leverage (LEV)	$\frac{Total\ Debt_t}{Assets_t}$	Control Variable.	-
Firm Size (SIZE)	$Natural\ Logarithm\ of\ Assets_t$	Control Variable.	+
Return on Asset (ROA)	$\frac{Net\ Income_t}{Assets_t}$	Control Variable.	+

(1) We consider only companies that have outstanding executive stock options as firms that compensate their managers with ESOP. Our data analysis shows that many companies have approved option plans, but have never granted options. We treat these firms as companies that do not adopt ESOP.
t = year of adoption
Source: Elaborated by the authors.

There is evidence that a firm's payout policy is affected by the percentage of domestic and foreign investors, which is a reflection of investors' tax-preferences (Liljeblom and Pasternack, 2006; Jeon *et al.,* 2011). We assume (H3) that our results will be analogous to Jeon *et al.* (2011)'s, however, given that dividends are tax free for domestic Brazilian investors and are normally taxed for foreign investors, we assert that having domestic controllers will increase the chance that a firm will include dividend protection in its ESOP. Considering this, we include a dummy for firms that have Domestic Controllers (DOM_i) in our model.

Our fourth hypothesis states that higher Corporate Governance (CG_i) increases the probability that a firm that compensates its managers through stock options will adopt a dividend protection clause. We measure CG_i as the percentage of independent board members, as Sharma (2011) shows that board independence increases a firm's propensity for paying dividends. Hence, firms with higher board independence might be more prone to include dividend protection in their ESOP.

In order to test our fifth hypotheses, we include a *dummy* for consistent dividend payers ($CDP_{i,t}$) which are firms that pay dividends every year during the sample period, as it is more likely that they will be affected by the lack of dividend protection.

We include $SIZE_i$ as a control variable based on the same rationality regarding its expected impact on dividends, assuming that larger firms are more likely to include this sort of protection because they have more stable cash flows (Canil, 2017). Our study also controls for Return on Assets (ROA_i) to test whether profitability could explain why companies avoid dividend protection. At last, we include the level of debt (LEV_i) as a control variable. Since firms with high leverage are more likely to present financial constraints on dividend payments (Fenn & Liang, 2001), we assume that they will have a hard time including dividend protection in their ESOP, because it is a commitment to paying more dividends.

4 Results and Discussion

4.1 Data description and Summary Statistics

In order to understand the relationship of our study variables, we first present descriptive data on our sample. Table 3 presents summary statistics for all of our variables related to H1 and H2. From the 211 firms in our sample, 94 (44,55%) have included an ESOP at some point between 2010 and 2020. However, very few companies (17; 8,05%) traded in B3 include dividend protection in their compensation contracts, which is consistent with the findings of Muniz *et al.* (2022). This finding is also consistent with evidence from the American literature (Weisbenner, 2000; Fenn & Liang, 2001), but differs from findings from Finland, where a significant portion of companies (41%) include dividend protection (Liljeblom & Pasternack, 2006).

Regarding our sample characteristics, shareholder concentration is high in the Brazilian context, as evidenced by the summary statistics of TOP1. This is a relevant characteristic of the Brazilian capital market, as hostile takeovers are not as frequent in B3 as they are in American exchange trades, for example. As Dittmar (2000) finds, the risk of takeovers in the American stock exchange can lead companies to repurchase their own shares as a defense mechanism.

Average dividend payments scaled by market value in the Brazilian sample (0.0356) is higher than the average payments for firms traded in the United States (0.013) (Fenn & Liang, 2001). This is not surprising, as dividends are more tax advantageous than capital gains for Brazilian investors, which is the opposite from the American tax legislation. Accordingly, share repurchase spending scaled by market value, on average, is higher for the American sample (0.012) when compared to the Brazilian sample (0.0016).

Dependent variables RP and DP are both limited at the minimum value of 0, as some firms might not repurchase stock or pay dividends. Hence, they present distributions such as the ones discussed by Tobin (1958), which calls for the use of econometric models that account for the censoring of these variables. While most of the observations for RP are equal to zero (1484; 81%), only a few of the DP observations sit at the lower limit (373; 20.5%). Hence, dividend payments are more common than share repurchases as a payout method.

Table 3: Summary statistics for variables in equations 1 and 2

Variables	Min.	Max	Median	Mean	Std. Dev.
RP	0.0000 (1)	0.0498	0.0000	0.0016	0.0055
DP	0.0000 (2)	0.6958	0.0221	0.0356	0.0530
SIZE	9.6387	20.6464	15.0790	15.0409	1.7487
LEV	0.0066	0.9990	0.5747	0.5634	0.2117
MKB	0.0437	149.6271	1.4204	2.6747	7.2966
TOP1 (%)	0.1400	100.00	45.6050	46.9702	26.3804
FCF	-1.1419	0.9245	0.0531	0.0470	0.1157
VOL	0.0023	3091.0850	0.0385	5.1141	120.1250
Categorical Variables	**Firms that include it (%)**	**Firms that do not include it (%)**	**Observations that include it (%) ***	**Observations that do not include it (%) ***	
ESOP	94 (44.55%)	107 (55.45%)	663 (36.23%)	1167 (63.77%)	
DPESOP	17 (8.05%)	194 (91.94%)	114 (6.23%)	1716 (93.77%)	
NDPESOP	77 (36.49%)	134 (63.51%)	549 (30.00%)	1281 (70.00%)	

This sample excludes firms with negative MKB.
n= 1830 observations (211 firms)
(1) 1,484 observations for RP are equal to 0
(2) 375 for DP are equal to 0
* does not indicate the percentage of firms or observations that have an active ESOP (protected or not) in 2020, as some firms have cancelled their ESOP during our sampling period.
Source: Elaborated by the authors.

Even though some of our variables present observations with relatively high or small values (VOL and TOP1), which affects their standard deviation, we find that excluding these companies as outliers has no impact on our models overall. Hence, we decide to keep these observations in our final sample. In Table 4, we present pairwise correlations between our variables.

Table 4: Pairwise Correlation of our study variables

Variables	DP	RP	ESOP	DP-ESOP	NDP-ESOP	SIZE	LEV	MKB	TOP1	FCF
RP	0.009									
ESOP (1)	-0.138*	0.18*								
DPESOP	-0.034	0.08*	0.277*							
NDPESOP	-0.12*	0.15*	0.88*	-0.169*						
SIZE	0.097*	0.033	0.104*	0.0206	0.103*					
LEV	-0.076*	-0.016	0.0083	0.0149	-0.0028	0.273*				
MKB	-0.06**	-0.021	0.04***	-0.028	0.0535	-0.096*	0.22*			
TOP1	0.126*	-0.116*	-0.342*	-0.14*	-0.3005*	-0.05**	-0.03	-0.034		
FCF	0.219*	0.0303	-0.0124	-0.073*	0.0197	0.04***	-0.09*	0.04***	0.03	
VOL	-0.026	-0.012	0.054**	-0.011	0.06***	0.0102	-0.0205	-0.006	0.019	-0.13*

*Significant at 1%; ** Significant at 5%; *** significant at 10%.
This sample excludes firms with negative MKB.
n= 1830 observations (211 firms)
(1) Dummy variable for all firms that adopt ESOP (dividend protected or not).
Source: Elaborated by the authors.

Consistent with H1a, there is a negative and significant (p-value < 0.001) relationship between NDPESOP and dividends. We also find that the correlation between DPESOP and dividends is not significant, which corroborates H1b. The correlation between ESOP and the dividend payout variable is a negative and statistically significant, which is not surprising considering that most of the plans are not dividend protected (see Table 3).

Regarding the relationship between ESOP and share repurchases, both NDPESOP and DPESOP have a positive correlation with RP at the 1% significance level, which corroborates H2a and H2b.

Only a few of the correlations regarding our dependent and control variables do not meet expectations displayed in Table 1. Size, Leverage, MKB and FCF do not significantly correlate with RP. However, this is not an indication that these variables do not affect share repurchases. The fact that RP is a censored variable and that most of the companies do not repurchase shares might explain the lack of significance of these correlations. This illustrates why it is relevant to estimate a model that accounts for both the categorical and continuous aspects of our dependent variables. Accordingly, in the next section, we estimate Tobit models in order to investigate the validity of H1a, H1b, H2a and H2b when controlling for other independent variables.

We display statistics for the sample utilized for estimating equation 3 on Table 5. The dependent variable in our Logit model is the probability that DPESOP will be equal to one when a firm adopts an ESOP. We find that only 22.22% of our subsample includes dividend protection, which is higher than our main sample (see Table 3). This leads us to assume that the probability that a firm will include dividend protection might be higher for newer plans, as we study a subsample that excludes older plans. We find that out of the 62 firms that have adopted executive stock option plans before 2010, only 8 (12.9%) have adopted dividend protection.

Table 5: Summary statistics for variables in equation 3

Variables	Min.	Max	Median	Mean	Std. Dev.
CG	0	1	0.25	.2820824	0.2208937
LEV	.0130562	0.8977375	0.5690684	0.5276598	0.2070931
SIZE	11.45191	18.22607	14.80715	14.85656	1.747533
ROA	-0.2823089	0.2033596	0.0279121	0.0330721	0.0849638

Categorical Variables	Firms that include it (%) *	Firms that do not include it (%) *
DPESOP	10 (22.22%)	35 (77.78%)
DOM	33 (73.33%)	12 (26.66%)
CDP	38 (84.44%)	7 (15.56%)

This sample consider variables for firms at the date when they adopt their first ESOP.
n= 45 observations
Source: Elaborated by the authors.

Overall, most of the companies in our sample have Brazilian controllers (73.33%). Considering the small level of dividend protection in this sample, this finding is surprising, as it indicates that controllers' tax preferences might be ignored when ESOP are designed. Board independence is also relatively small (28.2% on average). Additionally, even though all of the companies in this subsample have paid dividends at least once during the sampling period, only 15.56% are consistent dividend payers.

4.2 Results on Dividend Payout and Repurchase Payout

We display data regarding equations 1 and 2 (hypotheses 1a, 1b, 2a and 2b) on Table 6. We estimate two specifications for each dependent variable. Specification I excludes observations that present negative MKB. Given that this variable is not significant in our models, in specification II, we control whether the inclusion of companies that have negative book value generates different results regarding our ESOP-related variables. We find that results regarding hypotheses 1 and 2 do not change in this control specification.

Even though we display both specifications, we mostly focus on interpreting specifications I for DP and RP, as they include a sample of firms with positive MKB. We focus on these companies because negative MKB firms are usually under greater financial distress and have higher risk of going bankrupt. After all, their debt surpasses their assets value, which might affect the relationship between our control and dependent variables.

Table 6: Random Effects Tobit Models (H1a, H1b, H2a and H2b)
We present Tobit coefficients in **Bold** and p-values in *italic* under parenthesis.

Dependent Variable and Model Specification	Dividend Payout		Repurchase Payout	
	I	II	I	II
Dividend-Protected ESOP (DPESOP)	**-0.0082** *(0.379)*	**-0.0087** *(0.366)*	**0.0115** *(0.001*)*	**0.0117** *(0,001*)*
Non-Dividend-Protected ESOP (NDPESOP)	**-0.0109** *(0.021**)*	**-0.0101** *(0.037**)*	**0.0117** *(0,00*)*	**0.0121** *(0,00*)*
Market-to-Book (MKB)	**-0.0003349** *0,306*	N/A	**0.00007** *(0.58)*	N/A
Firm Size (SIZE)	**0.0083** *(0,00*)*	**0.0107** *(0,00*)*	**0.0019** *(0.004*)*	**0.0021** *(0,001*)*
Leverage (LEV)	**-0.0553** *(0,00*)*	**-0.0818** *(0,00*)*	**-0.0123** *(0.009*)*	**-0.0124** *(0,001*)*
Earnings Volatility (VOL)	**0.0000** *(0,427)*	**-0.00004** *(0.412)*	**-0.0006** *(0.533)*	**-0.0006** *(0.534)*
Free Cash Flow (FCF)	**0.1445** *(0,00*)*	**0.1104** *(0,00*)*	**0.0113** *(0.06***)*	**0.0107** *(0.04**)*
Shareholder Concentration (TOP1)	**0.0002** *(0,023**)*	**0.0002** *(0.074***)*	**-0.0001** *(0,001*)*	**-0.0001** *(0.001*)*
Constant	**-0.0822** *(0,00*)*	**-0.1019** *(0,00*)*	**-0.0393** *(0,00*)*	**-0.0421** *(0,00*)*
Number of Firms	211	220	211	220
Total Observations	1830	2026	1830	2026
Left-censored (= 0)	375	559	1,484	1676
LR Test (p-value) - Panel level variance (2)	0.00*	0.00*	0.00*	0.00*
Prob > Chi-Squared (3)	0.00*	0.00*	0.00*	0.00*

*Significant at 1%; ** Significant at 5%; *** significant at 10%.
(1) Unlike in a Pooled Tobit, the pseudo R-squared statistic is not available for the Random Effects Tobit.
(2) The panel level variance Likelihood-Ratio test (LR test) investigates whether the panel-level variance component is important. The null hypothesis of the LR test indicates that the panel estimator is not different from the pooled estimator.
(3) The Chi-Squared null hypothesis is that all coefficients in the estimated model are simultaneously equal to zero.
Source: Elaborated by the authors.

Contrary to other studies that adopt the Tobit estimator, we control whether the panel-level variance component is significant. Many studies have adopted a pooled data Tobit model, even though they have utilized a panel-data sample. We find that accounting for the panel-level variance component is relevant in all of our models, as it is never statistically equal to zero.

Regarding our control variables, most of our findings meet expectations based on the financial literature (see section 3.2.1). At the 1% significance level, there is a positive relationship between SIZE and DP in all models, as well as a positive relationship between SIZE and RP. This indicates that larger firms are more likely to present higher payout levels, which is consistent with other findings in the international (Dittmar, 2000; Fenn & Liang, 2001;

Cuny *et al.,* 2009) and Brazilian literature (Iquiapaza *et al.*, 2008; Holanda & Coelho, 2012; Cruz & Lamounier, 2020; Muniz *et al.*, 2022).

The level of debt negatively affects both dividend payments and share repurchases at the 1% significance level, indicating that financially constrained companies are less prone to distributing earnings. This finding is also consistent with other studies (Dittmar, 2000; Fenn & Liang, 2001; Cruz & Lamounier, 2020; Muniz *et al.*, 2022). Furthermore, the negative impact of LEV on RP corroborates the optimal leverage hypothesis, as repurchases reduce equity book value.

Free cash flow also affects both dependent variables similarly in all of our models, which is coherent with the FCF hypothesis. This variable positively affects DP and RP at the 1% significance level. Considering that FCF proxies the amount of resources that a firm possesses after investing in all positive net present value investment possibilities, this result corroborates the hypothesis that companies distribute earnings in the form of dividends and share repurchases as a way to deal with possible agency problems that might arise when there is free cash flow (Jensen, 1986).

Results on FCF (net operating cash flow) are similar in American companies for both dependent variables (Fenn & Liang, 2001). Iquiapaza *et al.* (2008) find that cash flow positively affects dividends for Brazilian companies when measured as EBITDA scaled by assets. Accordingly, Muniz *et al.* (2022) do not control for Free Cash-Flow, but find that the impact of current liquidity on dividends per share is positive. In the Brazilian literature, no other study has investigated the effect of FCF on share repurchases. However, Amorim *et al.* (2021) find that cash and equivalents scaled by assents do not affect share repurchases in Brazil. This does not contradict our findings, as we estimate a different construct.

When evaluating the impact of Earnings Volatility on our dependent variables, our results are not significant for any of the Tobit specifications. Fenn and Liang (2001) find a similar result for share repurchases. However, they find a negative and statistically significant relationship between DP and VOL. There are two possible explanations regarding this result: i) this relationship does not hold for Brazilian companies or; ii) the adaptation of the Earnings Volatility variable for panel data estimation was not ideal. It should be noted that this finding persists even if we exclude companies with VOL higher than 1 (extreme values).

Another variable that has not met theoretical expectations is MKB. We do not find a statistically significant effect of MKB on RP and DP, which suggests that the signaling hypothesis do not explain corporate payout for Brazilian companies. This suggests that the signaling hypothesis do not explain corporate payout for Brazilian companies, an interpretation corroborated by other Brazilian studies on dividend determinants (Fonteles *et al.*, 2012; Cruz and Lamounier, 2020) and share repurchases determinants (Nascimento, *et al.*, 2011; Cruz and Lamounier, 2020; Amorim *et al.*, 2021).

However, the signaling hypothesis holds for USA companies for both dividend payments and share repurchases (Fenn & Liang, 2001). This could relate to the fact that the USA capital market is more developed, leading signaling attempts to be more successful and incentivizing undervalued firms to increase payouts.

In the Brazilian context, previous research shows that it is relevant to control for the impact of share concentration on payout policy (Iquiapaza *et al.*, 2008; Hahn *et al.*, 2010). In our study, TOP1 has affected dividend payments positively and share repurchases negatively, which implies that Brazilian companies' shareholders are more interested in dividend payments than on capital gains. This finding is not surprising when considering the fact that dividends are not taxable in the Brazilian legislation. Nevertheless, the impact of TOP1 in our dependent variables highlights the importance of controlling for country-specific factors on payout policy.

After evaluating our control variables, we focus on NDPESOP and DPESOP. In H1a, we affirm that ***the adoption of a NDPESOP negatively affects the level of dividend payments***.

In H1b, we suggest that ***the adoption of a DPESOP does not affect the level of dividend payments.*** Accordingly, NDPESOP negatively affects dividend payments, while DPESOP present a statistically insignificant effect on DP. This confirms that the main reason why firms reduce dividend payments after adopting stock option relates to the lack of dividend protection (Lambert *et al.*, 1989; Fenn & Liang, 2001). Considering our findings, we do not reject hypotheses H1a and H1b when evaluating the impacts of DPESOP and NDPESOP on DP.

Our findings regarding DPESOP and NDPESOP differ from the ones obtained by Muniz *et al.* (2022) in their pooled Tobit model. The divergence could relate to the model specification, as these authors also study a sample of companies traded in the Brazilian stock market. They include a dummy for all companies that adopt an ESOP (dividend-protected or not) and include an interaction dummy in order to identify whether these companies are dividend-protected. They find that DPESOP positively affects dividends per share, while the relationship between ESOP and dividends is not significant. In our study, we include dummies that separately control for DPESOP and NDPESOP, as we expect this specification to reduce problems related to the correlation between ESOP and DPESOP (as shown in Table 4). Our dependent variable for dividends also differs from theirs (earnings per share) and we utilize a Random Effects Tobit model, as the panel level variance component is not statistically different from zero in our model.

Both Brazilian studies reach a similar conclusion regarding the fact that firms that adopt a NDPESOP are likely to pay smaller dividends than those that adopt a DPESOP. However, our study shows that, overall, there is no change in dividend payments when ESOP are dividend-protected compared to non-executive-optioned firms. We argue that our results are consistent with expectations based on agency theory, after all, as argued in the seminal work of Lambert *et al.* (1989), the only reason why adopting an ESOP might affect dividend payments in the first place is the lack of dividend protection, which makes dividend payments detrimental for managers' stock option gains. Hence, we argue that managers are not motivated to alter their companies' dividend policy when ESOP include dividend protection.

Our dividend findings also differ from the study of Liljeblon and Pasternack (2006). They split their sample between DPESOP and NDPESOP firms and observe that the scope of option programs only affects dividend payout significantly for firms with ESOP that are dividend-protected. They find that the program scope positively affects dividends for firms in the DPESOP group. Overall, their results contradict the notion that NDPESOP lead to reductions in dividend payments. However, these models do not control for the effects of program scope considering the full sample of companies, which might be a limitation to the generalization of their conclusion. We argue that, by controlling for all factors in single model, we can better control for possible impacts of the DPESOP and NDPESOP sample characteristics on our results. It should be noted that these authors also estimate a full sample model for dividends, however, find that larger non-dividend-protected option programs lead to higher dividend payments, which is both inconsistent with the literature and with their separate models.

Regarding share repurchases, in H2a we state that ***NDPESOP positively affect the level of share repurchases.*** We also hypothesize on H2b that ***DPESOP positively affect the level of share repurchases.*** We find that the Tobit coefficients of DPESOP (0.0115) and NDPESOP (0.0117) on the RP model are surprisingly similar. Both types of plans affect buybacks positively at the 1% significance level, which is coherent with hypotheses H2a and H2b and shows that both types of plan yield similar incentives regarding share repurchases.

Liljeblon and Pasternack (2006) have also investigated how the scope of DPESOP and NDPESOP affect repurchases. While they do not find significant results on the effects of these plans on share repurchases, their conclusion is also coherent with managers increasing share repurchases, as well as with the absence of a difference between DPESOP and NDPESOP firms regarding repurchases.

Our findings contradict the premise that NDPESOP lead managers to substitute dividend payments for repurchases (Fenn & Liang, 2001), as DPESOP also increase share repurchases. Overall, evidence corroborates our assertion that, while NDESOP and DPESOP generate different incentives on dividend payments, they generate similar incentives regarding repurchases.

It is unclear whether this constitutes an agency problem: on one hand, spending on repurchases could reduce the free cash flow problem (Jensen 1986). However, if managers rather repurchase shares than invest on projects with positive net present value given their focus on short-term market values, this could be detrimental for long-term value creation.

We propose two possible explanations regarding the reasoning behind ESOP (dividend-protected or not) incentivizing managers to increase spending on repurchases. Firstly, results are consistent with managers exploring the signaling effect of share repurchases in order to increment their option gains (Chan *et al.*, 2010). After all, stock-based incentives lead managers to try to enhance stock prices through both real performance and manipulation (Peng & Röell, 2014). Another possible explanation relates to buybacks reducing share dilution (Dittmar, 2000). Nevertheless, the explanation must be consistent between DPESOP and NDPESOP, as we show that they generate similar incentives on repurchases.

4.2.1 Regards considering our model specifications.

Unlike other studies which analyze outstanding options (or program size/scope), we utilize dummies for ESOP, as we do not find statistically significant results when utilizing continuous specifications of options such as program scope, granted options or exercised options. This finding could be interpreted as a sign that it is not the scope of option programs that influences payout decisions, but the – binary - adoption (or not) of a compensation package that generates incentives for managers to alter payout policy. However, there is also the possibility that our continuous data on options is unreliable. Many Brazilian companies, for example, display options that had already expired as outstanding options. Companies also fail to report data in some years, fill databases with data that belong to different information categories *etc*.

We control whether our results hold when analyzing only dividend-paying companies in order to control whether non-paying companies (firms that never paid any dividend during our sample period) affect our model coefficients significance. Results regarding DPESOP and NDPESOP do not change for this subsample, but we find that the whole sample model best fits the data.

4.3 Results on H3, H4 and H5.

In this section we test our three hypotheses regarding the determinants of dividend protection. In H3 we state that ***having domestic controllers increases the probability that dividend protection will be included in an ESOP.*** We also hypothesize in H4 that ***higher Corporate Governance increases the probability increases the probability that a dividend protection will be included in an ESOP.*** At last, in H5 we suggest that ***consistent dividend paying firms that compensate managers through stock options are more likely to adopt dividend protection than inconsistent payers are.***

We estimate equation 3 though a Pooled Logistic Regression for 45 companies that have adopted ESOP during 2010 and 2020 and report results on Table 7. Additionally, we include a specification excluding the constant variable and adopting a robust matrix, as this model better suits the goodness-of-fit test. We interpret results regarding specification II in order to evaluate our hypotheses.

Table 7: Pooled Logit Models (H3, H4 and H5)
We present Logit coefficients in Bold, p-values in italic under parenthesis and marginal effects in italic.

Variables	I	II (1)
Domestic Controller	**-2.5462****** *(0.055)* *-0.4192*	**-3.1116****** *(0.014)* *-0.5761*
Consistent Dividend Payer	**-1.5058** (0.283) *-0.1071*	**-1.1268** (0.360) *-0.0992*
Corporate Governance *(Board Independency)*	**3.7298****** *(0.078)* *0.3364*	**2.95114****** *(0.087)* *0 .3117*
Year of Adoption	**0.5644*** *(0.007)* *0.0509*	**0.4642*** *(0.013)* *0.0490*
Leverage	**-1.2830** *(0.682)* *-0.1157*	**-0.7692** *(0.803)* *-0.0812*
Firm Size	**0.2789** *(0.37)* *0.0251*	**-0.1318** *(0.285)* *-0.0139*
ROA	***8.861202*** *(0.167)* *0.7993*	**10.350****** *(0.051)* *1.093*
Constant	**-7.0383** 0.1630	**N/A**
Total Observations	45	45
Prob > Chi-Squared	0.0099*	0.0143**
Pseudo R^2	0.3882	N/A (2)
Area under ROC	0.8943	0.8771
Sensitivity	80%	60.00%
Specificity	94.29%	88.57%
Goodness of fit (prob>chi²)	0.0003*	0.2805

(1)We estimate this model using a robust matrix (Huber/White).
(2) The pseudo R^2 cannot be estimated in a model that does not include the constant variable. Excluding the constant has enhanced the goodness of fit test in every specification.
*Significant at 1%; ** Significant at 5%; *** significant at 10%.
Source: Elaborated by the authors.

At the 10% significance level, we find that, contrary to expectations laid out on H3, having Brazilian controllers negatively affects the probability that a company will include dividend protection on its management stock option package. Hence, firms with foreign controllers are more likely to include dividend protection. Considering that dividend protection leads to higher dividend payments, our finding is consistent with the study of Jeon *et al.* (2011) regarding the fact that foreign investors lead to higher dividend payments, which suggests that foreign monitoring can increase dividend payout. This explanation is sound considering that foreign investors tend to increase dividends in developing countries, on which domestic institutional investors are not as efficient at the monitoring role (Kim *et al.*, 2010). However, it contradicts our initial hypothesis that Brazilian controllers will adjust ESOP characteristics to conform to their tax preferences, leading us to reject H3.

Regarding the effects of Corporate Governance on P(DPESOP=1), we observe that higher board independence increases the probability that a firm will include dividend protection at the 10% significance level. This result indicates that higher board independence might lead companies to avoid possible agency problems regarding payout policy when setting up their ESOP. This is coherent with evidence that board independence is associated with higher dividend payments (Sharma, 2011). Overall, we do not reject H4.

When evaluating H5, we find that consistent dividend payers are no different from inconsistent payers regarding the probability that they will include dividend protection, as the coefficient for CDP is not significant. This leads us to reject our fifth hypothesis.

Although we only do not reject one of our three hypothesis regarding equation 3, we find novel evidence that newer plans are more likely to include dividend protection. By controlling for the time passage effect on the probability that a company will include dividend protection, we find that, at the 1% significance level, it is more likely that plans adopted in later years will include this characteristic.

Even though it is not clear why earlier plans were less likely to include dividend protection, there could be a simple explanation for this finding. Ever since Lambert *et al.* (1989) have published their seminal work on the association between unprotected ESOP and smaller dividend payments, many studies have shown that dividend protection might reduce this potential agency problem (Liljeblom & Pasternick, 2006; Cuny *et al.*, 2009; Muniz *et al.*, 2022). It is plausible to assume that practitioners gradually adapt to these new studies, which could explain this result.

Regarding our control variables, only ROA positively affects the probability that a company might include dividend protection in its ESOP. This signals that less profitable companies are less prone to committing to include dividend protection because it increases the cost of the ESOP.

The fact that variables such as Leverage and Firm size are insignificant in our model does not indicate that these firm characteristics do not influence the decision between adopting a DPESOP or a NDPESOP. The limited number of observations probably limits the generalization of our results. As the Brazilian capital market is still emergent and most of the companies have adopted ESOP before 2010, it is hard to obtain a larger sample. Nevertheless, we provide an initial model than can be tested in more developed markets.

5 Conclusion

Since the seminal work of Lambert *et al.* (1989), which finds that there is a negative impact of ESOP adoption on dividend payments, there have been many developments on the understanding of the relationship between this form of compensation and companies' payout policies. Overall, studies in this field have argued that the lack of dividend protection leads to reductions in dividend payments and increases in share repurchases (Voss, 2012). Initially most of the work in this field has investigated the effects of ESOP on dividends and share repurchases assuming that these plans are not dividend protected - or that most of them are not. However, these studies did not control for the effect of including this sort of protection in contracts, and did not investigate whether plans were "implicitly" dividend-protected (Fenn & Liang, 2001; Cuny *et al.*, 2009).

More recently, a few studies have focused on the different impacts of DPESOP and NDPESOP on dividend payments and share repurchases. Overall, it is clear from theoretical arguments and empirical evidence that dividend-protected ESOP incentivize managers to pay higher dividends than non-dividend-protected plans. However, it is unclear whether dividend protection will lead firms to pay higher dividends or simply nullify the negative incentives of NDPESOP on dividends.

We find that dividend protection completely offsets the incentive to alter dividend policy, as NDPESOP has no statistically significant effect on dividends. However, both DPESOP and NDPESOP positively affect share repurchases, and the effects of these plans are almost statistically identical.

Overall, our results show that the previously documented incentives of ESOP on share repurchases do not relate to the lack of dividend protection. Hence, we suggest that it is not the substitution of dividends for share repurchases that leads managers to increase share repurchases following the adoption of an ESOP, but the attempts to influence market perception over stock prices (exploring the signaling effect) or to influence stock values by acquiring shares.

At last, we find seminal evidence on the reasons behind why some companies adopt dividend protection and others do not. Dividend protection nullifies possible dividend policy altering incentives associated with ESOP, which leads firms with DPESOP to pay higher dividends than those with NDPESOP. Hence, we find that higher profitability increases the likelihood of including this provision. Monitoring incentives associated with foreign controllers and board independence also increase the likelihood that companies will adopt dividend protection. Additionally, practitioners seem to be slowly adapting to the empirical evidence on ESOP and (lack of) dividend protection, as the likelihood that companies will not adopt this provision seems to decline over time.

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CHAPTER 5:
Essays on Executive Stock Options: Concluding Remarks

We have started this study by asking the following research question: ***how do different management stock options contract features influence managers' incentives?*** This is clearly a very broad question, and we have no delusions that our study might fully answer it. Nevertheless, we presume that specific Executive Stock Option Plans (ESOP) designs can generate better incentives regarding efforts by reducing or eliminating manipulative behavior. Overall, we find theoretical and empirical evidence that supports this premise.

Our work focuses on the Brazilian capital market, as it has a weaker institutional setting, which could exacerbate manipulations. We have conducted three different studies in order to test our thesis:

i) An analysis of theoretical arguments for building ideal ESOP and an investigation of how Brazilian Exchange Traded Firms' conform to these features;
ii) An investigation of the relationship between different ESOP characteristics and earnings quality measures; and
iii) An analysis of why firms adapt dividend-protected ESOP and how they lead to alterations in firms' payout policies.

In order to conclude our thesis, we draw several relationships between our studies. Initially, by analyzing several theoretical arguments on how to build ideal compensation contracts (Goldman & Slezak, 2006; Edmans *et al.*, 2012; Beyer *et al.*, 2014; Peng & Röell, 2014; Dutta, & Fan, 2014; Varas, 2018; Marinovic & Varas, 2019 among others), we find that while Brazilian companies conform to some of the ideal features, there is room for improvement.

Brazilian companies that adopt ESOP have high levels of corporate governance. Usually, most companies traded in Brasil Bolsa Balcão (B3) do not have CEO/Chairman duality, do not compensate directors' board members with stock options and adopt high levels of corporate governance according to the B3 ruling. However, Brazilian companies can enhance their level of board independence

When conducting our first study, we found that most of the companies adopt vesting + lockup periods for the ESOP that last on average 4 years. Initially we had assumed that these contracts incentive horizons were ideal to generate good incentives. However, as we find in our second study, ideally ESOP should include incentives that last longer than 5 years in order to reduce manipulations and enhance EQ.

In our first study, we also find that most of the companies in our sample do not include dividend protection in their ESOP. In our third study, we find that this generates a potential agency problem, as lack of dividend protection reduces dividend payments. Considering Brazilian tax legislation, dividend payment reductions harm minority shareholders. We also find that dividend protection is included in firms that have higher monitoring, which indicates that lack of dividend protection is not ideal.

Overall, we argue that Brazilian companies should include longer vesting periods and that dividend-protection is desirable. Our findings for studies 2 and 3 support these claims. In our second study, we find that longer contracts enhance EQ measures. More specifically, firms should have incentives that last longer than five years in order to affect earnings persistence and earnings smoothness positively and to reduce discretionary accruals manipulation. However, even longer contracts do not completely eliminate manipulation, which is consistent with theoretical arguments on compensation contracts optimality (Marinovic & Varas, 2019).

Monitoring variables (corporate governance) also enhance EQ for companies that adopt ESOP, as board independence enhances earnings smoothness and reduces positive discretionary accruals management. Additionally, non-CEO/Chairman duality reduces the probability that companies might avoid missing earnings target measures through discretionary accruals.

While these aspects of contracts enhance EQ, we find that manipulation is prevalent in years that precede large stock option grants. Negative accruals manipulation and missed earnings targets usually precede larger grants, as managers try to affect strike prices negatively. We suggest that future research investigate whether mechanisms such as randomizing grant dates might reduce this type of behavior.

At last, we show that lack of dividend protection is associated with smaller dividends, such as in previous literature. However, we also find that plans that do not include dividend protections have similar effects on share repurchases as the ones previously reported. Both dividend-protected and non-dividend protected plans affect share repurchases similarly, as they have a positive effect on buyback spending. Overall, this contradicts arguments that indicate that non-dividend-protected ESOP lead managers to substitute dividends for repurchases, and might indicate that managers use buybacks in order to increase stock prices.

We also find novel evidence on why companies adopt dividend protection. Contrary to our initial expectation, having Brazilian controllers negatively affects the probability that a company might include a dividend protection on its ESOP. We first assumed that Brazilian controllers would be more likely to include dividend protection, as dividends are usually tax favorable over capital gains in the Brazilian capital market. Surprisingly, foreign controllers were more likely to include a dividend protection. As dividend protection removes incentives for managers to alter their dividend policy, this finding suggests that dividends play a monitoring role for foreign controllers. Accordingly, higher board independence also increases the likelihood that a company might adopt a dividend protection.

Another relevant finding is that there is a temporal trend on dividend protection adoption. Newer ESOP are more likely to include this provision, which suggests that practitioners gradually adapt to theoretical and empirical evidence from the financial literature on the effects of dividend protection on payout policy. This seems to be a great note to end our study on, as we hope that our findings can also corroborate to better financial practices. In order to achieve this goal, we present a summary of the ideal features of an ESOP.

In order to deal with manipulations, an ideal ESOP should:

i) include long-term incentives (vesting periods longer than 5 years);

ii) be followed by high quality corporate governance mechanisms;

iii) include strike price-setting mechanisms that are less susceptible to short-term stock price manipulation;

iv) contain provisions for re-setting strike prices in certain conditions (e.g.: a financial crisis) and;

v) include a dividend protection.

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APPENDIX A – Stata Reports for Chapter 3

Panel models for Chapter 3 – Commands and stata results

Models on Earnings Persistence - Systemic GMM – PART I

$$E_{i,t+1} = \alpha_o + \alpha_1 E_{i,t} + \alpha_2 LT_{i,t} + \alpha_3 ExOp_{i,t} + \alpha_4 ExOp_{i,t} LT_{i,t} + v_{t+1} \quad (6)$$

LT > 2

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 2 years

```
. xtabond2 futearn L.futearn lt2 exoptot exlt , gmm (L.futearn , eq(level) lag(1 1)) iv(lt2 exoptot exlt ) twostep robust
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       439
Time variable : year                            Number of groups   =        76
Number of instruments = 11                      Obs per group: min =         1
Wald chi2(4)    =    186.86                                    avg =      5.78
Prob > chi2     =     0.000                                    max =         9
------------------------------------------------------------------------------
             |              Corrected
     futearn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     futearn |
         L1. |   .4676484   .1771164     2.64   0.008     .1205067    .8147902
             |
         lt2 |   .0150932   .0228737     0.66   0.509    -.0297384    .0599247
     exoptot |   -.482514   1.091745    -0.44   0.659    -2.622296    1.657268
        exlt |   .3293283   1.105003     0.30   0.766    -1.836437    2.495094
       _cons |  -.0003493   .0216569    -0.02   0.987    -.0427959    .0420974
------------------------------------------------------------------------------

Instruments for first differences equation
  Standard
    D.(lt2 exoptot exlt)
Instruments for levels equation
  Standard
    lt2 exoptot exlt
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.L.futearn
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.34  Pr > z =  0.179
Arellano-Bond test for AR(2) in first differences: z =   0.48  Pr > z =  0.633
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(6)    =  33.38  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(6)    =   8.41  Prob > chi2 =  0.210
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(lt2 exoptot exlt)
    Hansen test excluding group:     chi2(3)    =   0.75  Prob > chi2 =  0.862
    Difference (null H = exogenous): chi2(3)    =   7.66  Prob > chi2 =  0.054
------------------------------------------------------------------------------
```

$$E_{i,t+1} = \alpha_o + \alpha_1 E_{i,t} + \alpha_2 LT_{i,t} + \alpha_3 ExOp_{i,t} + \alpha_4 ExOp_{i,t} LT_{i,t} + v_{t+1} \ (6)$$

LT>3–

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 3 years

```
. xtabond2 futearn L.futearn lt3 exoptot exlt , gmm (L.futearn , eq(level) lag(1 1)) iv(lt3 exoptot exlt ) twostep robust
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       439
Time variable : year                            Number of groups   =        76
Number of instruments = 11                      Obs per group: min =         1
Wald chi2(4)    =    120.06                                    avg =      5.78
Prob > chi2     =     0.000                                    max =         9
------------------------------------------------------------------------------
             |              Corrected
     futearn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     futearn |
         L1. |   .4791164   .1708411     2.80   0.005     .1442741    .8139588
             |
         lt3 |   .0003649   .0110353     0.03   0.974    -.0212638    .0219937
     exoptot |  -.0262165   .5535328    -0.05   0.962    -1.111121    1.058688
        exlt |  -.2107244     .627092    -0.34   0.737    -1.439802    1.018353
       _cons |   .0125267   .0107194     1.17   0.243    -.0084829    .0335363
------------------------------------------------------------------------------

Instruments for first differences equation
  Standard
    D.(lt3 exoptot exlt)
Instruments for levels equation
  Standard
    lt3 exoptot exlt
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.L.futearn
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.39  Pr > z =  0.165
Arellano-Bond test for AR(2) in first differences: z =   0.49  Pr > z =  0.627
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(6)    =  34.05  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(6)    =   8.20  Prob > chi2 =  0.224
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(lt3 exoptot exlt)
    Hansen test excluding group:     chi2(3)    =   1.87  Prob > chi2 =  0.599
    Difference (null H = exogenous): chi2(3)    =   6.33  Prob > chi2 =  0.097
```

$$E_{i,t+1} = \alpha_o + \alpha_1 E_{i,t} + \alpha_2 LT_{i,t} + \alpha_3 ExOp_{i,t} + \alpha_4 ExOp_{i,t} LT_{i,t} + v_{t+1} \quad (6)$$

LT>4 –

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 4 years

xtabond2 futearn L.futearn lt4 exoptot exlt , gmm (L.futearn , eq(level) lag(1 1)) iv(lt4 exoptot exlt) twostep robust

```
Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       439
Time variable : year                            Number of groups   =        76
Number of instruments = 11                      Obs per group: min =         1
Wald chi2(4)  =    118.60                                      avg =      5.78
Prob > chi2   =     0.000                                      max =         9
------------------------------------------------------------------------------
             |              Corrected
     futearn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     futearn |
         L1. |   .4533406   .1702231     2.66   0.008     .1197094    .7869718
             |
         lt4 |   .0035314   .0071687     0.49   0.622    -.0105191    .0175818
     exoptot |  -.7217777   .5942255    -1.21   0.224    -1.886438    .4428829
        exlt |    1.26164   .9462043     1.33   0.182    -.5928863    3.116167
       _cons |   .0121476   .0065398     1.86   0.063    -.0006701    .0249654
------------------------------------------------------------------------------

Instruments for first differences equation
  Standard
    D.(lt4 exoptot exlt)
Instruments for levels equation
  Standard
    lt4 exoptot exlt
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.L.futearn
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.41  Pr > z =  0.160
Arellano-Bond test for AR(2) in first differences: z =   0.54  Pr > z =  0.587
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(6)    =  35.80  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(6)    =   8.34  Prob > chi2 =  0.214
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(lt4 exoptot exlt)
    Hansen test excluding group:     chi2(3)    =   4.45  Prob > chi2 =  0.216
    Difference (null H = exogenous): chi2(3)    =   3.89  Prob > chi2 =  0.274
```

$$\boldsymbol{E_{i,t+1} = \alpha_o + \alpha_1 E_{i,t} + \alpha_2 LT_{i,t} + \alpha_3 ExOp_{i,t} + \alpha_4 ExOp_{i,t} LT_{i,t} + v_{t+1}} \textbf{ (6)}$$

LT>5

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 5 years

$$E_{i,t+1} = \alpha_o + \alpha_1 E_{i,t} + \alpha_2 LT_{i,t} + \alpha_3 ExOp_{i,t} + \alpha_4 ExOp_{i,t} LT_{i,t} + v_{t+1} \text{ (6)}$$

xtabond2 FutEarn L.FutEarn lt5 exoptot exlt , gmm (L.FutEarn , eq(level) lag(1 1)) iv(lt5 exoptot exlt) twostep robust

```
. xtabond2 FutEarn L.FutEarn lt5 exoptot exlt , gmm (L.FutEarn , eq(level) lag(1 1)) iv(lt5 exoptot exlt ) twostep robust
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       439
Time variable : year                            Number of groups   =        76
Number of instruments = 11                      Obs per group: min =         1
Wald chi2(4)  =     237.12                                     avg =      5.78
Prob > chi2   =      0.000                                     max =         9
------------------------------------------------------------------------------
             |              Corrected
     FutEarn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     FutEarn |
         L1. |   .4960562   .1922199     2.58   0.010     .1193122    .8728003
             |
         lt5 |  -.0138781    .010201    -1.36   0.174    -.0338718    .0061155
     exoptot |  -.6108869    .371936    -1.64   0.100    -1.339868    .1180943
        exlt |   1.858946    .384803     4.83   0.000     1.104746    2.613146
       _cons |   .0149561   .0066235     2.26   0.024     .0019743     .027938
------------------------------------------------------------------------------

Instruments for first differences equation
  Standard
    D.(lt5 exoptot exlt)
Instruments for levels equation
  Standard
    lt5 exoptot exlt
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.L.FutEarn
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.42  Pr > z =  0.155
Arellano-Bond test for AR(2) in first differences: z =   0.56  Pr > z =  0.573
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(6)    =  35.94  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(6)    =   8.02  Prob > chi2 =  0.236
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(lt5 exoptot exlt)
    Hansen test excluding group:     chi2(3)    =   3.44  Prob > chi2 =  0.328
    Difference (null H = exogenous): chi2(3)    =   4.58  Prob > chi2 =  0.205
```

$$\boldsymbol{E_{i,t+1} = \alpha_o + \alpha_1 E_{i,t} + \alpha_2 LT_{i,t} + \alpha_3 ExOp_{i,t} + \alpha_4 ExOp_{i,t} LT_{i,t} + v_{t+1}} \textbf{ (6)}$$

LT>6

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 5 years

$$E_{i,t+1} = \alpha_o + \alpha_1 E_{i,t} + \alpha_2 LT_{i,t} + \alpha_3 ExOp_{i,t} + \alpha_4 ExOp_{i,t} LT_{i,t} + v_{t+1} \text{ (6)}$$

xtabond2 FutEarn L.FutEarn lt5 exoptot exlt , gmm (L.FutEarn , eq(level) lag(1 1)) iv(lt5 exoptot exlt) twostep robust

```
. xtabond2 futearn L.futearn lt6 exoptot exlt , gmm (L.futearn , eq(level) lag(1 1)) iv(lt6 exoptot exlt ) twostep robust
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       439
Time variable : year                            Number of groups   =        76
Number of instruments = 11                      Obs per group: min =         1
Wald chi2(4)    =    295.01                                    avg =      5.78
Prob > chi2     =     0.000                                    max =         9
------------------------------------------------------------------------------
             |              Corrected
     futearn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     futearn |
         L1. |   .4915987   .1883961     2.61   0.009     .1223491    .8608482
             |
         lt6 |  -.0214257   .0191583    -1.12   0.263    -.0589753    .0161238
     exoptot |   -.545069   .3480331    -1.57   0.117    -1.227201    .1370632
        exlt |   1.980259   .3588521     5.52   0.000     1.276922    2.683596
       _cons |   .0148769   .0066974     2.22   0.026     .0017502    .0280037
------------------------------------------------------------------------------
```

```
Instruments for first differences equation
  Standard
    D.(lt6 exoptot exlt)
Instruments for levels equation
  Standard
    lt6 exoptot exlt
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.L.futearn
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.43  Pr > z =  0.152
Arellano-Bond test for AR(2) in first differences: z =   0.56  Pr > z =  0.576
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(6)    =  35.41  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(6)    =   7.55  Prob > chi2 =  0.273
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(lt6 exoptot exlt)
    Hansen test excluding group:     chi2(3)    =   3.60  Prob > chi2 =  0.308
    Difference (null H = exogenous): chi2(3)    =   3.95  Prob > chi2 =  0.267
```

Models on Earnings Persistence - Systemic GMM – PART II

$$E_{i,t+1} = \alpha_o + \gamma_1 AC_{i,t} + \gamma_2 CF_{i,t} + \gamma_3 LT_{i,t} + \gamma_4 ExOp_{i,t} + \gamma_5 ExOp_{i,t} LT_{i,t} + v_{t+1} \ (7)$$

LT>2 - ***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 2 years

```
. xtabond2 futearn L.futurecf L.futureaccruals lt2 exoptot exlt2 , gmm (L.futurecf L.futureaccruals, eq(level) lag(1 1)) iv(lt2 exoptot exlt2
> ) twostep robust
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       439
Time variable : year                            Number of groups   =        76
Number of instruments = 18                      Obs per group: min =         1
Wald chi2(5)  =    209.11                                      avg =      5.78
Prob > chi2   =     0.000                                      max =         9
------------------------------------------------------------------------------
             |              Corrected
     futearn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    futurecf |
         L1. |   .6460523    .147387     4.38   0.000     .3571791    .9349256
             |
futureaccruals |
         L1. |   .6382132   .1444714     4.42   0.000     .3550545    .9213719
             |
         lt2 |   .0075774   .0192569     0.39   0.694    -.0301655    .0453203
     exoptot |  -.6723155   .9307651    -0.72   0.470    -2.496582    1.151951
       exlt2 |   .6447294   .9382149     0.69   0.492    -1.194138    2.483597
       _cons |   .0024218   .0194967     0.12   0.901    -.0357911    .0406347
------------------------------------------------------------------------------

Instruments for first differences equation
  Standard
    D.(lt2 exoptot exlt2)
Instruments for levels equation
  Standard
    lt2 exoptot exlt2
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.(L.futurecf L.futureaccruals)
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.61  Pr > z =  0.108
Arellano-Bond test for AR(2) in first differences: z =   0.52  Pr > z =  0.604
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(12)    =  47.34  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(12)    =  10.88  Prob > chi2 =  0.539
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(lt2 exoptot exlt2)
    Hansen test excluding group:     chi2(9)     =  10.66  Prob > chi2 =  0.300
    Difference (null H = exogenous): chi2(3)     =   0.22  Prob > chi2 =  0.974
```

$$E_{i,t+1} = \alpha_o + \gamma_1 AC_{i,t} + \gamma_2 CF_{i,t} + \gamma_3 LT_{i,t} + \gamma_4 ExOp_{i,t} + \gamma_5 ExOp_{i,t} LT_{i,t} + v_{t+1} \quad (7)$$

LT>3 - *** This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 3 years

```
. xtabond2 futearn L.futurecf L.futureaccruals lt3 exoptot exlt3 , gmm (L.futurecf L.futureaccruals, eq(level) lag(1 1)) iv(lt3 exoptot exlt3
> ) twostep robust
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       439
Time variable : year                            Number of groups   =        76
Number of instruments = 18                      Obs per group: min =         1
Wald chi2(5)   =    138.89                                     avg =      5.78
Prob > chi2    =     0.000                                     max =         9
------------------------------------------------------------------------------
             |              Corrected
     futearn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    futurecf |
         L1. |   .6263459   .1315952     4.76   0.000      .368424    .8842678
             |
futureaccruals |
         L1. |   .6255333   .1293971     4.83   0.000     .3719197     .879147
             |
         lt3 |  -.0029222   .0093327    -0.31   0.754    -.0212139    .0153695
     exoptot |  -.1439001   .5668327    -0.25   0.800    -1.254872    .9670716
       exlt3 |   .0117261   .6095244     0.02   0.985     -1.18292    1.206372
       _cons |   .0102336   .0100347     1.02   0.308    -.0094341    .0299012
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(lt3 exoptot exlt3)
Instruments for levels equation
  Standard
    lt3 exoptot exlt3
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.(L.futurecf L.futureaccruals)
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.65  Pr > z =  0.099
Arellano-Bond test for AR(2) in first differences: z =   0.49  Pr > z =  0.625
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(12)   =  48.21  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(12)   =  11.00  Prob > chi2 =  0.529
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(lt3 exoptot exlt3)
    Hansen test excluding group:     chi2(9)    =  10.66  Prob > chi2 =  0.300
    Difference (null H = exogenous): chi2(3)    =   0.35  Prob > chi2 =  0.951
------------------------------------------------------------------------------
```

$$E_{i,t+1} = \alpha_o + \gamma_1 AC_{i,t} + \gamma_2 CF_{i,t} + \gamma_3 LT_{i,t} + \gamma_4 ExOp_{i,t} + \gamma_5 ExOp_{i,t} LT_{i,t} + v_{t+1} \quad (7)$$

LT>4 - ***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 4 years

xtabond2 futearn L.futurecf L.futureaccruals lt4 exoptot exlt, gmm (L.futurecf L.futureaccruals, eq(level) lag(1 1)) iv(lt4 exoptot exlt) twostep robust

```
. xtabond2 futearn L.futurecf L.futureaccruals lt4 exoptot exlt, gmm (L.futurecf L.futureaccruals, eq(level) lag(1 1)) iv(lt4 exoptot exlt) t
> wostep robust
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       439
Time variable : year                            Number of groups   =        76
Number of instruments = 18                      Obs per group: min =         1
Wald chi2(5)  =    154.64                                      avg =      5.78
Prob > chi2   =     0.000                                      max =         9
------------------------------------------------------------------------------
             |              Corrected
     futearn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    futurecf |
         L1. |   .6466907   .1219007     5.31   0.000     .4077697    .8856117
             |
futureaccruals |
         L1. |   .6515716   .1215865     5.36   0.000     .4132664    .8898767
             |
         lt4 |   .0021558   .0081673     0.26   0.792    -.0138518    .0181635
     exoptot |  -.8160477   .4773297    -1.71   0.087    -1.751597    .1195013
        exlt |   1.548377   .7663177     2.02   0.043     .0464218    3.050332
       _cons |   .0052389   .0072758     0.72   0.471    -.0090214    .0194991
------------------------------------------------------------------------------

Instruments for first differences equation
  Standard
    D.(lt4 exoptot exlt)
Instruments for levels equation
  Standard
    lt4 exoptot exlt
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.(L.futurecf L.futureaccruals)
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.74  Pr > z =  0.081
Arellano-Bond test for AR(2) in first differences: z =   0.55  Pr > z =  0.586
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(12)    =  49.71  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(12)    =  10.32  Prob > chi2 =  0.588
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(lt4 exoptot exlt)
    Hansen test excluding group:     chi2(9)     =   9.59  Prob > chi2 =  0.385
    Difference (null H = exogenous): chi2(3)     =   0.74  Prob > chi2 =  0.865
```

$$E_{i,t+1} = \alpha_o + \gamma_1 AC_{i,t} + \gamma_2 CF_{i,t} + \gamma_3 LT_{i,t} + \gamma_4 ExOp_{i,t} + \gamma_5 ExOp_{i,t} LT_{i,t} + v_{t+1} \quad (7)$$

LT>5 - ***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 5 years

```
. xtabond2 futearn L.futurecf L.futureaccruals lt5 exoptot exlt , gmm (L.futurecf L.futureaccruals, eq(level) lag(1 1)) iv(lt5 exoptot exlt )
>  twostep robust
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       439
Time variable : year                            Number of groups   =        76
Number of instruments = 18                      Obs per group: min =         1
Wald chi2(5)  =    412.46                                      avg =      5.78
Prob > chi2   =     0.000                                      max =         9
------------------------------------------------------------------------------
             |              Corrected
     futearn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    futurecf |
         L1. |   .6577844   .1550169     4.24   0.000     .3539569    .9616119
             |
futureaccruals |
         L1. |   .6591177   .1525545     4.32   0.000     .3601164     .958119
             |
         lt5 |  -.0192927   .0103475    -1.86   0.062    -.0395735    .0009881
     exoptot |  -.6130646   .3429339    -1.79   0.074    -1.285203    .0590735
        exlt |   2.090479   .3234997     6.46   0.000     1.456431    2.724527
       _cons |   .0100457   .0066333     1.51   0.130    -.0029553    .0230468
------------------------------------------------------------------------------

Instruments for first differences equation
  Standard
    D.(lt5 exoptot exlt)
Instruments for levels equation
  Standard
    lt5 exoptot exlt
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.(L.futurecf L.futureaccruals)
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.73  Pr > z =  0.084
Arellano-Bond test for AR(2) in first differences: z =   0.57  Pr > z =  0.572
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(12)    =  50.90  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(12)    =  10.47  Prob > chi2 =  0.575
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(lt5 exoptot exlt)
    Hansen test excluding group:     chi2(9)     =   8.46  Prob > chi2 =  0.489
    Difference (null H = exogenous): chi2(3)     =   2.01  Prob > chi2 =  0.569
```

$$E_{i,t+1} = \alpha_o + \gamma_1 AC_{i,t} + \gamma_2 CF_{i,t} + \gamma_3 LT_{i,t} + \gamma_4 ExOp_{i,t} + \gamma_5 ExOp_{i,t} LT_{i,t} + v_{t+1} \ (7)$$

LT > 6 - ***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 6 years

```
. xtabond2 futearn L.futurecf L.futureaccruals lt6 exoptot exlt6 , gmm (L.futurecf L.futureaccruals, eq(level) lag(1 1)) iv(lt6 exoptot exlt6
> ) twostep robust
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       439
Time variable : year                            Number of groups   =        76
Number of instruments = 18                      Obs per group: min =         1
Wald chi2(5)  =    471.62                                      avg =      5.78
Prob > chi2   =     0.000                                      max =         9
------------------------------------------------------------------------------
             |              Corrected
     futearn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    futurecf |
         L1. |   .6408263   .1472548     4.35   0.000     .3522122    .9294403
             |
futureaccruals |
         L1. |   .6443426   .1441021     4.47   0.000     .3619076    .9267775
             |
         lt6 |  -.0282841   .0210941    -1.34   0.180    -.0696277    .0130594
     exoptot |  -.5380268    .330823    -1.63   0.104    -1.186428    .1103743
       exlt6 |   2.164721   .3465275     6.25   0.000      1.48554    2.843903
       _cons |   .0096274   .0067888     1.42   0.156    -.0036784    .0229333
------------------------------------------------------------------------------

Instruments for first differences equation
  Standard
    D.(lt6 exoptot exlt6)
Instruments for levels equation
  Standard
    lt6 exoptot exlt6
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.(L.futurecf L.futureaccruals)
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.77  Pr > z =  0.076
Arellano-Bond test for AR(2) in first differences: z =   0.54  Pr > z =  0.586
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(12)    =  50.52  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(12)    =  10.33  Prob > chi2 =  0.587
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(lt6 exoptot exlt6)
    Hansen test excluding group:     chi2(9)     =   8.99  Prob > chi2 =  0.439
    Difference (null H = exogenous): chi2(3)     =   1.34  Prob > chi2 =  0.720
```

Models on Earnings Persistence - Systemic GMM – PART III

$$E_{i,t+1} = \alpha_o + \gamma_1 E_{i,t} + \gamma_3 ExOp_{i,t} + v_{t+1} \text{ (8)}$$

Equation 8 – Firms with LT5=1

xtabond2 futearn L.futearn exoptot, gmm (L.futearn , eq(level) lag(6 7)) iv(exoptot) twostep robust

```
. xtabond2 futearn L.futearn exoptot, gmm (L.futearn , eq(level) lag(6 7)) iv( exoptot) twostep robust
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =        59
Time variable : year                            Number of groups   =        16
Number of instruments = 5                       Obs per group: min =         1
Wald chi2(2)  =   1876.01                                      avg =      3.69
Prob > chi2   =     0.000                                      max =         9
------------------------------------------------------------------------------
             |              Corrected
     futearn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     futearn |
         L1. |   1.213061   .1295566     9.36   0.000     .9591342    1.466987
             |
     exoptot |   1.065142   .4307193     2.47   0.013     .2209474    1.909336
       _cons |  -.0310252   .0134794    -2.30   0.021    -.0574443   -.0046061
------------------------------------------------------------------------------

Instruments for first differences equation
  Standard
    D.exoptot
Instruments for levels equation
  Standard
    exoptot
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL(6/7).L.futearn
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.27  Pr > z =  0.206
Arellano-Bond test for AR(2) in first differences: z =   0.94  Pr > z =  0.346
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(2)    =   0.13  Prob > chi2 =  0.938
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(2)    =   0.14  Prob > chi2 =  0.933
  (Robust, but weakened by many instruments.)
```

$$E_{i,t+1} = \alpha_o + \gamma_1 AC_{i,t} + \gamma_2 CF_{i,t} + \gamma_3 ExOp_{i,t} + v_{t+1} \text{ (9)}$$

Equation 9 – Firmas com LT5=1

xtabond2 futearn L.futureaccruals L.futurecf exoptot , gmm (L.futureaccruals L.futurecf , eq(level) lag(2 2)) iv(exoptot) twostep robust

```
. xtabond2 futearn L.futureaccruals L.futurecf exoptot , gmm (L.futureaccruals L.futurecf , eq(level) lag(2 2)) iv(exoptot) twostep robust
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =        59
Time variable : year                            Number of groups   =        16
Number of instruments = 14                      Obs per group: min =         1
Wald chi2(3)  =     94.66                                      avg =      3.69
Prob > chi2   =     0.000                                      max =         9
------------------------------------------------------------------------------
             |              Corrected
     futearn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
futureaccruals |
         L1. |   1.016849   .1351772     7.52   0.000     .7519067    1.281792
             |
   futurecf |
         L1. |   1.157252   .1335082     8.67   0.000     .8955804    1.418923
             |
     exoptot |    .676223   .3372829     2.00   0.045     .0151606    1.337285
       _cons |   .0038918   .0086976     0.45   0.655    -.0131552    .0209389
------------------------------------------------------------------------------

Instruments for first differences equation
  Standard
    D.exoptot
Instruments for levels equation
  Standard
    exoptot
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL2.(L.futureaccruals L.futurecf)
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.63  Pr > z =  0.104
Arellano-Bond test for AR(2) in first differences: z =   0.28  Pr > z =  0.780
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(10)    =   9.89  Prob > chi2 =  0.450
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(10)    =   4.16  Prob > chi2 =  0.940
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(exoptot)
    Hansen test excluding group:     chi2(9)     =   3.04  Prob > chi2 =  0.963
    Difference (null H = exogenous): chi2(1)     =   1.12  Prob > chi2 =  0.289
```

$$E_{i,t+1} = \alpha_o + \gamma_1 E_{i,t} + \gamma_2\, ExOp_{i,t} + v_{t+1} \;(8)$$

Equation 8 – Firmas com LT5=0

xtabond2 futearn L.futearn exoptot , gmm (L.futearn , eq(level) lag(3 3)) iv(exoptot) twostep robust

```
. xtabond2 futearn L.futearn exoptot , gmm (L.futearn , eq(level) lag(3 3)) iv(exoptot) twostep robust
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       368
Time variable : year                            Number of groups   =        67
Number of instruments = 7                       Obs per group: min =         1
Wald chi2(2)    =     36.50                                    avg =      5.49
Prob > chi2     =     0.000                                    max =         9
------------------------------------------------------------------------------
             |              Corrected
     futearn |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     futearn |
         L1. |   .4563393   .2583382     1.77   0.077    -.0499943    .9626729
             |
     exoptot |  -.3874121   .2315682    -1.67   0.094    -.8412775    .0664532
       _cons |   .0171673   .0062762     2.74   0.006     .0048662    .0294684
------------------------------------------------------------------------------

Instruments for levels equation
  Standard
    exoptot
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL3.L.futearn
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.52  Pr > z =  0.128
Arellano-Bond test for AR(2) in first differences: z =  -0.09  Pr > z =  0.927
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(4)    =  61.45  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(4)    =   2.75  Prob > chi2 =  0.600
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(exoptot)
    Hansen test excluding group:     chi2(3)    =   1.32  Prob > chi2 =  0.723
    Difference (null H = exogenous): chi2(1)    =   1.43  Prob > chi2 =  0.232
```

$$E_{i,t+1} = \alpha_o + \gamma_1 AC_{i,t} + \gamma_2 CF_{i,t} + \gamma_3 ExOp_{i,t} + v_{t+1} \quad (9)$$

Equation 9 – Firmas com LT5=0

xtabond2 futearn L.futureaccruals L.futurecf exoptot , gmm (L.futureaccruals L.futurecf , eq(level) lag(1 7)) iv(exoptot) twostep robust

```
. xtabond2 futearn L.futureaccruals L.futurecf exoptot , gmm (L.futureaccruals L.futurecf , eq(level) lag(1 7)) iv(exoptot) twostep robust
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       368
Time variable : year                            Number of groups   =        67
Number of instruments = 58                      Obs per group: min =         1
Wald chi2(3)  =     47.83                                      avg =      5.49
Prob > chi2   =     0.000                                      max =         9
```

futearn	Coef.	Corrected Std. Err.	z	P>|z|	[95% Conf.	Interval]
futureaccruals						
L1.	.4937061	.1425812	3.46	0.001	.2142521	.7731602
futurecf						
L1.	.4738394	.1326438	3.57	0.000	.2138624	.7338164
exoptot	-.4609135	.2575072	-1.79	0.073	-.9656183	.0437914
_cons	.0120309	.0133461	0.90	0.367	-.0141269	.0381888

```
Instruments for first differences equation
  Standard
    D.exoptot
Instruments for levels equation
  Standard
    exoptot
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL(1/7).(L.futureaccruals L.futurecf)
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -0.93  Pr > z =  0.352
Arellano-Bond test for AR(2) in first differences: z =  -0.91  Pr > z =  0.363
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(54)   = 293.51  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(54)   =  45.39  Prob > chi2 =  0.792
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(exoptot)
    Hansen test excluding group:     chi2(53)   =  45.00  Prob > chi2 =  0.775
    Difference (null H = exogenous): chi2(1)    =   0.40  Prob > chi2 =  0.530
```

Discretionary Accruals Model – Estimating Earnings Management.

$$AC_{i,t} = \beta_{0i} + \phi_{ac}AC_{i,t-1} + \beta_1 \frac{1}{\left(\frac{AT_{i,t}+AT_{i,t-1}}{2}\right)} + \beta_2\,(\Delta REV_t - \Delta AR_t) + \ \beta_3\, PPE_t + \beta_4 E_{i,t} + v_{i,t} \quad (10)$$

xtabond2 accruals L.accruals reverseasset revminusrec ppe earningsroa, gmm (L.accruals revminusrec earningsroa, eq(level) lag(5 5)) iv(reverseasset ppe) twostep robust

```
. xtabond2 accruals L.accruals reverseasset revminusrec ppe earningsroa, gmm (L.accruals revminusrec earningsroa, eq(level) lag(5 5)) iv( rev
> erseasset ppe ) twostep robust
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =      2097
Time variable : year                            Number of groups   =       222
Number of instruments = 17                      Obs per group: min =         2
Wald chi2(5)  =  10098.72                                      avg =      9.45
Prob > chi2   =     0.000                                      max =        10
------------------------------------------------------------------------------
             |              Corrected
    accruals |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    accruals |
         L1. |    .279261   .0830317     3.36   0.001     .1165218    .4420002
             |
reverseasset |   416487.2   54635.39     7.62   0.000     309403.8    523570.6
 revminusrec |   -1.64155    .972879    -1.69   0.092    -3.548358    .2652573
         ppe |  -1.448913   1.348366    -1.07   0.283    -4.091662    1.193835
 earningsroa |   .1684543   .0286678     5.88   0.000     .1122664    .2246422
       _cons |   .0082766   .0222952     0.37   0.710    -.0354213    .0519745
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(reverseasset ppe)
Instruments for levels equation
  Standard
    reverseasset ppe
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL5.(L.accruals revminusrec earningsroa)
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -1.10  Pr > z =  0.270
Arellano-Bond test for AR(2) in first differences: z =   1.02  Pr > z =  0.308
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(11)    =   0.18  Prob > chi2 =  1.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(11)    =   4.29  Prob > chi2 =  0.961
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(reverseasset ppe)
    Hansen test excluding group:      chi2(9)    =   3.70  Prob > chi2 =  0.930
    Difference (null H = exogenous): chi2(2)    =   0.60  Prob > chi2 =  0.742
```

Estimating Residuals:

predict residuals

(option xb assumed; fitted values)

(222 missing values generated)

Discretionary Accruals Determinants – Equation 11

$$DA_{i,t} = \beta_{0i} + \phi_{da}DA_{i,t-1} + \beta_1 GrOp_{i,t+1} + \beta_4 ExOp_{i,t+1} + \beta_5 LT_{i,t} + \beta_6 ExOp_{i,t+1}LT_{i,t} + \beta_9 LEV_{i,t-1} + \beta_{10} lnSales_{i,t} + \varepsilon_{i,t} \quad (11)$$

Model considering LT > 2

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 2 years

xtabond2 lagdiscaccruals L.lagdiscaccruals sales lev independency lt2 exop exlt grop, gmm (L.lagdiscaccruals sales lev, eq(level) lag(1 2)) iv(independency grop lt2) twostep robust

```
. xtabond2 lagdiscaccruals L.lagdiscaccruals sales lev independency lt2 exop exlt grop, gmm (L.lagdiscaccruals sales lev, eq(level) lag(1 2)
>  iv(independency  grop lt2) twostep robust
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       389
Time variable : year                            Number of groups   =        72
Number of instruments = 41                      Obs per group: min =         1
Wald chi2(8)  =     39.94                                      avg =      5.40
Prob > chi2   =     0.000                                      max =         8
------------------------------------------------------------------------------
                |              Corrected
lagdiscaccruals |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
----------------+-------------------------------------------------------------
lagdiscaccruals |
            L1. |  -.1350675   .0632691    -2.13   0.033    -.2590726   -.0110624
                |
          sales |  -.2324802    .114577    -2.03   0.042     -.457047   -.0079134
            lev |   1.646256   .6384116     2.58   0.010     .3949922     2.89752
   independency |  -.5871709   .3571867    -1.64   0.100    -1.287244    .1129022
            lt2 |   .1602257    .397186     0.40   0.687    -.6182446    .9386961
           exop |   12.76695   76.07356     0.17   0.867    -136.3345    161.8684
           exlt |  -51.63343   78.79057    -0.66   0.512    -206.0601    102.7932
           grop |  -29.09873    9.29171    -3.13   0.002    -47.31015   -10.88731
          _cons |   2.874258   1.488515     1.93   0.053    -.0431786    5.791695
------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(independency grop lt2)
Instruments for levels equation
  Standard
    independency grop lt2
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL(1/2).(L.lagdiscaccruals sales lev)
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -5.02  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =  -0.55  Pr > z =  0.582
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(32)   = 101.86  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(32)   =  39.57  Prob > chi2 =  0.168
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(independency grop lt2)
    Hansen test excluding group:     chi2(29)   =  37.26  Prob > chi2 =  0.140
    Difference (null H = exogenous): chi2(3)    =   2.31  Prob > chi2 =  0.511
```

<u>Model considering LT > 3</u>

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 3 years

xtabond2 lagdiscaccruals L.lagdiscaccruals sales lev independency lt3 exop exlt grop, gmm (L.lagdiscaccruals sales lev, eq(level) lag(1 2)) iv(independency grop) twostep robust

```
. xtabond2 lagdiscaccruals L.lagdiscaccruals sales lev independency lt3 exop exlt grop, gmm (L.lagdiscaccruals sales lev, eq(level) lag(1 2))
>  iv(independency grop) twostep robust
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       389
Time variable : year                            Number of groups   =        72
Number of instruments = 40                      Obs per group: min =         1
Wald chi2(8)  =     32.98                                      avg =      5.40
Prob > chi2   =     0.000                                      max =         8
------------------------------------------------------------------------------
                 |              Corrected
 lagdiscaccruals |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------+----------------------------------------------------------------
 lagdiscaccruals |
             L1. |  -.1380893   .0671135    -2.06   0.040    -.2696295   -.0065492
                 |
           sales |  -.2569201   .1214262    -2.12   0.034    -.4949111   -.0189291
             lev |   1.719591   .6175352     2.78   0.005     .5092443    2.929938
    independency |  -.6531315   .3628142    -1.80   0.072    -1.364234    .0579714
             lt3 |   .1940061   .5163125     0.38   0.707    -.8179479     1.20596
            exop |  -17.59037   41.10762    -0.43   0.669    -98.15982    62.97909
            exlt |  -22.81761   42.71038    -0.53   0.593    -106.5284    60.89319
            grop |  -28.60085   10.30731    -2.77   0.006     -48.8028   -8.398908
           _cons |   3.213876   1.496588     2.15   0.032     .2806178    6.147135
----------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(independency grop)
Instruments for levels equation
  Standard
    independency grop
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL(1/2).(L.lagdiscaccruals sales lev)
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -4.91  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =  -0.61  Pr > z =  0.545
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(31)   = 101.31  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(31)   =  40.27  Prob > chi2 =  0.123
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(independency grop)
    Hansen test excluding group:     chi2(29)   =  37.25  Prob > chi2 =  0.140
    Difference (null H = exogenous): chi2(2)    =   3.02  Prob > chi2 =  0.221
```

Model considering LT > 4

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 4 years

xtabond2 lagdiscaccruals L.lagdiscaccruals sales lev independency lt4 exop exlt grop, gmm (L.lagdiscaccruals sales lev, eq(level) lag(1 2)) iv(grop) twostep robust

```
. xtabond2 lagdiscaccruals L.lagdiscaccruals sales lev independency lt4 exop exlt grop, gmm (L.lagdiscaccruals sales lev, eq(level) lag(1 2))
> iv(grop ) twostep robust
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       389
Time variable : year                            Number of groups   =        72
Number of instruments = 39                      Obs per group: min =         1
Wald chi2(8)   =     26.88                                     avg =      5.40
Prob > chi2    =     0.001                                     max =         8
------------------------------------------------------------------------------
                |              Corrected
lagdiscaccruals |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
----------------+----------------------------------------------------------------
lagdiscaccruals |
            L1. |  -.0616828   .0768738    -0.80   0.422    -.2123526    .0889871
                |
          sales |   -.207614   .1296239    -1.60   0.109    -.4616722    .0464443
            lev |   1.444862   .7844914     1.84   0.066    -.0927129    2.982437
   independency |  -1.684037    1.02514    -1.64   0.100    -3.693274    .3252004
            lt4 |  -.1720333   .5884731    -0.29   0.770    -1.325419    .9813527
           exop |  -50.22733   22.51211    -2.23   0.026    -94.35025   -6.104418
           exlt |   22.91188   47.99452     0.48   0.633    -71.15565    116.9794
           grop |  -27.02751   10.23156    -2.64   0.008      -47.081   -6.974012
          _cons |   3.273716   1.919555     1.71   0.088     -.488544    7.035975
---------------------------------------------------------------------------------

Instruments for first differences equation
  Standard
    D.grop
Instruments for levels equation
  Standard
    grop
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL(1/2).(L.lagdiscaccruals sales lev)
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -4.78  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =   0.14  Pr > z =  0.886
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(30)    =  96.56  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(30)    =  39.50  Prob > chi2 =  0.115
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(grop)
    Hansen test excluding group:     chi2(29)    =  38.88  Prob > chi2 =  0.104
    Difference (null H = exogenous): chi2(1)     =   0.61  Prob > chi2 =  0.433
```

<u>Model considering LT > 5</u>

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 5 years

xtabond2 lagdiscaccruals L.lagdiscaccruals sales lev independency lt5 exop exlt grop, gmm (L.lagdiscaccruals sales lev, eq(level) lag(1 2)) iv(independency grop exlt lt5) twostep robust

```
. xtabond2 lagdiscaccruals L.lagdiscaccruals sales lev independency lt5 exop exlt grop, gmm (L.lagdiscaccruals sales lev, eq(level) lag(1 2))
> iv(independency grop exlt lt5) twostep robust
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM

Group variable: firm                           Number of obs      =       389
Time variable : year                           Number of groups   =        72
Number of instruments = 42                     Obs per group: min =         1
Wald chi2(8)   =      29.25                                   avg =      5.40
Prob > chi2    =      0.000                                   max =         8
```

lagdiscaccruals	Coef.	Corrected Std. Err.	z	P>|z|	[95% Conf.	Interval]
lagdiscaccruals						
L1.	-.1221664	.0623245	-1.96	0.050	-.2443201	-.0000126
sales	-.2533981	.1055046	-2.40	0.016	-.4601833	-.0466128
lev	1.748389	.655154	2.67	0.008	.4643106	3.032467
independency	-.656052	.3497586	-1.88	0.061	-1.341566	.0294621
lt5	-.1294333	.145592	-0.89	0.374	-.4147883	.1559217
exop	-44.04237	17.17118	-2.56	0.010	-77.69727	-10.38746
exlt	34.90042	17.67977	1.97	0.048	.248708	69.55213
grop	-25.26818	9.644566	-2.62	0.009	-44.17118	-6.365177
_cons	3.312492	1.447091	2.29	0.022	.4762459	6.148738

```
Instruments for first differences equation
  Standard
    D.(independency grop exlt lt5)
Instruments for levels equation
  Standard
    independency grop exlt lt5
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL(1/2).(L.lagdiscaccruals sales lev)

Arellano-Bond test for AR(1) in first differences: z =  -5.05  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =  -0.11  Pr > z =  0.911

Sargan test of overid. restrictions: chi2(33)    =  99.70  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(33)    =  41.46  Prob > chi2 =  0.148
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(independency grop exlt lt5)
    Hansen test excluding group:     chi2(29)    =  37.17  Prob > chi2 =  0.142
    Difference (null H = exogenous): chi2(4)     =   4.29  Prob > chi2 =  0.368
```

<u>Model considering LT > 6</u>

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 6 years

xtabond2 lagdiscaccruals L.lagdiscaccruals sales lev independency lt6 exop exlt grop, gmm (L.lagdiscaccruals sales lev, eq(level) lag(1 2)) iv(independency grop exlt lt6) twostep robust

```
. xtabond2 lagdiscaccruals L.lagdiscaccruals sales lev independency lt6 exop exlt grop, gmm (L.lagdiscaccruals sales lev, eq(level) lag(1 2))
>  iv(independency grop exlt lt6) twostep robust
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       389
Time variable : year                            Number of groups   =        72
Number of instruments = 42                      Obs per group: min =         1
Wald chi2(8)  =     36.58                                      avg =      5.40
Prob > chi2   =     0.000                                      max =         8
------------------------------------------------------------------------------
                |              Corrected
lagdiscaccruals |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
----------------+----------------------------------------------------------------
lagdiscaccruals |
            L1. |  -.1167726   .0653665    -1.79   0.074    -.2448886    .0113434
                |
          sales |  -.2602786    .104344    -2.49   0.013    -.4647891   -.0557682
            lev |   1.734491   .6373747     2.72   0.007     .4852596    2.983723
   independency |   -.720489   .3602769    -2.00   0.046    -1.426619   -.0143593
            lt6 |  -.3579107   .1722289    -2.08   0.038    -.6954732   -.0203483
           exop |  -41.23521   15.83276    -2.60   0.009    -72.26684   -10.20357
           exlt |   31.51291   14.62928     2.15   0.031     2.840045    60.18577
           grop |  -26.18213   9.126491    -2.87   0.004    -44.06973    -8.29454
          _cons |   3.465271   1.438641     2.41   0.016     .6455859    6.284956
---------------------------------------------------------------------------------

Instruments for first differences equation
  Standard
    D.(independency grop exlt lt6)
Instruments for levels equation
  Standard
    independency grop exlt lt6
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL(1/2).(L.lagdiscaccruals sales lev)
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -5.06  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =  -0.21  Pr > z =  0.836
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(33)   = 101.49  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(33)   =  40.43  Prob > chi2 =  0.175
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(independency grop exlt lt6)
    Hansen test excluding group:     chi2(29)   =  37.51  Prob > chi2 =  0.134
    Difference (null H = exogenous): chi2(4)    =   2.91  Prob > chi2 =  0.573
```

Models on Target Earnings

Miss_Zero Quarter

$$\boldsymbol{Miss\_Zero\_Quarter}_{\,i,t} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1} LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t} \; (12.a)$$

Model considering LT > 2

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 2 years

xtlogit misst1losses2mvquarterly Sizet1início Levt1início independency lt2 exop exlt grop, re noconstant

```
Random-effects logistic regression              Number of obs     =        341
Group variable: firm                            Number of groups  =         50

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        6.8
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =      70.83
Log likelihood  = -95.108179                    Prob > chi2       =     0.0000
```

misst1losses2mvquarterly	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.1738303	.0649444	-2.68	0.007	-.301119	-.0465417
Levt1início	-.1876276	1.311455	-0.14	0.886	-2.758032	2.382777
independency	1.272956	1.075113	1.18	0.236	-.8342271	3.380138
lt2	-.5726369	.8102625	-0.71	0.480	-2.160722	1.015448
exop	3.531207	41.73685	0.08	0.933	-78.27152	85.33393
exlt	-7.011242	45.85941	-0.15	0.878	-96.89404	82.87155
grop	39.88268	22.41082	1.78	0.075	-4.041714	83.80708
/lnsig2u	-.3039653	.822444			-1.915926	1.307995
sigma_u	.8590032	.353241			.3836737	1.923214
rho	.1832005	.1230689			.0428287	.5292535

```
LR test of rho=0: chibar2(01) = 3.10                  Prob >= chibar2 = 0.039
```

estimates store re

xtlogit misst1losses2mvquarterly Sizet1início Levt1início independency lt2 exop exlt grop, fe

```
Conditional fixed-effects logistic regression   Number of obs     =        154
Group variable: firm                            Number of groups  =         18

                                                Obs per group:
                                                              min =          4
                                                              avg =        8.6
                                                              max =         11

                                                LR chi2(7)        =       5.60
Log likelihood  = -44.849484                    Prob > chi2       =     0.5872
```

misst1losses2mvquarterly	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	.0646326	.5217972	0.12	0.901	-.958071	1.087336
Levt1início	-1.062176	2.410619	-0.44	0.659	-5.786903	3.662551
independency	.5622134	1.658838	0.34	0.735	-2.68905	3.813477
lt2	-.5495893	1.28577	-0.43	0.669	-3.069652	1.970474
exop	-4031.451	490941	-0.01	0.993	-966258.1	958195.2
exlt	4020.813	490941	0.01	0.993	-958205.9	966247.5
grop	30.71286	42.30467	0.73	0.468	-52.20278	113.6285

```
. estimates store fe

. hausman fe re

Note: the rank of the differenced variance matrix (1) does not equal the number of coefficients being tested (7);
        be sure this is what you expect, or there may be problems computing the test.  Examine the output of your
        estimators for anything unexpected and possibly consider scaling your variables so that the coefficients
        are on a similar scale.
```

	Coefficients (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
Sizet1início	.0646326	-.1738303	.238463	.5177398
Levt1início	-1.062176	-.1876276	-.8745485	2.022665
independency	.5622134	1.272956	-.7107422	1.26328
lt2	-.5495893	-.5726369	.0230476	.9983383
exop	-4031.451	3.531207	-4034.983	490941
exlt	4020.813	-7.011242	4027.824	490941
grop	30.71286	39.88268	-9.169826	35.88092

```
                         b = consistent under Ho and Ha; obtained from xtlogit
          B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

    Test:  Ho:  difference in coefficients not systematic

                  chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        0.00
                Prob>chi2 =      0.9934


. quietly xtlogit misst1losses2mvquarterly Sizet1início Levt1início independency lt2 exop exlt grop, re noconstant

. margins, dydx(*) predict(pr)

Average marginal effects                        Number of obs     =        341
Model VCE    : OIM

Expression   : Pr(misst1losses2mvquarterly=1), predict(pr)
dy/dx w.r.t. : Sizet1início Levt1início independency lt2 exop exlt grop
```

	dy/dx	Delta-method Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.0122757	.0046378	-2.65	0.008	-.0213657	-.0031857
Levt1início	-.0132501	.0925042	-0.14	0.886	-.1945549	.1680548
independency	.0898949	.0769139	1.17	0.242	-.0608536	.2406434
lt2	-.0404391	.0569622	-0.71	0.478	-.1520829	.0712047
exop	.2493704	2.951077	0.08	0.933	-5.534635	6.033375
exlt	-.4951272	3.246112	-0.15	0.879	-6.857389	5.867135
grop	2.816476	1.59386	1.77	0.077	-.3074317	5.940385

```
. estat ic

Akaike's information criterion and Bayesian information criterion
```

Model	N	ll(null)	ll(model)	df	AIC	BIC
.	341	.	-95.10818	8	206.2164	236.8714

Note: BIC uses N = number of observations. See **[R] BIC note**.

$$\boldsymbol{Miss\_Zero\_Quarter}_{i,t} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1}LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t} \ (12.a)$$

Model considering LT > 3

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 3 years

xtlogit misst1losses2mvquarterly Sizet1início Levt1início independency lt3 exop exlt grop, re noconstant

```
Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        6.8
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =      66.35
Log likelihood  = -95.222733                    Prob > chi2       =     0.0000
```

misst1losses2mvquarterly	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.2132522	.05887	-3.62	0.000	-.3286352	-.0978692
Levt1início	-.8104782	1.426549	-0.57	0.570	-3.606464	1.985507
independency	1.55448	1.116301	1.39	0.164	-.6334291	3.742389
lt3	.3714617	.6399903	0.58	0.562	-.8828963	1.62582
exop	-5.53061	33.57186	-0.16	0.869	-71.33025	60.26903
exlt	4.918242	40.40535	0.12	0.903	-74.27479	84.11128
grop	39.57424	22.41101	1.77	0.077	-4.350531	83.49901
/lnsig2u	-.0995694	.7774713			-1.623385	1.424246
sigma_u	.9514343	.3698564			.4441057	2.038314
rho	.2157823	.1315639			.0565599	.5580863

```
LR test of rho=0: chibar2(01) = 3.97                  Prob >= chibar2 = 0.023

. estimates store re
```

xtlogit misst1losses2mvquarterly Sizet1início Levt1início independency lt3 exop exlt grop, fe noconstant

```
Conditional fixed-effects logistic regression   Number of obs     =        154
Group variable: firm                            Number of groups  =         18

                                                Obs per group:
                                                              min =          4
                                                              avg =        8.6
                                                              max =         11

                                                LR chi2(7)        =       4.52
Log likelihood  = -45.391166                    Prob > chi2       =     0.7188
```

misst1losses2mvquarterly	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.0154597	.5181485	-0.03	0.976	-1.031012	1.000093
Levt1início	-2.751304	2.3872	-1.15	0.249	-7.430129	1.927522
independency	.9181034	1.776547	0.52	0.605	-2.563865	4.400072
lt3	.7813089	1.222311	0.64	0.523	-1.614376	3.176994
exop	-125.8814	116.6427	-1.08	0.280	-354.4969	102.7342
exlt	127.1166	123.75	1.03	0.304	-115.4289	369.6621
grop	.3179972	37.56664	0.01	0.993	-73.31127	73.94727

```
. estimates store fe
```

```
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                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       fe           re         Difference          S.E.
-------------+----------------------------------------------------------------
Sizet1início |   -.0154597    -.2132522        .1977925        .5147933
 Levt1início |   -2.751304    -.8104782       -1.940825        1.914074
independency |    .9181034      1.55448       -.6363763        1.382025
         lt3 |    .7813089     .3714617        .4098473        1.041372
        exop |   -125.8814     -5.53061       -120.3507         111.707
        exlt |    127.1166     4.918242        122.1984        116.9678
        grop |    .3179972     39.57424       -39.25624        30.14962
------------------------------------------------------------------------------
                         b = consistent under Ho and Ha; obtained from xtlogit
          B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

    Test:  Ho:  difference in coefficients not systematic

                  chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        5.66
                Prob>chi2 =      0.5799


. quietly xtlogit misst1losses2mvquarterly Sizet1início Levt1início independency lt3 exop exlt grop, re noconstant

. margins, dydx(*) predict(pr)

Average marginal effects                        Number of obs     =        341
Model VCE    : OIM

Expression   : Pr(misst1losses2mvquarterly=1), predict(pr)
dy/dx w.r.t. : Sizet1início Levt1início independency lt3 exop exlt grop

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Sizet1início |  -.0150011   .0041378    -3.63   0.000     -.023111   -.0068911
 Levt1início |  -.0570126    .100037    -0.57   0.569    -.2530814    .1390562
independency |   .1093489   .0798709     1.37   0.171    -.0471953    .2658931
         lt3 |   .0261302   .0451176     0.58   0.562    -.0622987    .1145592
        exop |  -.3890473   2.356708    -0.17   0.869     -5.00811    4.230016
        exlt |   .3459707   2.837862     0.12   0.903    -5.216138    5.908079
        grop |   2.783825   1.595625     1.74   0.081    -.3435422    5.911192
------------------------------------------------------------------------------

. estat ic

Akaike's information criterion and Bayesian information criterion

-----------------------------------------------------------------------------
       Model |        Obs  ll(null)  ll(model)      df         AIC        BIC
-------------+---------------------------------------------------------------
           . |        341         .  -95.22273       8    206.4455   237.1005
-----------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.
```

$$\boldsymbol{Miss\_Zero\_Quarter}_{\,i,t} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1}LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t} \ (12.a)$$

Model considering LT > 4

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 4 years

xtlogit misst1losses2mvquarterly Sizet1início Levt1início independency lt4 exop exlt grop, re noconstant

```
Random-effects logistic regression              Number of obs     =        341
Group variable: firm                            Number of groups  =         50

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        6.8
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =      66.30
Log likelihood  = -94.747761                    Prob > chi2       =     0.0000
```

misst1losses2mvquarterly	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.2144425	.0567255	-3.78	0.000	-.3256225	-.1032626
Levt1início	-.7517038	1.367367	-0.55	0.582	-3.431693	1.928286
independency	1.619195	1.09623	1.48	0.140	-.5293773	3.767766
lt4	.4689685	.5772183	0.81	0.417	-.6623586	1.600296
exop	-8.720817	27.21129	-0.32	0.749	-62.05397	44.61234
exlt	15.48893	36.0652	0.43	0.668	-55.19757	86.17543
grop	37.90664	22.61709	1.68	0.094	-6.422047	82.23532
/lnsig2u	-.1453858	.7744687			-1.663317	1.372545
sigma_u	.9298864	.360084			.4353268	1.986298
rho	.2081302	.1276417			.0544665	.5452998

```
LR test of rho=0: chibar2(01) = 3.87                   Prob >= chibar2 = 0.025

. estimates store re
```

xtlogit misst1losses2mvquarterly Sizet1início Levt1início independency lt4 exop exlt grop, fe noconstant

```
Conditional fixed-effects logistic regression   Number of obs     =        154
Group variable: firm                            Number of groups  =         18

                                                Obs per group:
                                                              min =          4
                                                              avg =        8.6
                                                              max =         11

                                                LR chi2(7)        =       3.93
Log likelihood  = -45.684809                    Prob > chi2       =     0.7879
```

misst1losses2mvquarterly	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.1668214	.5343309	-0.31	0.755	-1.214091	.8804479
Levt1início	-2.99522	2.538055	-1.18	0.238	-7.969716	1.979275
independency	.9720986	1.790172	0.54	0.587	-2.536574	4.480772
lt4	.7656352	1.07915	0.71	0.478	-1.349459	2.88073
exop	-53.71285	50.27631	-1.07	0.285	-152.2526	44.82691
exlt	97.30003	82.98475	1.17	0.241	-65.34708	259.9471
grop	-11.41022	39.40602	-0.29	0.772	-88.64459	65.82415

```
. estimates store fe
```

```
. hausman fe re

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       fe           re         Difference          S.E.
-------------+----------------------------------------------------------------
Sizet1início |   -.1668214    -.2144425        .0476211        .5313113
 Levt1início |    -2.99522    -.7517038       -2.243516         2.13823
independency |    .9720986     1.619195        -.647096        1.415272
         lt4 |    .7656352     .4689685        .2966668        .9118022
        exop |   -53.71285    -8.720817       -44.99203        42.27591
        exlt |    97.30003     15.48893         81.8111          74.738
        grop |   -11.41022     37.90664       -49.31686         32.2692
------------------------------------------------------------------------------
                         b = consistent under Ho and Ha; obtained from xtlogit
          B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

    Test:  Ho:  difference in coefficients not systematic

                  chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        6.63
                Prob>chi2 =      0.4682

. quietly xtlogit misst1losses2mvquarterly Sizet1início Levt1início independency lt4 exop exlt grop, re noconstant

. margins, dydx(*) predict(pr)

Average marginal effects                        Number of obs     =        341
Model VCE    : OIM

Expression   : Pr(misst1losses2mvquarterly=1), predict(pr)
dy/dx w.r.t. : Sizet1início Levt1início independency lt4 exop exlt grop

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Sizet1início |  -.0149724   .0039575    -3.78   0.000     -.022729   -.0072157
 Levt1início |  -.0524839   .0952531    -0.55   0.582    -.2391765    .1342087
independency |    .113052   .0780484     1.45   0.147    -.0399201     .266024
         lt4 |   .0327433   .0405222     0.81   0.419    -.0466787    .1121653
        exop |  -.6088864   1.895132    -0.32   0.748    -4.323276    3.105503
        exlt |   1.081435   2.508118     0.43   0.666    -3.834385    5.997255
        grop |   2.646637   1.599879     1.65   0.098    -.4890691    5.782343
------------------------------------------------------------------------------
```

$$Miss\_Zero\_Quarter_{i,t} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1} LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t} \ (12.a)$$

Model considering LT > 5

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 5 years

xtlogit misst1losses2mvquarterly Sizet1início Levt1início independency lt5 exop exlt grop, re noconstant

```
Random-effects logistic regression              Number of obs     =        341
Group variable: firm                            Number of groups  =         50

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        6.8
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =      67.55
Log likelihood  = -95.266642                    Prob > chi2       =     0.0000
```

misst1losses2mvquarterly	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.2035805	.0552796	-3.68	0.000	-.3119265	-.0952346
Levt1início	-.5111707	1.311638	-0.39	0.697	-3.081935	2.059593
independency	1.436781	1.093396	1.31	0.189	-.7062367	3.579798
lt5	.0692576	.6877177	0.10	0.920	-1.278644	1.41716
exop	-9.629514	24.58328	-0.39	0.695	-57.81186	38.55283
exlt	19.17771	36.97445	0.52	0.604	-53.29087	91.6463
grop	42.9205	22.97903	1.87	0.062	-2.117578	87.95857
/lnsig2u	-.1358313	.7410516			-1.588266	1.316603
sigma_u	.9343393	.3461968			.451973	1.931509
rho	.2097093	.1228154			.0584633	.5313976

```
LR test of rho=0: chibar2(01) = 4.22                  Prob >= chibar2 = 0.020
```

estimates store re

xtlogit misst1losses2mvquarterly Sizet1início Levt1início independency lt5 exop exlt grop, fe noconstant

```
Conditional fixed-effects logistic regression   Number of obs     =        154
Group variable: firm                            Number of groups  =         18

                                                Obs per group:
                                                              min =          4
                                                              avg =        8.6
                                                              max =         11

                                                LR chi2(7)        =       5.11
Log likelihood  = -45.094044                    Prob > chi2       =     0.6465
```

misst1losses2mvquarterly	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.2314789	.5282034	-0.44	0.661	-1.266738	.8037807
Levt1início	-3.049457	2.509413	-1.22	0.224	-7.967816	1.868902
independency	1.393583	1.858182	0.75	0.453	-2.248387	5.035553
lt5	.9426149	1.325692	0.71	0.477	-1.655693	3.540923
exop	-58.7006	49.05877	-1.20	0.231	-154.854	37.45282
exlt	139.6823	86.33091	1.62	0.106	-29.52314	308.8878
grop	-13.23857	39.07934	-0.34	0.735	-89.83266	63.35552

```
. estimates store fe
```

```
. hausman fe re

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |      fe           re          Difference          S.E.
-------------+----------------------------------------------------------------
Sizet1início |   -.2314789    -.2035805       -.0278983        .5253028
 Levt1início |   -3.049457    -.5111707       -2.538286        2.139336
independency |    1.393583     1.436781       -.0431976         1.50244
         lt5 |    .9426149     .0692576        .8733573        1.133359
        exop |    -58.7006    -9.629514       -49.07109        42.45498
        exlt |    139.6823     19.17771        120.5046        78.01228
        grop |   -13.23857      42.9205       -56.15907        31.60947
------------------------------------------------------------------------------
                         b = consistent under Ho and Ha; obtained from xtlogit
          B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

    Test:  Ho:  difference in coefficients not systematic

                  chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        7.62
                Prob>chi2 =      0.3672
```

quietly xtlogit misst1losses2mvquarterly Sizet1início Levt1início independency lt5 exop exlt grop, re noconstant

```
. margins, dydx(*) predict(pr)

Average marginal effects                        Number of obs     =        341
Model VCE    : OIM

Expression   : Pr(misst1losses2mvquarterly=1), predict(pr)
dy/dx w.r.t. : Sizet1início Levt1início independency lt5 exop exlt grop

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Sizet1início |  -.0143543   .0038686    -3.71   0.000    -.0219366    -.006772
 Levt1início |  -.0360422   .0923252    -0.39   0.696    -.2169962    .1449118
independency |   .1013062   .0784248     1.29   0.196    -.0524036    .2550159
         lt5 |   .0048833   .0484909     0.10   0.920     -.090157    .0999236
        exop |  -.6789687    1.73143    -0.39   0.695    -4.072508    2.714571
        exlt |   1.352204   2.603383     0.52   0.603    -3.750334    6.454741
        grop |   3.026287   1.642591     1.84   0.065    -.1931325    6.245707
------------------------------------------------------------------------------


. estat ic

Akaike's information criterion and Bayesian information criterion

-----------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df         AIC        BIC
-------------+---------------------------------------------------------------
           . |        341          .  -95.26664       8    206.5333   237.1883
-----------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.
```

$$\boldsymbol{Miss\_Zero\_Quarter}_{\,i,t} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1} LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t} \ (12.a)$$

Model considering LT > 6

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 6 years

xtlogit misst1losses2mvquarterly Sizet1início Levt1início independency lt6 exop exlt grop, re noconstant

```
Random-effects logistic regression              Number of obs      =       341
Group variable: firm                            Number of groups   =        50

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        6.8
                                                              max =         11

Integration method: mvaghermite                 Integration pts.   =        12

                                                Wald chi2(7)       =     69.35
Log likelihood  = -95.241812                    Prob > chi2        =    0.0000
```

misst1losses2mvquarterly	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.2037263	.0543364	-3.75	0.000	-.3102237	-.0972288
Levt1início	-.4870164	1.299106	-0.37	0.708	-3.033217	2.059184
independency	1.431131	1.086562	1.32	0.188	-.6984925	3.560754
lt6	.4227619	1.172512	0.36	0.718	-1.875319	2.720842
exop	2.51359	20.6019	0.12	0.903	-37.86539	42.89257
exlt	-89.56338	258.0717	-0.35	0.729	-595.3746	416.2478
grop	38.02944	22.48542	1.69	0.091	-6.041182	82.10006
/lnsig2u	-.2226957	.7603093			-1.712875	1.267483
sigma_u	.8946275	.3400968			.4246724	1.884649
rho	.1956758	.1196626			.0519699	.5191495

```
LR test of rho=0: chibar2(01) = 3.79                 Prob >= chibar2 = 0.026

. estimates store re
```

xtlogit misst1losses2mvquarterly Sizet1início Levt1início independency lt6 exop exlt grop, fe noconstant

```
Conditional fixed-effects logistic regression   Number of obs      =       154
Group variable: firm                            Number of groups   =        18

                                                Obs per group:
                                                              min =          4
                                                              avg =        8.6
                                                              max =         11

                                                LR chi2(7)         =      2.01
Log likelihood  = -46.643057                    Prob > chi2        =    0.9592
```

misst1losses2mvquarterly	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.012935	.523809	-0.02	0.980	-1.039582	1.013712
Levt1início	-2.142842	2.34571	-0.91	0.361	-6.740349	2.454665
independency	.2964413	1.642828	0.18	0.857	-2.923443	3.516325
lt6	.1958736	1.52442	0.13	0.898	-2.791936	3.183683
exop	-27.22238	35.07044	-0.78	0.438	-95.95919	41.51443
exlt	-149.3137	362.7569	-0.41	0.681	-860.3042	561.6768
grop	-9.264885	38.49441	-0.24	0.810	-84.71253	66.18276

```
. estimates store fe
```

```
. hausman fe re

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |      fe           re          Difference          S.E.
-------------+----------------------------------------------------------------
Sizet1início |   -.012935    -.2037263        .1907912        .5209832
 Levt1início |  -2.142842    -.4870164       -1.655826        1.953121
independency |   .2964413     1.431131       -1.134689         1.23218
         lt6 |   .1958736     .4227619       -.2268883        .9742045
        exop |  -27.22238      2.51359       -29.73597        28.38129
        exlt |  -149.3137    -89.56338       -59.75028        254.9345
        grop |  -9.264885     38.02944       -47.29432         31.2446
------------------------------------------------------------------------------
                          b = consistent under Ho and Ha; obtained from xtlogit
          B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

    Test:  Ho:  difference in coefficients not systematic

                  chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        6.43
                Prob>chi2 =      0.4906
```

Quietly xtlogit misst1losses2mvquarterly Sizet1início Levt1início independency lt6 exop exlt grop, re noconstant

```
. margins, dydx(*) predict(pr)

Average marginal effects                        Number of obs     =        341
Model VCE    : OIM

Expression   : Pr(misst1losses2mvquarterly=1), predict(pr)
dy/dx w.r.t. : Sizet1início Levt1início independency lt6 exop exlt grop

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Sizet1início |  -.0144432   .0038387    -3.76   0.000    -.0219669   -.0069194
 Levt1início |   -.034527   .0919406    -0.38   0.707    -.2147274    .1456734
independency |   .1014599   .0784157     1.29   0.196     -.052232    .2551519
         lt6 |   .0299717   .0832373     0.36   0.719    -.1331704    .1931138
        exop |   .1782008   1.461599     0.12   0.903     -2.68648    3.042882
        exlt |   -6.34959    18.3241    -0.35   0.729    -42.26416    29.56498
        grop |   2.696095   1.609584     1.68   0.094    -.4586316    5.850821
------------------------------------------------------------------------------


. estat ic

Akaike's information criterion and Bayesian information criterion

-----------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df         AIC        BIC
-------------+---------------------------------------------------------------
           . |        341          .  -95.24181       8    206.4836   237.1387
-----------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.
```

Miss_Zero Year

$$\boldsymbol{Miss}_{Zero_{Year}\,i,t} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1} LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t} \; (12.b)$$

Model considering LT > 2

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 2 years

xtlogit misst1losses2mv Sizet1início Levt1início ceochairman lt2 exop exlt grop, re noconstant

```
Random-effects logistic regression              Number of obs     =        557
Group variable: firm                            Number of groups  =         81

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        6.9
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =      73.83
Log likelihood  = -90.939271                    Prob > chi2       =     0.0000
```

misst1losses2mv	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.2207568	.0619715	-3.56	0.000	-.3422187	-.0992948
Levt1início	.3252328	1.02395	0.32	0.751	-1.681673	2.332138
ceochairman	-1.023242	1.098748	-0.93	0.352	-3.17675	1.130265
lt2	-.4732403	.7565284	-0.63	0.532	-1.956009	1.009528
exop	-75.41814	132.5215	-0.57	0.569	-335.1554	184.3191
exlt	85.43791	133.4164	0.64	0.522	-176.0535	346.9293
grop	-1.652233	29.45669	-0.06	0.955	-59.38628	56.08181
/lnsig2u	.0923199	.9190419			-1.708969	1.893609
sigma_u	1.047242	.4812296			.4255025	2.57746
rho	.2500159	.1723276			.0521626	.6687997

```
LR test of rho=0: chibar2(01) = 2.01                  Prob >= chibar2 = 0.078

. estimates store re
```

xtlogit misst1losses2mv Sizet1início Levt1início ceochairman lt2 exop exlt grop, fe noconstant

```
Conditional fixed-effects logistic regression   Number of obs     =        133
Group variable: firm                            Number of groups  =         18

                                                Obs per group:
                                                              min =          3
                                                              avg =        7.4
                                                              max =         11

                                                LR chi2(7)        =       9.13
Log likelihood  = -32.017603                    Prob > chi2       =     0.2436
```

misst1losses2mv	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.0808024	.6957608	-0.12	0.908	-1.444468	1.282864
Levt1início	1.028592	2.288983	0.45	0.653	-3.457733	5.514917
ceochairman	-1.165941	1.159551	-1.01	0.315	-3.43862	1.106737
lt2	-.5460032	1.323799	-0.41	0.680	-3.140602	2.048596
exop	-10254.53	1325281	-0.01	0.994	-2607757	2587248
exlt	10162.38	1325281	0.01	0.994	-2587340	2607665
grop	19.45602	49.79209	0.39	0.696	-78.13468	117.0467

```
. estimates store fe
```

```
. estat ic

Akaike's information criterion and Bayesian information criterion
```

Model	N	ll(null)	ll(model)	df	AIC	BIC
.	557	.	-90.93927	8	197.8785	232.4591

Note: BIC uses N = number of observations. See [R] BIC note.

```
. hausman fe re

Note: the rank of the differenced variance matrix (1) does not equal the number of coefficients being tested (7);
        be sure this is what you expect, or there may be problems computing the test.  Examine the output of your
        estimators for anything unexpected and possibly consider scaling your variables so that the coefficients
        are on a similar scale.
```

	---- Coefficients ---- (b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
Sizet1início	-.0808024	-.2207568	.1399544	.6929954
Levt1início	1.028592	.3252328	.7033588	2.047186
ceochairman	-1.165941	-1.023242	-.1426992	.3705548
lt2	-.5460032	-.4732403	-.0727629	1.086328
exop	-10254.53	-75.41814	-10179.11	1325281
exlt	10162.38	85.43791	10076.94	1325281
grop	19.45602	-1.652233	21.10825	40.14418

```
                          b = consistent under Ho and Ha; obtained from xtlogit
           B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

    Test:  Ho:  difference in coefficients not systematic

                  chi2(1) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        0.00
                Prob>chi2 =      0.9939
```

quietly xtlogit misst1losses2mv Sizet1início Levt1início ceochairman lt2 exop exlt grop, re noconstant

```
. margins, dydx(*) predict(pr)

Average marginal effects                        Number of obs     =        557
Model VCE    : OIM

Expression   : Pr(misst1losses2mv=1), predict(pr)
dy/dx w.r.t. : Sizet1início Levt1início ceochairman lt2 exop exlt grop
```

	dy/dx	Delta-method Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.0084758	.0025654	-3.30	0.001	-.0135038	-.0034478
Levt1início	.0124871	.0393687	0.32	0.751	-.0646742	.0896484
ceochairman	-.0392867	.0429407	-0.91	0.360	-.123449	.0448756
lt2	-.0181697	.0291822	-0.62	0.534	-.0753658	.0390263
exop	-2.89563	5.137117	-0.56	0.573	-12.96419	7.172934
exlt	3.280332	5.179	0.63	0.526	-6.870322	13.43099
grop	-.0634364	1.131166	-0.06	0.955	-2.280482	2.153609

$$\boldsymbol{Miss\_Zero\_Year}_{i,t} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1} LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t} \ (12.b)$$

Model considering LT > 3

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 3 years

xtlogit misst1losses2mv Sizet1início Levt1início ceochairman lt3 exop exlt grop, re noconstant

```
Random-effects logistic regression              Number of obs     =        557
Group variable: firm                            Number of groups  =         81

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        6.9
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =      77.02
Log likelihood  = -89.357396                    Prob > chi2       =     0.0000

------------------------------------------------------------------------------
misst1losses2mv |     Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
----------------+-------------------------------------------------------------
   Sizet1início | -.2673928   .0675359    -3.96   0.000    -.3997608   -.1350248
    Levt1início |  .1936494   1.127541     0.17   0.864    -2.016291     2.40359
    ceochairman | -1.085443   1.093732    -0.99   0.321    -3.229118    1.058233
            lt3 |  .6155935   .7528393     0.82   0.414    -.8599444    2.091131
           exop | -183.4691   320.4206    -0.57   0.567    -811.4819    444.5437
           exlt |  195.1061   320.9697     0.61   0.543     -433.983    824.1952
           grop | -7.558677   29.65491    -0.25   0.799    -65.68122    50.56387
----------------+-------------------------------------------------------------
       /lnsig2u |  -.036462   .9915425                      -1.97985    1.906925
----------------+-------------------------------------------------------------
        sigma_u |  .9819342   .4868147                      .3716046    2.594679
            rho |  .2266527   .1737988                      .0402835    .6717428
------------------------------------------------------------------------------
LR test of rho=0: chibar2(01) = 1.72                  Prob >= chibar2 = 0.095

. estimates store re

convergence not achieved

Conditional fixed-effects logistic regression   Number of obs     =        133
Group variable: firm                            Number of groups  =         18

                                                Obs per group:
                                                              min =          3
                                                              avg =        7.4
                                                              max =         11

                                                LR chi2(6)        =      15.21
Log likelihood  = -28.978929                    Prob > chi2       =     0.0187

------------------------------------------------------------------------------
misst1losses2mv |     Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
----------------+-------------------------------------------------------------
   Sizet1início | -.3187725    .668519    -0.48   0.633    -1.629046    .9915008
    Levt1início | -2.578732   3.112267    -0.83   0.407    -8.678663      3.5212
    ceochairman | -1.072218   1.134718    -0.94   0.345    -3.296225    1.151788
            lt3 | -.0828071   1.267041    -0.07   0.948    -2.566162    2.400548
           exop | -25145.22   62.37367  -403.14   0.000    -25267.47   -25022.97
           exlt |  25052.48          .        .       .            .           .
           grop |  15.89135   49.17338     0.32   0.747    -80.48669    112.2694
------------------------------------------------------------------------------

. estimates store fe
```

```
. hausman fe re

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       fe           re         Difference          S.E.
-------------+----------------------------------------------------------------
Sizet1início |   -.3187725    -.2673928        -.0513797        .6650989
 Levt1início |   -2.578732     .1936494        -2.772381        2.900837
 ceochairman |   -1.072218    -1.085443         .0132242        .3022167
         lt3 |   -.0828071     .6155935        -.6984006         1.01913
        exop |   -25145.22    -183.4691        -24961.75               .
        grop |    15.89135    -7.558677         23.45003        39.22509
------------------------------------------------------------------------------
                         b = consistent under Ho and Ha; obtained from xtlogit
          B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

    Test:  Ho:  difference in coefficients not systematic

                  chi2(6) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          = -5427.87    chi2<0 ==> model fitted on these
                                        data fails to meet the asymptotic
                                        assumptions of the Hausman test;
                                        see suest for a generalized test

. estat ic

Akaike's information criterion and Bayesian information criterion

-----------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df         AIC        BIC
-------------+---------------------------------------------------------------
           . |        557          .   -89.3574       8    194.7148   229.2953
-----------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.

. margins, dydx(*) predict(pr)

Average marginal effects                        Number of obs     =        557
Model VCE    : OIM

Expression   : Pr(misst1losses2mv=1), predict(pr)
dy/dx w.r.t. : Sizet1início Levt1início ceochairman lt3 exop exlt grop

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Sizet1início |  -.0102467   .0029431    -3.48   0.000     -.016015   -.0044784
 Levt1início |   .0074208   .0432283     0.17   0.864     -.077305    .0921467
 ceochairman |  -.0415952   .0427416    -0.97   0.330    -.1253671    .0421768
         lt3 |   .0235901    .029409     0.80   0.422    -.0340505    .0812307
        exop |  -7.030704   12.36531    -0.57   0.570    -31.26626    17.20485
        exlt |   7.476645   12.39267     0.60   0.546    -16.81254    31.76583
        grop |  -.2896554   1.138183    -0.25   0.799    -2.520453    1.941143
------------------------------------------------------------------------------
```

$$\boldsymbol{Miss\_Zero\_Year}_{i,t} = \beta_0 + \ \beta_1 GrOp_{i,t+1} \ + \ \beta_2 ExOp_{i,t+1} \ + \beta_3 LT_{i,t} + \ \beta_4 ExOp_{i,t+1} LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} \ + \ \beta_7 lnA_{i,t-1} + \ \varepsilon_{i,t} \ (12.b)$$

Model considering LT > 4

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 4 years

xtlogit misst1losses2mv Sizet1início Levt1início ceochairman lt4 exop exlt grop, re noconstant

```
Random-effects logistic regression              Number of obs     =        557
Group variable: firm                            Number of groups  =         81

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        6.9
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =      83.06
Log likelihood  = -86.391017                    Prob > chi2       =     0.0000
```

misst1losses2mv	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Sizet1início	-.2820992	.0580731	-4.86	0.000	-.3959205	-.168278
Levt1início	.5319414	1.030303	0.52	0.606	-1.487415	2.551298
ceochairman	-1.226272	1.126765	-1.09	0.276	-3.434692	.9821479
lt4	1.084334	.6044639	1.79	0.073	-.1003935	2.269061
exop	-72.6799	99.50434	-0.73	0.465	-267.7048	122.345
exlt	93.78572	101.063	0.93	0.353	-104.2941	291.8655
grop	-11.0648	27.41035	-0.40	0.686	-64.7881	42.6585
/lnsig2u	-.4050871	1.190839			-2.739088	1.928914
sigma_u	.8166509	.4862498			.2542228	2.623363
rho	.1685506	.1668857			.0192664	.6765729

```
LR test of rho=0: chibar2(01) = 1.06                 Prob >= chibar2 = 0.152

.

. logit misst1losses2mv Sizet1início Levt1início ceochairman lt4 exop exlt grop, noconstant

Iteration 0:   log likelihood = -386.08298
Iteration 1:   log likelihood = -89.971936
Iteration 2:   log likelihood = -87.377479
Iteration 3:   log likelihood = -86.934069
Iteration 4:   log likelihood = -86.920005
Iteration 5:   log likelihood = -86.919932
Iteration 6:   log likelihood = -86.919932

Logistic regression                             Number of obs     =        557
                                                Wald chi2(7)      =     187.16
Log likelihood = -86.919932                     Prob > chi2       =     0.0000
```

misst1losses2mv	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
Sizet1início	-.2621417	.0496961	-5.27	0.000	-.3595442	-.1647392
Levt1início	.4560202	.9583243	0.48	0.634	-1.422261	2.334301
ceochairman	-1.134082	1.104213	-1.03	0.304	-3.2983	1.030136
lt4	1.018267	.5474038	1.86	0.063	-.0546248	2.091159
exop	-63.30263	93.93711	-0.67	0.500	-247.416	120.8107
exlt	85.90868	95.46435	0.90	0.368	-101.198	273.0154
grop	-8.969244	24.61501	-0.36	0.716	-57.21377	39.27528

```
. estat ic
```

Akaike's information criterion and Bayesian information criterion

Model	N	ll(null)	ll(model)	df	AIC	BIC
.	557	.	-86.91993	7	187.8399	218.0978

Note: BIC uses N = number of observations. See **[R] BIC note**.

```
Marginal effects after logit
      y  = Pr(misst1losses2mv) (predict)
         =  .02912751
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.	]	X
Sizet1~o	-.0074131	.00217	-3.41	0.001	-.011671	-.003155	15.2111
Levt1i~o	.0128958	.02713	0.48	0.634	-.040269	.06606	.579296
ceocha~n*	-.0215333	.01391	-1.55	0.122	-.048795	.005729	.087971
lt4*	.031372	.01928	1.63	0.104	-.006408	.069152	.447038
exop	-1.790141	2.42818	-0.74	0.461	-6.5493	2.96901	.005393
exlt	2.42942	2.4005	1.01	0.312	-2.27548	7.13432	.002596
grop	-.2536421	.6983	-0.36	0.716	-1.62229	1.115	.002266

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. estat class, cutoff(0.0394973070017953)
```

Logistic model for misst1losses2mv

	True		
Classified	D	~D	Total
+	16	203	219
-	6	332	338
Total	22	535	557

Classified + if predicted Pr(D) >= .0394973
True D defined as misst1losses2mv != 0

Sensitivity	Pr(+| D)	72.73%
Specificity	Pr(-|~D)	62.06%
Positive predictive value	Pr(D| +)	7.31%
Negative predictive value	Pr(~D| -)	98.22%
False + rate for true ~D	Pr(+|~D)	37.94%
False - rate for true D	Pr(-| D)	27.27%
False + rate for classified +	Pr(~D| +)	92.69%
False - rate for classified -	Pr(D| -)	1.78%
Correctly classified		62.48%

```
. estat gof
```

Logistic model for misst1losses2mv, goodness-of-fit test

```
       number of observations =       557
 number of covariate patterns =       557
             Pearson chi2(550) =       538.00
                   Prob > chi2 =         0.6347
```

$$\boldsymbol{Miss\_Zero\_Year}_{i,t} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1} LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t} \quad (12.b)$$

Model considering LT > 5

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 5 years

xtlogit misst1losses2mv Sizet1início Levt1início ceochairman lt5 exop exlt grop, re noconstant

```
Random-effects logistic regression              Number of obs     =        557
Group variable: firm                            Number of groups  =         81

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        6.9
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =      78.55
Log likelihood  = -86.470107                    Prob > chi2       =     0.0000
```

misst1losses2mv	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.2283677	.0479555	-4.76	0.000	-.3223588	-.1343767
Levt1início	.3331074	.9596747	0.35	0.729	-1.54782	2.214035
ceochairman	-1.61891	1.352926	-1.20	0.231	-4.270596	1.032776
lt5	-.0891999	.7337059	-0.12	0.903	-1.527237	1.348837
exop	-97.2283	71.37901	-1.36	0.173	-237.1286	42.67198
exlt	147.7629	75.53712	1.96	0.050	-.2871483	295.8129
grop	12.87154	33.46566	0.38	0.701	-52.71994	78.46303
/lnsig2u	-.3364163	1.29025			-2.86526	2.192427
sigma_u	.8451779	.5452453			.2386804	2.992812
rho	.1783944	.1891117			.0170216	.731369

```
LR test of rho=0: chibar2(01) = 0.90                  Prob >= chibar2 = 0.171

. logit misst1losses2mv Sizet1início Levt1início ceochairman lt5 exop exlt grop, noconstant

Iteration 0:   log likelihood = -386.08298
Iteration 1:   log likelihood = -89.381536
Iteration 2:   log likelihood = -87.267679
Iteration 3:   log likelihood = -86.930774
Iteration 4:   log likelihood = -86.922346
Iteration 5:   log likelihood = -86.922339

Logistic regression                             Number of obs     =        557
                                                Wald chi2(7)      =     190.55
Log likelihood = -86.922339                     Prob > chi2       =     0.0000
```

misst1losses2mv	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.2131463	.0398635	-5.35	0.000	-.2912773	-.1350153
Levt1início	.3095246	.8655148	0.36	0.721	-1.386853	2.005902
ceochairman	-1.801197	1.458827	-1.23	0.217	-4.660445	1.058052
lt5	.0293921	.6221546	0.05	0.962	-1.190009	1.248793
exop	-88.7598	67.76762	-1.31	0.190	-221.5819	44.0623
exlt	138.0188	71.02604	1.94	0.052	-1.18965	277.2273
grop	18.49783	28.8238	0.64	0.521	-37.99577	74.99143

```
. estat gof

Logistic model for misst1losses2mv, goodness-of-fit test

       number of observations =       557
 number of covariate patterns =       557
            Pearson chi2(550) =       569.08
                  Prob > chi2 =         0.2780

. lroc

Logistic model for misst1losses2mv

number of observations =      557
area under ROC curve   =   0.6160

. estat class, cutoff(0.0394973070017953)

Logistic model for misst1losses2mv

              -------- True --------
Classified |         D            ~D  |      Total
-----------+--------------------------+-----------
     +     |        13           234  |        247
     -     |         9           301  |        310
-----------+--------------------------+-----------
   Total   |        22           535  |        557

Classified + if predicted Pr(D) >= .0394973
True D defined as misst1losses2mv != 0
--------------------------------------------------
Sensitivity                     Pr( +| D)   59.09%
Specificity                     Pr( -|~D)   56.26%
Positive predictive value       Pr( D| +)    5.26%
Negative predictive value       Pr(~D| -)   97.10%
--------------------------------------------------
False + rate for true ~D        Pr( +|~D)   43.74%
False - rate for true D         Pr( -| D)   40.91%
False + rate for classified +   Pr(~D| +)   94.74%
False - rate for classified -   Pr( D| -)    2.90%
--------------------------------------------------
Correctly classified                        56.37%
--------------------------------------------------

. estat ic

Akaike's information criterion and Bayesian information criterion

-----------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df         AIC        BIC
-------------+---------------------------------------------------------------
           . |        557          .  -86.92234       7    187.8447   218.1026
-----------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.

. mfx

Marginal effects after logit
      y  = Pr(misst1losses2mv) (predict)
         =  .02914075
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
Sizet1~o |  -.0060302      .00188   -3.21   0.001  -.009714 -.002347   15.2111
Levt1i~o |   .0087569      .02451    0.36   0.721   -.03928  .056794   .579296
ceocha~n*|  -.0282012      .01211   -2.33   0.020   -.05194 -.004462   .087971
    lt5* |   .0008396      .01797    0.05   0.963  -.034374  .036053   .152603
    exop |  -2.511154     1.61179   -1.56   0.119  -5.67021  .647902   .005393
    exlt |   3.904769     1.56725    2.49   0.013   .833017  6.97652   .001069
    grop |   .5233327       .8109    0.65   0.519  -1.06601  2.11267   .002266
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

$$\boldsymbol{Miss\_Zero\_Year}_{i,t} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1} LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t} \ (12.b)$$

Model considering LT > 6

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 5 years

xtlogit misst1losses2mv Sizet1início Levt1início ceochairman lt6 exop exlt grop, re noconstant

```
Random-effects logistic regression              Number of obs     =        557
Group variable: firm                            Number of groups  =         81

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        6.9
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =      70.53
Log likelihood  = -88.754989                    Prob > chi2       =     0.0000

------------------------------------------------------------------------------
misst1losses2mv |     Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
----------------+-------------------------------------------------------------
  Sizet1início  | -.2365882   .0501062    -4.72   0.000    -.3347945    -.138382
   Levt1início  |  .2896405   1.020886     0.28   0.777    -1.711259     2.29054
   ceochairman  | -1.584837   1.323668    -1.20   0.231    -4.179179    1.009505
           lt6  |  -2.48921   2.610126    -0.95   0.340    -7.604963    2.626542
          exop  | -31.92189    35.5214    -0.90   0.369    -101.5426    37.69878
          exlt  |  109.9849   57.69759     1.91   0.057    -3.100301    223.0701
          grop  |  8.715029   31.68566     0.28   0.783    -53.38773    70.81779
----------------+-------------------------------------------------------------
      /lnsig2u  |  .1925406    .880748                     -1.533694    1.918775
----------------+-------------------------------------------------------------
       sigma_u  |  1.101057   .4848767                      .4644753    2.610097
           rho  |  .2692744    .173301                      .0615407    .6743503
------------------------------------------------------------------------------
LR test of rho=0: chibar2(01) = 2.25                   Prob >= chibar2 = 0.067

. estimates store re
```

xtlogit misst1losses2mv Sizet1início Levt1início ceochairman lt6 exop exlt grop, fe noconstant

```
Conditional fixed-effects logistic regression   Number of obs     =        133
Group variable: firm                            Number of groups  =         18

                                                Obs per group:
                                                              min =          3
                                                              avg =        7.4
                                                              max =         11

                                                LR chi2(5)        =       7.96
Log likelihood  = -32.602403                    Prob > chi2       =     0.1585

------------------------------------------------------------------------------
misst1losses2mv |     Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
----------------+-------------------------------------------------------------
  Sizet1início  | -.2373781   .5974586    -0.40   0.691    -1.408375    .9336191
   Levt1início  |  .9413628   2.260416     0.42   0.677    -3.488972    5.371697
   ceochairman  | -1.156551   1.164554    -0.99   0.321    -3.439034    1.125933
           lt6  |         0  (omitted)
          exop  | -106.6511   56.06005    -1.90   0.057    -216.5268    3.224538
          exlt  |         0  (omitted)
          grop  |  15.43525   49.10114     0.31   0.753    -80.80122    111.6717
------------------------------------------------------------------------------

. estimates store fe
```

```
. hausman fe re

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |      fe           re          Difference          S.E.
-------------+----------------------------------------------------------------
Sizet1início |   -.2373781    -.2365882       -.0007899        .5953538
 Levt1início |    .9413628     .2896405        .6517223        2.016748
 ceochairman |   -1.156551    -1.584837        .4282861               .
        exop |   -106.6511    -31.92189       -74.72925        43.37003
        grop |    15.43525     8.715029        6.720221        37.50921
------------------------------------------------------------------------------
                         b = consistent under Ho and Ha; obtained from xtlogit
          B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

    Test:  Ho:  difference in coefficients not systematic

                  chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        2.54
                Prob>chi2 =      0.7707
                (V_b-V_B is not positive definite)
. quietly xtlogit misst1losses2mv Sizet1início Levt1início ceochairman lt6 exop exlt grop, re noconstant

. margins, dydx(*) predict(pr)

Average marginal effects                        Number of obs     =        557
Model VCE    : OIM

Expression   : Pr(misst1losses2mv=1), predict(pr)
dy/dx w.r.t. : Sizet1início Levt1início ceochairman lt6 exop exlt grop

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Sizet1início |  -.0088749   .0020768    -4.27   0.000    -.0129453   -.0048046
 Levt1início |   .0108651   .0383352     0.28   0.777    -.0642705    .0860006
 ceochairman |  -.0594507   .0509599    -1.17   0.243    -.1593304    .0404289
         lt6 |  -.0933758   .0995718    -0.94   0.348     -.288533    .1017814
        exop |  -1.197461   1.359815    -0.88   0.379    -3.862649    1.467728
        exlt |   4.125777   2.294355     1.80   0.072    -.3710763    8.622629
        grop |     .32692   1.189608     0.27   0.783    -2.004669    2.658509
------------------------------------------------------------------------------

. estat ic

Akaike's information criterion and Bayesian information criterion

-----------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df         AIC        BIC
-------------+---------------------------------------------------------------
           . |        557          .  -88.75499       8      193.51   228.0905
-----------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.
```

Miss_Zero DA

$$\boldsymbol{Miss\_Zero}\ (\boldsymbol{DA})_{i,t} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1} LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t}\ (12.c)$$

Model considering LT > 2

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 2 years

xtlogit misst1zeroda Sizet1início Levt1início ceochairman lt2 exop exlt grop, re noconstant

```
Random-effects logistic regression              Number of obs     =        556
Group variable: firm                            Number of groups  =         81

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        6.9
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =      98.86
Log likelihood  = -154.06031                    Prob > chi2       =     0.0000
```

misst1zeroda	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.2096583	.046587	-4.50	0.000	-.3009672	-.1183493
Levt1início	1.285761	.7236246	1.78	0.076	-.1325174	2.704039
ceochairman	-1.215547	.8296439	-1.47	0.143	-2.841619	.410525
lt2	-.6008965	.589883	-1.02	0.308	-1.757046	.5552529
exop	28.64512	40.11404	0.71	0.475	-49.97696	107.2672
exlt	-.5018515	42.37409	-0.01	0.991	-83.55355	82.54985
grop	26.51694	17.69471	1.50	0.134	-8.164054	61.19794
/lnsig2u	.1597718	.5899645			-.9965373	1.316081
sigma_u	1.083163	.319514			.6075817	1.931005
rho	.2628756	.1143186			.1008891	.5312675

```
LR test of rho=0: chibar2(01) = 8.62                 Prob >= chibar2 = 0.002

. estimates store re

.
```

xtlogit misst1zeroda Sizet1início Levt1início ceochairman lt2 exop exlt grop, fe noconstant

```
Conditional fixed-effects logistic regression   Number of obs     =        209
Group variable: firm                            Number of groups  =         29

                                                Obs per group:
                                                              min =          2
                                                              avg =        7.2
                                                              max =         11

                                                LR chi2(7)        =      19.37
Log likelihood  = -64.188185                    Prob > chi2       =     0.0071
```

misst1zeroda	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	1.468511	.6147592	2.39	0.017	.2636053	2.673417
Levt1início	-.5334667	1.579391	-0.34	0.736	-3.629016	2.562083
ceochairman	-.8460737	.8766497	-0.97	0.334	-2.564276	.8721281
lt2	.4035964	.9591577	0.42	0.674	-1.476318	2.283511
exop	-67.00322	61.94907	-1.08	0.279	-188.4212	54.41471
exlt	91.46432	66.69797	1.37	0.170	-39.26131	222.1899
grop	78.37252	36.5596	2.14	0.032	6.717015	150.028

```
. estimates store fe
```

```
. hausman fe re

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       fe           re         Difference          S.E.
-------------+----------------------------------------------------------------
Sizet1início |    1.468511    -.2096583        1.678169        .6129914
 Levt1início |   -.5334667     1.285761       -1.819227        1.403867
 ceochairman |   -.8460737    -1.215547        .3694734        .2832061
         lt2 |    .4035964    -.6008965        1.004493         .756321
        exop |   -67.00322     28.64512       -95.64834        47.20752
        exlt |    91.46432    -.5018515        91.96617        51.50782
        grop |    78.37252     26.51694        51.85557        31.99221
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtlogit
            B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

    Test:  Ho:  difference in coefficients not systematic

                  chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       16.32
                Prob>chi2 =      0.0223
```

Odds Ratio:

```
. xtlogit misst1zeroda Sizet1início Levt1início ceochairman lt2 exop exlt grop, fe noconstant
note: multiple positive outcomes within groups encountered.
note: 52 groups (347 obs) dropped because of all positive or
      all negative outcomes.

Iteration 0:   log likelihood = -69.944144
Iteration 1:   log likelihood = -64.266538
Iteration 2:   log likelihood = -64.188508
Iteration 3:   log likelihood = -64.188185
Iteration 4:   log likelihood = -64.188185

Conditional fixed-effects logistic regression   Number of obs     =        209
Group variable: firm                            Number of groups  =         29

                                                Obs per group:
                                                              min =          2
                                                              avg =        7.2
                                                              max =         11

                                                LR chi2(7)        =      19.37
Log likelihood  = -64.188185                    Prob > chi2       =     0.0071

------------------------------------------------------------------------------
misst1zeroda |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Sizet1início |   1.468511   .6147592     2.39   0.017     .2636053    2.673417
 Levt1início |  -.5334667   1.579391    -0.34   0.736    -3.629016    2.562083
 ceochairman |  -.8460737   .8766497    -0.97   0.334    -2.564276    .8721281
         lt2 |   .4035964   .9591577     0.42   0.674    -1.476318    2.283511
        exop |  -67.00322   61.94907    -1.08   0.279    -188.4212    54.41471
        exlt |   91.46432   66.69797     1.37   0.170    -39.26131    222.1899
        grop |   78.37252    36.5596     2.14   0.032     6.717015     150.028
------------------------------------------------------------------------------

. estat ic

Akaike's information criterion and Bayesian information criterion

-----------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df         AIC        BIC
-------------+---------------------------------------------------------------
           . |        209  -73.87146  -64.18818       7    142.3764   165.7727
-----------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.
```

$$\boldsymbol{Miss\_Zero}\ (\boldsymbol{DA})_{\boldsymbol{i},\boldsymbol{t}} = \beta_0 + \ \beta_1 GrOp_{i,t+1}\ +\ \beta_2 ExOp_{i,t+1}\ + \beta_3 LT_{i,t} +\ \beta_4 ExOp_{i,t+1} LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1}\ +\ \beta_7 lnA_{i,t-1} +\ \varepsilon_{i,t}\ (12.c)$$

Model considering LT > 3

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 3 years

xtlogit misst1zeroda Sizet1início Levt1início ceochairman lt3 exop exlt grop, re noconstant

```
Random-effects logistic regression              Number of obs     =        556
Group variable: firm                            Number of groups  =         81

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        6.9
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =      93.45
Log likelihood  = -154.55767                    Prob > chi2       =     0.0000
```

misst1zeroda	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.248385	.0436343	-5.69	0.000	-.3339067	-.1628634
Levt1início	1.191421	.7536572	1.58	0.114	-.2857201	2.668562
ceochairman	-1.268283	.8346733	-1.52	0.129	-2.904213	.3676462
lt3	.1113665	.497506	0.22	0.823	-.8637272	1.08646
exop	31.32714	23.0143	1.36	0.173	-13.78006	76.43433
exlt	-6.74925	28.09382	-0.24	0.810	-61.81212	48.31362
grop	27.03123	17.56266	1.54	0.124	-7.390954	61.45341
/lnsig2u	.3399405	.5484014			-.7349065	1.414787
sigma_u	1.18527	.3250018			.6924957	2.028697
rho	.2992426	.1149978			.1272213	.5557522

```
LR test of rho=0: chibar2(01) = 11.38                 Prob >= chibar2 = 0.000
```

estimates store re2

```
. xtlogit misst1zeroda Sizet1início Levt1início ceochairman lt3 exop exlt grop, fe noconstant
note: multiple positive outcomes within groups encountered.
note: 52 groups (347 obs) dropped because of all positive or
      all negative outcomes.

Iteration 0:   log likelihood = -70.859001
Iteration 1:   log likelihood = -64.442977
Iteration 2:   log likelihood = -64.037738
Iteration 3:   log likelihood = -64.036526
Iteration 4:   log likelihood = -64.036526

Conditional fixed-effects logistic regression   Number of obs     =        209
Group variable: firm                            Number of groups  =         29

                                                Obs per group:
                                                              min =          2
                                                              avg =        7.2
                                                              max =         11

                                                LR chi2(7)        =      19.67
Log likelihood  = -64.036526                    Prob > chi2       =     0.0063
```

misst1zeroda	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	1.516235	.6273459	2.42	0.016	.2866593	2.74581
Levt1início	-.8509379	1.603924	-0.53	0.596	-3.99457	2.292695
ceochairman	-.8673634	.878523	-0.99	0.323	-2.589237	.85451
lt3	1.024133	.9023904	1.13	0.256	-.7445196	2.792786
exop	-11.8236	24.82466	-0.48	0.634	-60.47904	36.83185
exlt	38.66466	34.8321	1.11	0.267	-29.605	106.9343
grop	69.80283	34.05826	2.05	0.040	3.049864	136.5558

```
. estimates store fe2


. hausman fe2 re2
```

	(b) fe2	(B) re2	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	Coefficients			
Sizet1início	1.516235	-.248385	1.76462	.6258266
Levt1início	-.8509379	1.191421	-2.042359	1.415829
ceochairman	-.8673634	-1.268283	.40092	.274086
lt3	1.024133	.1113665	.9127666	.7528587
exop	-11.8236	31.32714	-43.15073	9.306235
exlt	38.66466	-6.74925	45.41391	20.59157
grop	69.80283	27.03123	42.7716	29.18078

```
                 b = consistent under Ho and Ha; obtained from xtlogit
  B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

Test:  Ho:  difference in coefficients not systematic

              chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                      =       70.58
            Prob>chi2 =      0.0000
```

Odds ratio

```
. xtlogit misst1zeroda Sizet1início Levt1início ceochairman lt3 exop exlt grop, fe or
note: multiple positive outcomes within groups encountered.
note: 52 groups (347 obs) dropped because of all positive or
      all negative outcomes.

Iteration 0:   log likelihood = -70.859001
Iteration 1:   log likelihood = -64.442977
Iteration 2:   log likelihood = -64.037738
Iteration 3:   log likelihood = -64.036526
Iteration 4:   log likelihood = -64.036526

Conditional fixed-effects logistic regression   Number of obs     =        209
Group variable: firm                            Number of groups  =         29

                                                Obs per group:
                                                              min =          2
                                                              avg =        7.2
                                                              max =         11

                                                LR chi2(7)        =      19.67
Log likelihood  = -64.036526                    Prob > chi2       =     0.0063
```

misst1zeroda	Odds Ratio	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	4.555042	2.857587	2.42	0.016	1.33197	15.57723
Levt1início	.4270143	.6848982	-0.53	0.596	.0184154	9.901582
ceochairman	.4200576	.3690303	-0.99	0.323	.0750773	2.350223
lt3	2.78468	2.512869	1.13	0.256	.4749624	16.32644
exop	7.33e-06	.000182	-0.48	0.634	5.42e-27	9.91e+15
exlt	6.19e+16	2.16e+18	1.11	0.267	1.39e-13	2.76e+46
grop	2.07e+30	7.03e+31	2.05	0.040	21.11248	2.02e+59

```
. estat ic
```

Akaike's information criterion and Bayesian information criterion

Model	N	ll(null)	ll(model)	df	AIC	BIC
.	209	-73.87146	-64.03653	7	142.0731	165.4694

Note: BIC uses N = number of observations. See **[R] BIC note**.

$$\boldsymbol{Miss\_Zero}\ (\boldsymbol{DA})_{\boldsymbol{i,t}} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1} LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t}\ (12.c)$$

Model considering LT > 4

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 4 years

```
Random-effects logistic regression              Number of obs     =        556
Group variable: firm                            Number of groups  =         81

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        6.9
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =      88.82
Log likelihood  =  -154.1364                    Prob > chi2       =     0.0000

------------------------------------------------------------------------------
 misst1zeroda |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Sizet1início |  -.2530505   .0409253    -6.18   0.000    -.3332626   -.1728385
 Levt1início |   1.210618   .7665084     1.58   0.114     -.291711    2.712947
 ceochairman |   -1.43374   .8843626    -1.62   0.105    -3.167059    .2995788
         lt4 |   .2411521   .4926101     0.49   0.624     -.724346     1.20665
        exop |    20.3459   17.92993     1.13   0.256    -14.79611    55.48791
        exlt |   13.82748   25.76442     0.54   0.591    -36.66985    64.32482
        grop |   25.24407   17.81333     1.42   0.156     -9.66942    60.15756
-------------+----------------------------------------------------------------
    /lnsig2u |    .419892   .5265981                     -.6122213    1.452005
-------------+----------------------------------------------------------------
     sigma_u |   1.233611   .3248087                      .7363051    2.066802
         rho |   .3162725   .1138738                      .1414779    .5649209
------------------------------------------------------------------------------
LR test of rho=0: chibar2(01) = 12.95                  Prob >= chibar2 = 0.000

. estimates store re


. xtlogit misst1zeroda Sizet1início Levt1início ceochairman lt4 exop exlt grop, fe
note: multiple positive outcomes within groups encountered.
note: 52 groups (347 obs) dropped because of all positive or
      all negative outcomes.

Iteration 0:   log likelihood = -69.010079
Iteration 1:   log likelihood = -63.169093
Iteration 2:   log likelihood = -62.691445
Iteration 3:   log likelihood = -62.568986
Iteration 4:   log likelihood = -62.547898
Iteration 5:   log likelihood = -62.542805
Iteration 6:   log likelihood = -62.541809
Iteration 7:   log likelihood = -62.541636
Iteration 8:   log likelihood = -62.541618
Iteration 9:   log likelihood = -62.541614

Conditional fixed-effects logistic regression   Number of obs     =        209
Group variable: firm                            Number of groups  =         29

                                                Obs per group:
                                                              min =          2
                                                              avg =        7.2
                                                              max =         11

                                                LR chi2(7)        =      22.66
Log likelihood  = -62.541614                    Prob > chi2       =     0.0020

------------------------------------------------------------------------------
 misst1zeroda |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Sizet1início |   1.363409   .6161867     2.21   0.027     .1557051    2.571113
 Levt1início |  -.6737636   1.563789    -0.43   0.667    -3.738733    2.391206
 ceochairman |  -1.424924   1.093774    -1.30   0.193    -3.568681    .7188337
         lt4 |   17.17672    1105.88     0.02   0.988    -2150.308    2184.662
        exop |  -7.750316    22.0266    -0.35   0.725    -50.92166    35.42103
        exlt |  -5.609758    58.2558    -0.10   0.923     -119.789    108.5695
        grop |   64.15381   33.21034     1.93   0.053    -.9372614    129.2449
------------------------------------------------------------------------------

. estimates store fe

. hausman fe re
```

```
. hausman fe re

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       fe           re         Difference          S.E.
-------------+----------------------------------------------------------------
Sizet1início |    1.363409    -.2530505        1.616459        .6148261
 Levt1início |   -.6737636     1.210618       -1.884381        1.363048
 ceochairman |   -1.424924     -1.43374        .0088162         .643618
         lt4 |    17.17672     .2411521        16.93557         1105.88
        exop |   -7.750316      20.3459       -28.09622         12.7941
        exlt |   -5.609758     13.82748       -19.43724        52.24876
        grop |    64.15381     25.24407        38.90974        28.02877
------------------------------------------------------------------------------
                         b = consistent under Ho and Ha; obtained from xtlogit
          B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

    Test:  Ho:  difference in coefficients not systematic

                  chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       15.64
                Prob>chi2 =      0.0286

. estat ic

Akaike's information criterion and Bayesian information criterion

-----------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df         AIC        BIC
-------------+---------------------------------------------------------------
           . |        209  -73.87146  -62.54161       7    139.0832   162.4796
-----------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.
```

$$\boldsymbol{Miss\_Zero\ (DA)}_{i,t} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1} LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t}\ (12.c)$$

<u>**Model considering LT > 5**</u>

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 5 years

xtlogit misst1zeroda Sizet1início Levt1início ceochairman lt5 exop exlt grop, re noconstant

```
Random-effects logistic regression              Number of obs     =        556
Group variable: firm                            Number of groups  =         81

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        6.9
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =      85.71
Log likelihood  = -150.58304                    Prob > chi2       =     0.0000

------------------------------------------------------------------------------
misst1zeroda |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Sizet1início |  -.2365589   .0376208    -6.29   0.000    -.3102942   -.1628235
 Levt1início |   1.175693   .7617908     1.54   0.123    -.3173891    2.668776
 ceochairman |  -2.089551   1.136929    -1.84   0.066    -4.317891    .1387889
         lt5 |  -.8003987    .751769    -1.06   0.287    -2.273839    .6730415
        exop |   .1721787   17.68798     0.01   0.992    -34.49562    34.83997
        exlt |   81.64793   31.53875     2.59   0.010     19.83311    143.4627
        grop |    36.3337   18.38906     1.98   0.048     .2918064     72.3756
-------------+----------------------------------------------------------------
    /lnsig2u |   .4744532   .5140938                     -.5331522    1.482059
-------------+----------------------------------------------------------------
     sigma_u |   1.267728   .3258656                      .7659977    2.098094
         rho |   .3281875   .1133476                      .1513567    .5722926
------------------------------------------------------------------------------
LR test of rho=0: chibar2(01) = 13.40                  Prob >= chibar2 = 0.000

. estimates store re2
```

xtlogit misst1zeroda Sizet1início Levt1início ceochairman lt5 exop exlt grop, fe noconstant

```
Conditional fixed-effects logistic regression   Number of obs     =        209
Group variable: firm                            Number of groups  =         29

                                                Obs per group:
                                                              min =          2
                                                              avg =        7.2
                                                              max =         11

                                                LR chi2(7)        =      23.72
Log likelihood  = -62.009895                    Prob > chi2       =     0.0013

------------------------------------------------------------------------------
misst1zeroda |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Sizet1início |   1.630672   .6147988     2.65   0.008     .4256882    2.835655
 Levt1início |  -.2069133   1.575335    -0.13   0.896    -3.294513    2.880687
 ceochairman |  -1.137212   1.086271    -1.05   0.295    -3.266264     .991841
         lt5 |  -4.195141   4.975432    -0.84   0.399    -13.94681    5.556527
        exop |  -14.46988   20.30613    -0.71   0.476    -54.26916     25.3294
        exlt |   123.3697   66.06857     1.87   0.062    -6.122341    252.8617
        grop |   62.31788   34.40257     1.81   0.070    -5.109922    129.7457
------------------------------------------------------------------------------

. estimates store fe2
```

```
. hausman fe2 re2

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |      fe2          re2         Difference          S.E.
-------------+----------------------------------------------------------------
Sizet1início |    1.630672    -.2365589        1.867231        .6136467
 Levt1início |   -.2069133     1.175693       -1.382607        1.378896
 ceochairman |   -1.137212    -2.089551        .9523396               .
         lt5 |   -4.195141    -.8003987       -3.394742         4.91831
        exop |   -14.46988     .1721787       -14.64206        9.973682
        exlt |    123.3697     81.64793        41.72175        58.05483
        grop |    62.31788      36.3337        25.98418        29.07541
------------------------------------------------------------------------------
                          b = consistent under Ho and Ha; obtained from xtlogit
           B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

    Test:  Ho:  difference in coefficients not systematic

                  chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       11.29
                Prob>chi2 =      0.1266
                (V_b-V_B is not positive definite)


. quietly xtlogit misst1zeroda Sizet1início Levt1início ceochairman lt5 exop exlt grop, re noconstant

. margins, dydx(*) predict(pr)

Average marginal effects                        Number of obs     =        556
Model VCE    : OIM

Expression   : Pr(misst1zeroda=1), predict(pr)
dy/dx w.r.t. : Sizet1início Levt1início ceochairman lt5 exop exlt grop

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Sizet1início |  -.0160608   .0023081    -6.96   0.000    -.0205847    -.011537
 Levt1início |   .0798221   .0522828     1.53   0.127    -.0226503    .1822946
 ceochairman |  -.1418673   .0791019    -1.79   0.073    -.2969042    .0131696
         lt5 |   -.054342   .0513818    -1.06   0.290    -.1550486    .0463646
        exop |   .0116898   1.200919     0.01   0.992    -2.342068    2.365448
        exlt |   5.543377    2.15234     2.58   0.010     1.324867    9.761886
        grop |   2.466828   1.250308     1.97   0.048     .0162693    4.917387
------------------------------------------------------------------------------

. estat ic

Akaike's information criterion and Bayesian information criterion

-----------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df         AIC        BIC
-------------+---------------------------------------------------------------
           . |        556          .   -150.583       8    317.1661   351.7322
-----------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.
```

$$\boldsymbol{Miss\_Zero}\ (\boldsymbol{DA})_{i,t} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1} LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t}\ (12.c)$$

Model considering LT > 6

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 6 years

xtlogit misst1zeroda Sizet1início Levt1início ceochairman lt6 exop exlt grop, re noconstant

```
Random-effects logistic regression              Number of obs     =        556
Group variable: firm                            Number of groups  =         81

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        6.9
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =      86.79
Log likelihood  = -151.33691                    Prob > chi2       =     0.0000
```

misst1zeroda	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.2386102	.0369333	-6.46	0.000	-.3109982	-.1662223
Levt1início	1.163358	.7628763	1.52	0.127	-.3318524	2.658568
ceochairman	-2.110314	1.147238	-1.84	0.066	-4.358859	.1382305
lt6	-.5749984	1.041158	-0.55	0.581	-2.61563	1.465633
exop	4.639516	16.89779	0.27	0.784	-28.47953	37.75857
exlt	74.83986	33.13568	2.26	0.024	9.895119	139.7846
grop	35.33397	18.16613	1.95	0.052	-.2709877	70.93893
/lnsig2u	.4536174	.513424			-.5526752	1.45991
sigma_u	1.25459	.3220683			.7585568	2.074987
rho	.3236101	.1123816			.148866	.5668627

```
LR test of rho=0: chibar2(01) = 13.31                 Prob >= chibar2 = 0.000

. estimates store re
```

xtlogit misst1zeroda Sizet1início Levt1início ceochairman lt6 exop exlt grop, fe

```
Conditional fixed-effects logistic regression   Number of obs     =        209
Group variable: firm                            Number of groups  =         29

                                                Obs per group:
                                                              min =          2
                                                              avg =        7.2
                                                              max =         11

                                                LR chi2(7)        =      24.30
Log likelihood  = -61.723686                    Prob > chi2       =     0.0010
```

misst1zeroda	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	1.391772	.5948897	2.34	0.019	.2258101	2.557735
Levt1início	-.2487039	1.561335	-0.16	0.873	-3.308864	2.811456
ceochairman	-1.370596	1.09434	-1.25	0.210	-3.515464	.7742716
lt6	-1047.628	107144.1	-0.01	0.992	-211046.3	208951
exop	-9.32386	20.30301	-0.46	0.646	-49.11703	30.46931
exlt	12118.36	1139814	0.01	0.992	-2221875	2246112
grop	66.9242	33.60779	1.99	0.046	1.054134	132.7943

```
. estimates store fe
```

```
. hausman fe re

Note: the rank of the differenced variance matrix (2) does not equal the number of coefficients being tested (7);
        be sure this is what you expect, or there may be problems computing the test.  Examine the output of your
        estimators for anything unexpected and possibly consider scaling your variables so that the coefficients
        are on a similar scale.

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       fe           re         Difference          S.E.
-------------+----------------------------------------------------------------
Sizet1início |    1.391772    -.2386102        1.630383        .5937421
 Levt1início |   -.2487039     1.163358       -1.412061        1.362272
 ceochairman |   -1.370596    -2.110314        .7397182               .
         lt6 |   -1047.628    -.5749984       -1047.053        107144.1
        exop |    -9.32386     4.639516       -13.96338        11.25509
        exlt |    12118.36     74.83986        12043.52         1139814
        grop |     66.9242     35.33397        31.59023          28.275
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtlogit
            B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

    Test:  Ho:  difference in coefficients not systematic

                  chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        0.00
                Prob>chi2 =      0.9999
                (V_b-V_B is not positive definite)
```

quietly xtlogit misst1zeroda Sizet1início Levt1início ceochairman lt5 exop exlt grop, re noconstant

```
. margins, dydx(*) predict(pr)

Average marginal effects                        Number of obs     =        556
Model VCE    : OIM

Expression   : Pr(misst1zeroda=1), predict(pr)
dy/dx w.r.t. : Sizet1início Levt1início ceochairman lt6 exop exlt grop

------------------------------------------------------------------------------
             |            Delta-method
             |      dy/dx   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Sizet1início |  -.0162781   .0022974    -7.09   0.000    -.0207809   -.0117752
 Levt1início |   .0793646   .0526264     1.51   0.132    -.0237812    .1825104
 ceochairman |  -.1439663   .0801839    -1.80   0.073    -.3011238    .0131912
         lt6 |  -.0392266   .0710596    -0.55   0.581    -.1785008    .1000476
        exop |   .3165092   1.153709     0.27   0.784    -1.944719    2.577738
        exlt |   5.105598   2.259821     2.26   0.024       .67643    9.534765
        grop |   2.410494   1.238543     1.95   0.052    -.0170061    4.837994
------------------------------------------------------------------------------


. estat ic

Akaike's information criterion and Bayesian information criterion

-----------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df         AIC        BIC
-------------+---------------------------------------------------------------
           . |        556          .  -151.3369       8    318.6738     353.24
-----------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.
```

Miss Prior DA

$$\boldsymbol{Miss\_Prior\ (DA)_{i,t}} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1}LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t}\ (12.d)$$

Model considering LT > 2

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 2 years

xtlogit missprioryeart1da Sizet1início Levt1início independence lt2 exop exlt grop, re noconstant

```
Random-effects logistic regression              Number of obs     =        487
Group variable: firm                            Number of groups  =         82

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        5.9
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =     100.71
Log likelihood  = -278.98769                    Prob > chi2       =     0.0000
```

missprioryeart1da	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.0677479	.0301767	-2.25	0.025	-.1268931	-.0086027
Levt1início	-.3313978	.4619652	-0.72	0.473	-1.236833	.5740374
independence	.3234028	.5133386	0.63	0.529	-.6827223	1.329528
lt2	.0432341	.3598949	0.12	0.904	-.662147	.7486151
exop	-46.9824	49.78294	-0.94	0.345	-144.5552	50.59038
exlt	48.26243	50.55311	0.95	0.340	-50.81985	147.3447
grop	26.43497	13.88838	1.90	0.057	-.7857522	53.6557
/lnsig2u	-12.32953	20.68858			-52.8784	28.21934
sigma_u	.0021022	.0217459			3.29e-12	1342000
rho	1.34e-06	.0000278			3.30e-24	1

```
LR test of rho=0: chibar2(01) = 6.3e-05               Prob >= chibar2 = 0.497

.

. logit missprioryeart1da Sizet1início Levt1início independency lt2 exop exlt grop, noconstant

Iteration 0:   log likelihood = -337.56268
Iteration 1:   log likelihood = -279.06096
Iteration 2:   log likelihood = -278.98794
Iteration 3:   log likelihood = -278.98765
Iteration 4:   log likelihood = -278.98765

Logistic regression                             Number of obs     =        487
                                                Wald chi2(7)      =     100.73
Log likelihood = -278.98765                     Prob > chi2       =     0.0000
```

missprioryeart1da	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.06775	.0301779	-2.25	0.025	-.1268976	-.0086023
Levt1início	-.3315251	.4619942	-0.72	0.473	-1.237017	.5739668
independency	.3232733	.5133589	0.63	0.529	-.6828916	1.329438
lt2	.0431849	.3599071	0.12	0.904	-.66222	.7485898
exop	-46.98524	49.78611	-0.94	0.345	-144.5642	50.59374
exlt	48.26789	50.55626	0.95	0.340	-50.82056	147.3563
grop	26.43832	13.88869	1.90	0.057	-.7830171	53.65965

```
. estat ic

Akaike's information criterion and Bayesian information criterion

-----------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df         AIC        BIC
-------------+---------------------------------------------------------------
           . |        487          .  -278.9877       7    571.9753   601.2932
-----------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.

. mfx

Marginal effects after logit
      y  = Pr(missprioryeart1da) (predict)
         =  .26422824
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
Sizet1~o |  -.0131714      .00576   -2.29   0.022   -.02446 -.001883   15.3019
Levt1i~o |  -.0644524      .08976   -0.72   0.473  -.240386  .111481   .582995
indepe~y |   .0628481      .09978    0.63   0.529  -.132723  .258419   .358338
    lt2* |   .0083292      .06886    0.12   0.904  -.126627  .143285   .887064
    exop |  -9.134479     9.66149   -0.95   0.344  -28.0706  9.80169   .005238
    exlt |   9.383841     9.81156    0.96   0.339  -9.84646  28.6141   .004947
    grop |   5.139918     2.70503    1.90   0.057  -.161847  10.4417   .002234
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1

. estat class, cutoff(0.26)

Logistic model for missprioryeart1da

              -------- True --------
Classified |         D            ~D  |      Total
-----------+--------------------------+-----------
     +     |        65           176  |        241
     -     |        65           181  |        246
-----------+--------------------------+-----------
   Total   |       130           357  |        487

Classified + if predicted Pr(D) >= .26
True D defined as missprioryeart1da != 0
--------------------------------------------------
Sensitivity                     Pr( +| D)   50.00%
Specificity                     Pr( -|~D)   50.70%
Positive predictive value       Pr( D| +)   26.97%
Negative predictive value       Pr(~D| -)   73.58%
--------------------------------------------------
False + rate for true ~D        Pr( +|~D)   49.30%
False - rate for true D         Pr( -| D)   50.00%
False + rate for classified +   Pr(~D| +)   73.03%
False - rate for classified -   Pr( D| -)   26.42%
--------------------------------------------------
Correctly classified                        50.51%
--------------------------------------------------



. estat gof

Logistic model for missprioryeart1da, goodness-of-fit test

       number of observations =       487
 number of covariate patterns =       487
            Pearson chi2(480) =       487.58
                  Prob > chi2 =         0.3956
```

$$\boldsymbol{Miss\_Prior}\ (\boldsymbol{DA})_{\boldsymbol{i,t}} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1} LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t}\ (12.d)$$

Model considering LT > 3

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 3 years

xtlogit missprioryeart1da Sizet1início Levt1início ceochairman lt3 exop exlt grop, re noconstant

xtlogit missprioryeart1da Sizet1início Levt1início independency lt3 exop exlt grop, re

```
Random-effects logistic regression              Number of obs     =        487
Group variable: firm                            Number of groups  =         82

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        5.9
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =     100.34
Log likelihood  = -279.55597                    Prob > chi2       =     0.0000
```

missprioryeart1da	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.0605794	.0243605	-2.49	0.013	-.108325	-.0128337
Levt1início	-.3044397	.4556722	-0.67	0.504	-1.197541	.5886614
independency	.28881	.5123075	0.56	0.573	-.7152943	1.292914
lt3	-.0983565	.250885	-0.39	0.695	-.590082	.3933691
exop	3.308439	17.02855	0.19	0.846	-30.0669	36.68378
exlt	-5.205259	20.20891	-0.26	0.797	-44.814	34.40348
grop	24.04028	13.2177	1.82	0.069	-1.865938	49.9465
/lnsig2u	-13.75393	34.22165			-80.82714	53.31927
sigma_u	.0010313	.0176458			2.81e-18	3.79e+11
rho	3.23e-07	.0000111			2.40e-36	1

```
LR test of rho=0: chibar2(01) = 1.8e-05               Prob >= chibar2 = 0.498
```

```
. logit missprioryeart1da Sizet1início Levt1início independency lt3 exop exlt grop, noconstant

Iteration 0:   log likelihood = -337.56268
Iteration 1:   log likelihood = -279.60053
Iteration 2:   log likelihood = -279.55596
Iteration 3:   log likelihood = -279.55596

Logistic regression                             Number of obs     =        487
                                                Wald chi2(7)      =     100.33
Log likelihood = -279.55596                     Prob > chi2       =     0.0000
```

missprioryeart1da	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.0605779	.0243602	-2.49	0.013	-.1083231	-.0128328
Levt1início	-.3044076	.4556647	-0.67	0.504	-1.197494	.5886788
independency	.2888426	.5123024	0.56	0.573	-.7152516	1.292937
lt3	-.0983683	.2508822	-0.39	0.695	-.5900884	.3933517
exop	3.308229	17.02847	0.19	0.846	-30.06696	36.68342
exlt	-5.205636	20.20882	-0.26	0.797	-44.8142	34.40293
grop	24.03969	13.21764	1.82	0.069	-1.866418	49.94579

Akaike's information criterion and Bayesian information criterion

Model	N	ll(null)	ll(model)	df	AIC	BIC
.	487	.	-279.556	7	573.1119	602.4298

Note: BIC uses N = number of observations. See **[R] BIC note**.

```
. estat class, cutoff(0.2669)

Logistic model for missprioryeart1da
```

Classified	True D	~D	Total
+	54	119	173
-	76	238	314
Total	130	357	487

```
Classified + if predicted Pr(D) >= .2669
True D defined as missprioryeart1da != 0
```

Sensitivity	Pr(+| D)	41.54%
Specificity	Pr(-|~D)	66.67%
Positive predictive value	Pr(D| +)	31.21%
Negative predictive value	Pr(~D| -)	75.80%
False + rate for true ~D	Pr(+|~D)	33.33%
False - rate for true D	Pr(-| D)	58.46%
False + rate for classified +	Pr(~D| +)	68.79%
False - rate for classified -	Pr(D| -)	24.20%
Correctly classified		59.96%

```
. mfx

Marginal effects after logit
      y  = Pr(missprioryeart1da) (predict)
         =  .26477853
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Sizet1~o	-.0117928	.00463	-2.55	0.011	-.020862	-.002724	15.3019
Levt1i~o	-.0592593	.08866	-0.67	0.504	-.233033	.114514	.582995
indepe~y	.0562292	.09972	0.56	0.573	-.139211	.25167	.358338
lt3*	-.0193375	.04979	-0.39	0.698	-.116921	.078246	.714579
exop	.6440158	3.31515	0.19	0.846	-5.85356	7.14159	.005238
exlt	-1.013386	3.93408	-0.26	0.797	-8.72405	6.69728	.004055
grop	4.679826	2.57578	1.82	0.069	-.36861	9.72826	.002234

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. estat gof
```

Logistic model for missprioryeart1da, goodness-of-fit test

```
       number of observations =       487
 number of covariate patterns =       487
            Pearson chi2(480) =       487.78
                  Prob > chi2 =         0.3931
```

$$\boldsymbol{Miss\_Prior}\ (\boldsymbol{DA})_{i,t} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1} LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t}\ (12.d)$$

Model considering LT > 4

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 4 years

xtlogit missprioryeart1da Sizet1início Levt1início independency lt4 exop exlt grop, re noconstant

```
Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        5.9
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =     100.21
Log likelihood  = -279.72056                    Prob > chi2       =     0.0000
```

missprioryeart1da	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.0630525	.0242166	-2.60	0.009	-.1105162	-.0155887
Levt1início	-.3337718	.4597271	-0.73	0.468	-1.23482	.5672768
independency	.2852717	.5156717	0.55	0.580	-.7254264	1.29597
lt4	-.029651	.235534	-0.13	0.900	-.4912892	.4319872
exop	-1.494258	12.73223	-0.12	0.907	-26.44898	23.46046
exlt	1.765549	18.46622	0.10	0.924	-34.42757	37.95867
grop	23.70038	13.29451	1.78	0.075	-2.356385	49.75714
/lnsig2u	-13.65914	34.27342			-80.8338	53.51552
sigma_u	.0010813	.0185303			2.80e-18	4.18e+11
rho	3.55e-07	.0000122			2.38e-36	1

```
LR test of rho=0: chibar2(01) = 1.8e-05              Prob >= chibar2 = 0.498

. logit missprioryeart1da Sizet1início Levt1início independency lt4 exop exlt grop, noconstant

Iteration 0:   log likelihood = -337.56268
Iteration 1:   log likelihood = -279.76775
Iteration 2:   log likelihood = -279.72056
Iteration 3:   log likelihood = -279.72056

Logistic regression                             Number of obs     =        487
                                                Wald chi2(7)      =     100.21
Log likelihood = -279.72056                     Prob > chi2       =     0.0000
```

missprioryeart1da	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.0630508	.0242163	-2.60	0.009	-.1105139	-.0155876
Levt1início	-.3337449	.45972	-0.73	0.468	-1.23478	.5672897
independency	.2853022	.5156666	0.55	0.580	-.7253857	1.29599
lt4	-.0296705	.2355317	-0.13	0.900	-.4913041	.4319631
exop	-1.494713	12.73215	-0.12	0.907	-26.44927	23.45985
exlt	1.765606	18.46613	0.10	0.924	-34.42734	37.95855
grop	23.69981	13.29445	1.78	0.075	-2.356836	49.75646

```
. mfx

Marginal effects after logit
      y  = Pr(missprioryeart1da) (predict)
         =  .26486104
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Sizet1~o	-.0122766	.00459	-2.67	0.008	-.02128	-.003274	15.3019
Levt1i~o	-.0649834	.08946	-0.73	0.468	-.240318	.110351	.582995
indepe~y	.0555511	.10039	0.55	0.580	-.141208	.252311	.358338
lt4*	-.0057732	.0458	-0.13	0.900	-.095537	.083991	.451745
exop	-.2910351	2.479	-0.12	0.907	-5.14978	4.56771	.005238
exlt	.3437806	3.59555	0.10	0.924	-6.70337	7.39093	.002582
grop	4.614583	2.59163	1.78	0.075	-.464925	9.69409	.002234

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. estat class, cutoff(0.2669)

Logistic model for missprioryeart1da
```

Classified	True D	True ~D	Total
+	57	133	190
-	73	224	297
Total	130	357	487

```
Classified + if predicted Pr(D) >= .2669
True D defined as missprioryeart1da != 0

Sensitivity                     Pr( +| D)   43.85%
Specificity                     Pr( -|~D)   62.75%
Positive predictive value       Pr( D| +)   30.00%
Negative predictive value       Pr(~D| -)   75.42%

False + rate for true ~D        Pr( +|~D)   37.25%
False - rate for true D         Pr( -| D)   56.15%
False + rate for classified +   Pr(~D| +)   70.00%
False - rate for classified -   Pr( D| -)   24.58%

Correctly classified                        57.70%
```

```
. estat gof
```

Logistic model for missprioryeart1da, goodness-of-fit test

```
       number of observations =       487
 number of covariate patterns =       487
            Pearson chi2(480) =       488.04
                  Prob > chi2 =         0.3899
```

$$\boldsymbol{Miss\_Prior}\ (\boldsymbol{DA})_{i,t} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1}LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t}\ (12.d)$$

Model considering LT > 5

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 5 years

xtlogit missprioryeart1da Sizet1início Levt1início independency lt5 exop exlt grop, re

```
Random-effects logistic regression              Number of obs     =        487
Group variable: firm                            Number of groups  =         82

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        5.9
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =     100.50
Log likelihood  =  -279.4266                    Prob > chi2       =     0.0000
```

missprioryeart1da	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.0606485	.0229418	-2.64	0.008	-.1056137	-.0156834
Levt1início	-.351168	.4595786	-0.76	0.445	-1.251926	.5495896
independency	.2731348	.5127706	0.53	0.594	-.7318771	1.278147
lt5	-.2363951	.3265595	-0.72	0.469	-.8764401	.4036498
exop	-4.041881	11.72762	-0.34	0.730	-27.02759	18.94383
exlt	11.14088	19.67914	0.57	0.571	-27.42953	49.71129
grop	25.48214	13.56386	1.88	0.060	-1.102536	52.06682
/lnsig2u	-13.7508	34.25233			-80.88413	53.38253
sigma_u	.0010329	.0176893			2.73e-18	3.91e+11
rho	3.24e-07	.0000111			2.27e-36	1

```
LR test of rho=0: chibar2(01) = 1.8e-05                Prob >= chibar2 = 0.498

. logit missprioryeart1da Sizet1início Levt1início independence lt5 exop exlt grop, noconstant

Iteration 0:   log likelihood = -337.56268
Iteration 1:   log likelihood = -279.47469
Iteration 2:   log likelihood =  -279.4266
Iteration 3:   log likelihood = -279.42659

Logistic regression                             Number of obs     =        487
                                                Wald chi2(7)      =     100.50
Log likelihood = -279.42659                     Prob > chi2       =     0.0000
```

missprioryeart1da	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.0606472	.0229416	-2.64	0.008	-.1056119	-.0156826
Levt1início	-.3511401	.4595716	-0.76	0.445	-1.251884	.5496037
independence	.2731695	.5127654	0.53	0.594	-.7318321	1.278171
lt5	-.2364269	.3265579	-0.72	0.469	-.8764687	.403615
exop	-4.042305	11.72754	-0.34	0.730	-27.02786	18.94325
exlt	11.141	19.67909	0.57	0.571	-27.4293	49.71131
grop	25.48164	13.56382	1.88	0.060	-1.102963	52.06625

```
. mfx

Marginal effects after logit
      y  = Pr(missprioryeart1da) (predict)
         =  .26452707
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
Sizet1~o |  -.0117991      .00434   -2.72   0.007  -.020311 -.003287   15.3019
Levt1i~o |  -.0683152      .08935   -0.76   0.445   -.24344  .106809   .582995
indepe~e |   .0531458      .09975    0.53   0.594  -.142357  .248649   .358338
    lt5* |  -.0442004      .05849   -0.76   0.450  -.158843  .070442   .156057
    exop |  -.7864406     2.28097   -0.34   0.730  -5.25707  3.68419   .005238
    exlt |    2.16751     3.82682    0.57   0.571  -5.33292  9.66794   .001204
    grop |   4.957517     2.64132    1.88   0.061  -.219378  10.1344   .002234
------------------------------------------------------------------------------
(*) dy/dx is for discrete change of dummy variable from 0 to 1

. estat ic

Akaike's information criterion and Bayesian information criterion

-----------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df         AIC        BIC
-------------+---------------------------------------------------------------
           . |        487          .  -279.4266       7    572.8532    602.171
-----------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.


. estat gof

Logistic model for missprioryeart1da, goodness-of-fit test

       number of observations =       487
 number of covariate patterns =       487
            Pearson chi2(480) =       488.31
                  Prob > chi2 =         0.3866

. estat class, cutoff(0.2699)

Logistic model for missprioryeart1da

              -------- True --------
Classified |         D            ~D  |      Total
-----------+--------------------------+-----------
     +     |        53           129  |        182
     -     |        77           228  |        305
-----------+--------------------------+-----------
   Total   |       130           357  |        487

Classified + if predicted Pr(D) >= .2699
True D defined as missprioryeart1da != 0
--------------------------------------------------
Sensitivity                     Pr( +| D)   40.77%
Specificity                     Pr( -|~D)   63.87%
Positive predictive value       Pr( D| +)   29.12%
Negative predictive value       Pr(~D| -)   74.75%
--------------------------------------------------
False + rate for true ~D        Pr( +|~D)   36.13%
False - rate for true D         Pr( -| D)   59.23%
False + rate for classified +   Pr(~D| +)   70.88%
False - rate for classified -   Pr( D| -)   25.25%
--------------------------------------------------
Correctly classified                        57.70%
--------------------------------------------------
```

Model considering LT > 6

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 6 years

$$\boldsymbol{Miss\_Prior}\ (\boldsymbol{DA})_{\boldsymbol{i,t}} = \beta_0 + \beta_1 GrOp_{i,t+1} + \beta_2 ExOp_{i,t+1} + \beta_3 LT_{i,t} + \beta_4 ExOp_{i,t+1} LT_{i,t} + \beta_5 CG_{i,t} + \beta_6 LEV_{i,t-1} + \beta_7 lnA_{i,t-1} + \varepsilon_{i,t}\ (10)$$

xtlogit missprioryeart1da Sizet1início Levt1início independency lt6 exop exlt grop, re

```
Random-effects logistic regression              Number of obs     =        487
Group variable: firm                            Number of groups  =         82

Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        5.9
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =     100.36
Log likelihood  = -279.58162                    Prob > chi2       =     0.0000
```

missprioryeart1da	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.0629956	.0227435	-2.77	0.006	-.1075721	-.0184191
Levt1início	-.3428525	.4608821	-0.74	0.457	-1.246165	.5604599
independency	.278619	.5136818	0.54	0.588	-.7281789	1.285417
lt6	.0045732	.432421	0.01	0.992	-.8429563	.8521028
exop	-3.956692	11.39756	-0.35	0.728	-26.2955	18.38212
exlt	10.14557	20.35248	0.50	0.618	-29.74456	50.03569
grop	24.81326	13.4217	1.85	0.064	-1.492792	51.11931
/lnsig2u	-13.64987	34.23749			-80.75412	53.45439
sigma_u	.0010863	.0185969			2.91e-18	4.05e+11
rho	3.59e-07	.0000123			2.58e-36	1

```
LR test of rho=0: chibar2(01) = 1.8e-05               Prob >= chibar2 = 0.498

. logit missprioryeart1da Sizet1início Levt1início independency lt6 exop exlt grop , noconstant

Iteration 0:   log likelihood = -337.56268
Iteration 1:   log likelihood = -279.62822
Iteration 2:   log likelihood = -279.58161
Iteration 3:   log likelihood = -279.58161

Logistic regression                             Number of obs     =        487
                                                Wald chi2(7)      =     100.36
Log likelihood = -279.58161                     Prob > chi2       =     0.0000
```

missprioryeart1da	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Sizet1início	-.0629946	.0227433	-2.77	0.006	-.1075706	-.0184185
Levt1início	-.3428235	.4608752	-0.74	0.457	-1.246122	.5604753
independency	.2786521	.5136767	0.54	0.587	-.7281357	1.28544
lt6	.0045468	.4324188	0.01	0.992	-.8429784	.852072
exop	-3.957202	11.39751	-0.35	0.728	-26.2959	18.3815
exlt	10.14603	20.3524	0.50	0.618	-29.74395	50.03601
grop	24.81269	13.42165	1.85	0.065	-1.49326	51.11865

```
. estat ic

Akaike's information criterion and Bayesian information criterion
```

Model	N	ll(null)	ll(model)	df	AIC	BIC
.	487	.	-279.5816	7	573.1632	602.4811

Note: BIC uses N = number of observations. See [R] BIC note.

```
. mfx

Marginal effects after logit
      y  = Pr(missprioryeart1da) (predict)
         =  .26467881
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
Sizet1~o	-.0122602	.0043	-2.85	0.004	-.020686	-.003835	15.3019
Levt1i~o	-.0667217	.08964	-0.74	0.457	-.242406	.108963	.582995
indepe~e	.0542324	.09996	0.54	0.587	-.141688	.250153	.358338
lt6*	.0008857	.08431	0.01	0.992	-.164363	.166135	.073922
exop	-.7701663	2.21765	-0.35	0.728	-5.11668	3.57635	.005238
exlt	1.974659	3.95999	0.50	0.618	-5.78678	9.7361	.000701
grop	4.829144	2.61462	1.85	0.065	-.295426	9.95371	.002234

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. estat class, cutoff(0.2669)

Logistic model for missprioryeart1da
```

	True		
Classified	D	~D	Total
+	53	131	184
-	77	226	303
Total	130	357	487

Classified + if predicted Pr(D) >= .2669
True D defined as missprioryeart1da != 0

Sensitivity	Pr(+| D)	40.77%
Specificity	Pr(-|~D)	63.31%
Positive predictive value	Pr(D| +)	28.80%
Negative predictive value	Pr(~D| -)	74.59%
False + rate for true ~D	Pr(+|~D)	36.69%
False - rate for true D	Pr(-| D)	59.23%
False + rate for classified +	Pr(~D| +)	71.20%
False - rate for classified -	Pr(D| -)	25.41%
Correctly classified		57.29%

```
. estat gof
```

Logistic model for missprioryeart1da, goodness-of-fit test

```
       number of observations =       487
 number of covariate patterns =       487
             Pearson chi2(480) =       488.18
                   Prob > chi2 =         0.3882
```

Models on Earnings Smoothness

Model considering LT > 2

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 2 years

xtabond2 smoothness L.smoothness salesvolatility avgcfo lnassetsavgt4 mkbt4 levt4 lt exopavg exoplt gropavg losses averasalesgrowth independency logopcycle oplev, gmm(L.smoothness salesvolatility avgcfo losses averasalesgrowth mkbt4, eq(level) lag(1 1)) iv(independency lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg oplev levt4) twostep robust

```
. xtabond2 smoothness L.smoothness salesvolatility avgcfo lnassetsavgt4 mkbt4 levt4 lt exopavg exoplt gropavg loss
> es averasalesgrowth independency logopcycle oplev, gmm(L.smoothness salesvolatility avgcfo losses averasalesgrow
> th mkbt4,  eq(level) lag(1 1)) iv(independency lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg oplev levt4)
>  twostep robust
Favoring speed over space. To switch, type or click on mata: mata set matafavor space, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       381
Time variable : year                            Number of groups   =        69
Number of instruments = 51                      Obs per group: min =         1
Wald chi2(15) =  71713.65                                      avg =      5.52
Prob > chi2   =     0.000                                      max =         8
----------------------------------------------------------------------------------
                 |              Corrected
      smoothness |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------+----------------------------------------------------------------
      smoothness |
             L1. |   .7691812   .0919826     8.36   0.000     .5888986    .9494639
                 |
 salesvolatility |   -.773467   .8353658    -0.93   0.354    -2.410754    .8638198
          avgcfo |  -.6343851   1.563843    -0.41   0.685    -3.699461    2.430691
   lnassetsavgt4 |  -.0233629   .0420134    -0.56   0.578    -.1057077     .058982
           mkbt4 |   .0203431   .0300918     0.68   0.499    -.0386357     .079322
           levt4 |   .1321916    .384738     0.34   0.731    -.6218811    .8862643
              lt |   .0010233   .1563593     0.01   0.995    -.3054354    .3074819
         exopavg |  -18.78562   11.26342    -1.67   0.095    -40.86151    3.290274
          exoplt |   10.56423   11.05062     0.96   0.339    -11.09459    32.22306
         gropavg |   34.10954   13.14447     2.59   0.009     8.346845    59.87224
          losses |  -.4018177   .3575888    -1.12   0.261    -1.102679    .2990434
averasalesgrowth |   .4164412   .3516246     1.18   0.236    -.2727304    1.105613
    independency |   .4423303   .2207403     2.00   0.045     .0096873    .8749733
      logopcycle |   .0017108   .0789781     0.02   0.983    -.1530834     .156505
         oplevt4 |  -.0377459   .2427278    -0.16   0.876    -.5134836    .4379918
           _cons |  -.0123275    .911099    -0.01   0.989    -1.798049    1.773394
----------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(independency lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg
    oplevt4 levt4)
Instruments for levels equation
  Standard
    independency lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg oplevt4
    levt4
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.(L.smoothness salesvolatility avgcfo losses averasalesgrowth mkbt4)
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.25  Pr > z =  0.024
Arellano-Bond test for AR(2) in first differences: z =   0.75  Pr > z =  0.452
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(35)   =  41.79  Prob > chi2 =  0.200
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(35)   =  30.87  Prob > chi2 =  0.668
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(independency lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg oplevt4 levt4)
    Hansen test excluding group:     chi2(26)   =  24.59  Prob > chi2 =  0.542
    Difference (null H = exogenous): chi2(9)    =   6.28  Prob > chi2 =  0.711
```

<u>Model considering LT > 3</u>

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 3 years

xtabond2 smoothness L.smoothness salesvolatility avgcfo lnassetsavgt4 mkbt4 levt4 lt exopavg exoplt gropavg losses averasalesgrowth independency logopcycle oplev, gmm(L.smoothness salesvolatility avgcfo losses averasalesgrowth mkbt4, eq(level) lag(1 1)) iv(independency lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg oplev levt4) twostep robust

```
. xtabond2 smoothness L.smoothness salesvolatility avgcfo lnassetsavgt4 mkbt4 levt4 lt exopavg exoplt gropavg loss
> es averasalesgrowth independency logopcycle oplev, gmm(L.smoothness salesvolatility avgcfo losses averasalesgrow
> th mkbt4,  eq(level) lag(1 1)) iv(independency lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg oplev levt4)
>  twostep robust
Favoring speed over space. To switch, type or click on mata: mata set matafavor space, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       381
Time variable : year                            Number of groups   =        69
Number of instruments = 51                      Obs per group: min =         1
Wald chi2(15) =   2727.51                                      avg =      5.52
Prob > chi2   =     0.000                                      max =         8
----------------------------------------------------------------------------------
                 |              Corrected
      smoothness |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------+----------------------------------------------------------------
      smoothness |
             L1. |   .7659993   .0989098     7.74   0.000     .5721397    .9598589
                 |
 salesvolatility |  -.8346926   .7607133    -1.10   0.273    -2.325663    .6562781
          avgcfo |  -.8012051   1.428377    -0.56   0.575    -3.600772    1.998361
   lnassetsavgt4 |  -.0270778   .0456548    -0.59   0.553    -.1165596     .062404
           mkbt4 |   .0205686   .0308674     0.67   0.505    -.0399305    .0810676
           levt4 |   .0345887    .432605     0.08   0.936    -.8133016     .882479
              lt |   .0379229   .1243338     0.31   0.760    -.2057669    .2816126
         exopavg |   -18.4103   9.927492    -1.85   0.064    -37.86783    1.047225
          exoplt |   9.916861    9.56463     1.04   0.300    -8.829469    28.66319
         gropavg |   31.96427   13.48217     2.37   0.018     5.539702    58.38884
          losses |  -.4171067   .3438397    -1.21   0.225     -1.09102    .2568067
averasalesgrowth |    .429332   .3351534     1.28   0.200    -.2275567    1.086221
    independency |     .45863   .2201902     2.08   0.037     .0270651    .8901949
      logopcycle |  -.0125679   .0745612    -0.17   0.866    -.1587052    .1335693
         oplevt4 |  -.0079909   .2313424    -0.03   0.972    -.4614138    .4454319
           _cons |   .1670799   .8642946     0.19   0.847    -1.526906    1.861066
----------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(independency lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg
    oplevt4 levt4)
Instruments for levels equation
  Standard
    independency lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg oplevt4
    levt4
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.(L.smoothness salesvolatility avgcfo losses averasalesgrowth mkbt4)
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.24  Pr > z =  0.025
Arellano-Bond test for AR(2) in first differences: z =   0.75  Pr > z =  0.456
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(35)   =  42.25  Prob > chi2 =  0.186
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(35)   =  32.01  Prob > chi2 =  0.613
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(independency lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg oplevt4 levt4)
    Hansen test excluding group:     chi2(26)   =  24.94  Prob > chi2 =  0.522
    Difference (null H = exogenous): chi2(9)    =   7.07  Prob > chi2 =  0.630
```

<u>Model considering LT > 4</u>

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 4 years

xtabond2 smoothness L.smoothness salesvolatility avgcfo lnassetsavgt4 mkbt4 levt4 lt exopavg exoplt gropavg losses averasalesgrowth independency logopcycle oplev, gmm(L.smoothness salesvolatility avgcfo losses averasalesgrowth mkbt4, eq(level) lag(1 1)) iv(independency lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg oplev levt4) twostep robust

```
. xtabond2 smoothness L.smoothness salesvolatility avgcfo lnassetsavgt4 mkbt4 levt4 lt exopavg exoplt gropavg loss
> es averasalesgrowth independency logopcycle oplev, gmm(L.smoothness salesvolatility avgcfo losses averasalesgrow
> th mkbt4,  eq(level) lag(1 1)) iv(independency lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg oplev levt4)
>  twostep robust
Favoring speed over space. To switch, type or click on mata: mata set matafavor space, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       381
Time variable : year                            Number of groups   =        69
Number of instruments = 51                      Obs per group: min =         1
Wald chi2(15) =    980.00                                      avg =      5.52
Prob > chi2   =     0.000                                      max =         8
----------------------------------------------------------------------------------
                 |              Corrected
      smoothness |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------+----------------------------------------------------------------
      smoothness |
             L1. |    .773076   .0915854     8.44   0.000     .5935719    .9525801
                 |
 salesvolatility |  -1.241083   .7695535    -1.61   0.107     -2.74938    .2672143
          avgcfo |  -.9859769   1.448426    -0.68   0.496    -3.824839    1.852885
   lnassetsavgt4 |  -.0177414   .0447762    -0.40   0.692    -.1055012    .0700184
           mkbt4 |   .0243042   .0308881     0.79   0.431    -.0362355    .0848438
           levt4 |   .0757827   .3996293     0.19   0.850    -.7074764    .8590417
              lt |  -.0821839   .1172543    -0.70   0.483     -.311998    .1476303
         exopavg |  -11.80752   12.95602    -0.91   0.362    -37.20085     13.5858
          exoplt |   2.496104   13.74645     0.18   0.856    -24.44644    29.43865
         gropavg |   33.69281   15.57912     2.16   0.031     3.158287    64.22732
          losses |  -.3519668   .3333627    -1.06   0.291    -1.005346    .3014121
averasalesgrowth |   .4711222   .3448261     1.37   0.172    -.2047244    1.146969
    independency |   .4179131   .2151034     1.94   0.052    -.0036818    .8395079
      logopcycle |  -.0124079   .0718572    -0.17   0.863    -.1532454    .1284297
         oplevt4 |  -.0651995    .238281    -0.27   0.784    -.5322218    .4018227
           _cons |   .1202597   .8455645     0.14   0.887    -1.537016    1.777536
----------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(independency lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg
    oplevt4 levt4)
Instruments for levels equation
  Standard
    independency lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg oplevt4
    levt4
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL.(L.smoothness salesvolatility avgcfo losses averasalesgrowth mkbt4)
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.23  Pr > z =  0.026
Arellano-Bond test for AR(2) in first differences: z =   0.74  Pr > z =  0.457
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(35)   =  42.02  Prob > chi2 =  0.193
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(35)   =  31.40  Prob > chi2 =  0.643
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(independency lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg oplevt4 levt4)
    Hansen test excluding group:     chi2(26)    =  24.59  Prob > chi2 =  0.542
    Difference (null H = exogenous): chi2(9)     =   6.81  Prob > chi2 =  0.657
```

<u>Model considering LT > 5</u>

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 5 years

xtabond2 smoothness L.smoothness salesvolatility avgcfo lnassetsavgt4 mkbt4 levt4 lt exopavg exoplt gropavg losses averasalesgrowth independency logopcycle oplev, gmm(L.smoothness salesvolatility avgcfo losses averasalesgrowth mkbt4, eq(level) lag(3 3)) iv(independency L.lnassetsavgt4 L.logopcycle L.exopavg exoplt lt L.gropavg L.oplev L.levt4) twostep robust

```
. xtabond2 smoothness L.smoothness salesvolatility avgcfo lnassetsavgt4 mkbt4 levt4 lt exopavg exoplt gropavg loss
> es averasalesgrowth independency logopcycle oplev, gmm(L.smoothness salesvolatility avgcfo losses averasalesgrow
> th mkbt4,  eq(level) lag(3 3)) iv(independency L.lnassetsavgt4 L.logopcycle L.exopavg exoplt lt L.gropavg L.ople
> v L.levt4) twostep robust
Favoring speed over space. To switch, type or click on mata: mata set matafavor space, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       381
Time variable : year                            Number of groups   =        69
Number of instruments = 39                      Obs per group: min =         1
Wald chi2(15) =   1531.81                                      avg =      5.52
Prob > chi2   =     0.000                                      max =         8
----------------------------------------------------------------------------------
                 |              Corrected
      smoothness |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------+----------------------------------------------------------------
      smoothness |
             L1. |   .7878252   .1870991     4.21   0.000     .4211176    1.154533
                 |
 salesvolatility |   .9314823   2.656728     0.35   0.726     -4.27561    6.138574
          avgcfo |    -1.4034   1.981658    -0.71   0.479    -5.287377    2.480578
   lnassetsavgt4 |  -.0239444    .055523    -0.43   0.666    -.1327675    .0848787
           mkbt4 |  -.0031152   .0260071    -0.12   0.905    -.0540881    .0478578
           levt4 |   .2507569   .3949284     0.63   0.525    -.5232885    1.024802
              lt |   -.261574   .1142314    -2.29   0.022    -.4854634   -.0376845
         exopavg |  -11.59066   15.88402    -0.73   0.466    -42.72278    19.54145
          exoplt |   31.51671   13.71546     2.30   0.022     4.634893    58.39852
         gropavg |   6.782791    22.1042     0.31   0.759    -36.54065    50.10623
          losses |  -.8543765   .4711691    -1.81   0.070    -1.777851    .0690981
averasalesgrowth |  -1.186092   .6885302    -1.72   0.085    -2.535586    .1634025
    independency |   .4444135   .2210267     2.01   0.044     .0112092    .8776178
      logopcycle |  -.0021675   .1317287    -0.02   0.987     -.260351    .2560161
         oplevt4 |   .1857832    .479098     0.39   0.698    -.7532317    1.124798
           _cons |   .2689216   1.878133     0.14   0.886    -3.412152    3.949995
----------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(independency L.lnassetsavgt4 L.logopcycle L.exopavg exoplt lt L.gropavg
    L.oplevt4 L.levt4)
Instruments for levels equation
  Standard
    independency L.lnassetsavgt4 L.logopcycle L.exopavg exoplt lt L.gropavg
    L.oplevt4 L.levt4
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL3.(L.smoothness salesvolatility avgcfo losses averasalesgrowth mkbt4)
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.01  Pr > z =  0.044
Arellano-Bond test for AR(2) in first differences: z =   0.77  Pr > z =  0.443
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(23)   =  45.71  Prob > chi2 =  0.003
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(23)   =  16.60  Prob > chi2 =  0.829
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(independency L.lnassetsavgt4 L.logopcycle L.exopavg exoplt lt L.gropavg L.oplevt4 L.levt4)
    Hansen test excluding group:     chi2(14)   =   9.07  Prob > chi2 =  0.827
    Difference (null H = exogenous): chi2(9)    =   7.53  Prob > chi2 =  0.582
```

Model considering LT > 6

***This model considers the LT dummy equal to 1 when the vesting+lockup period is higher than 6 years

xtabond2 smoothness L.smoothness salesvolatility avgcfo lnassetsavgt4 mkbt4 levt4 lt exopavg exoplt gropavg losses averasalesgrowth independency logopcycle oplev, gmm(L.smoothness salesvolatility avgcfo losses averasalesgrowth mkbt4, eq(level) lag(3 3)) iv(independency L.lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg oplev L.levt4) twostep robust

```
. xtabond2 smoothness L.smoothness salesvolatility avgcfo lnassetsavgt4 mkbt4 levt4 lt exopavg exoplt gropavg loss
> es averasalesgrowth independency logopcycle oplev, gmm(L.smoothness salesvolatility avgcfo losses averasalesgrow
> th mkbt4,  eq(level) lag(3 3)) iv(independency L.lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg oplev L.le
> vt4) twostep robust
Favoring speed over space. To switch, type or click on mata: mata set matafavor space, perm.
Warning: Two-step estimated covariance matrix of moments is singular.
  Using a generalized inverse to calculate optimal weighting matrix for two-step estimation.
  Difference-in-Sargan/Hansen statistics may be negative.

Dynamic panel-data estimation, two-step system GMM
------------------------------------------------------------------------------
Group variable: firm                            Number of obs      =       381
Time variable : year                            Number of groups   =        69
Number of instruments = 39                      Obs per group: min =         1
Wald chi2(15) =   1815.84                                      avg =      5.52
Prob > chi2   =     0.000                                      max =         8
----------------------------------------------------------------------------------
                 |              Corrected
      smoothness |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------+----------------------------------------------------------------
      smoothness |
             L1. |   .7897856   .2058342     3.84   0.000      .386358    1.193213
                 |
 salesvolatility |   .8407375   2.112978     0.40   0.691    -3.300622    4.982097
          avgcfo |  -1.160481   1.907384    -0.61   0.543    -4.898886    2.577924
   lnassetsavgt4 |  -.0315269   .0415479    -0.76   0.448    -.1129592    .0499054
           mkbt4 |   .0002371   .0253914     0.01   0.993    -.0495291    .0500034
           levt4 |   .2542584   .4360725     0.58   0.560     -.600428    1.108945
              lt |  -.3108882   .1298644    -2.39   0.017    -.5654178   -.0563586
         exopavg |  -6.355312   8.762326    -0.73   0.468    -23.52915    10.81853
          exoplt |   36.15816   21.58249     1.68   0.094    -6.142738    78.45905
         gropavg |   10.05209    23.5101     0.43   0.669    -36.02686    56.13105
          losses |  -.8633208   .5118034    -1.69   0.092    -1.866437    .1397954
averasalesgrowth |  -1.123828   .7230434    -1.55   0.120    -2.540967    .2933105
    independency |   .4799091   .2255473     2.13   0.033     .0378445    .9219736
     logopcycle |   .0012607   .1032295     0.01   0.990    -.2010654    .2035867
         oplevt4 |   .1927644   .3645121     0.53   0.597    -.5216662    .9071949
           _cons |   .2885569   1.168771     0.25   0.805    -2.002192    2.579305
----------------------------------------------------------------------------------
Instruments for first differences equation
  Standard
    D.(independency L.lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg
    oplevt4 L.levt4)
Instruments for levels equation
  Standard
    independency L.lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg
    oplevt4 L.levt4
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    DL3.(L.smoothness salesvolatility avgcfo losses averasalesgrowth mkbt4)
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -2.04  Pr > z =  0.041
Arellano-Bond test for AR(2) in first differences: z =   0.71  Pr > z =  0.479
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(23)   =  44.69  Prob > chi2 =  0.004
  (Not robust, but not weakened by many instruments.)
Hansen test of overid. restrictions: chi2(23)   =  16.15  Prob > chi2 =  0.849
  (Robust, but weakened by many instruments.)

Difference-in-Hansen tests of exogeneity of instrument subsets:
  iv(independency L.lnassetsavgt4 logopcycle exopavg exoplt lt L.gropavg oplevt4 L.levt4)
    Hansen test excluding group:     chi2(14)   =   7.90  Prob > chi2 =  0.895
    Difference (null H = exogenous): chi2(9)    =   8.26  Prob > chi2 =  0.509
```

APPENDIX B - Panel models for Chapter 4 – Commands and stata results

PART I - Time Series Tobit Models – Repurchase and Dividend Determinants

Dividend Models – Specification I

xttobit divvmt1 pd mkbt1 planosempd top1 fcf vol sizet1 levt1, ll(0)

```
Random-effects tobit regression                 Number of obs     =      1,830
                                                   Uncensored     =      1,455
Limits: lower = 0                                  Left-censored  =        375
        upper = +inf                               Right-censored =          0

Group variable: firm                            Number of groups  =        211
Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        8.7
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(8)      =     166.21
Log likelihood  =  1873.5537                    Prob > chi2       =     0.0000

------------------------------------------------------------------------------
     divvmt1 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          pd |  -.0081884   .0093043    -0.88   0.379    -.0264245    .0100478
  planosempd |  -.0108976   .0047062    -2.32   0.021    -.0201216   -.0016735
       mkbt1 |  -.0003349   .0003269    -1.02   0.306    -.0009757    .0003058
        top1 |   .0001976    .000087     2.27   0.023     .0000272    .0003681
         fcf |   .1444584   .0145535     9.93   0.000      .115934    .1729828
         vol |  -.0000395   .0000497    -0.79   0.427    -.0001369    .0000579
      sizet1 |   .0083451   .0014224     5.87   0.000     .0055572    .0111331
       levt1 |  -.0553047   .0106209    -5.21   0.000    -.0761214   -.0344881
       _cons |  -.0822169   .0210731    -3.90   0.000    -.1235194   -.0409144
-------------+----------------------------------------------------------------
    /sigma_u |   .0285486   .0022684    12.59   0.000     .0241027    .0329945
    /sigma_e |   .0529894   .0010362    51.14   0.000     .0509585    .0550202
-------------+----------------------------------------------------------------
         rho |   .2249638   .0286715                      .1728597    .2849677
------------------------------------------------------------------------------
LR test of sigma_u=0: chibar2(01) = 167.01            Prob >= chibar2 = 0.000
```

Dividend Models – Specification II

```
. xtset firm year
       panel variable:  firm (unbalanced)
        time variable:  year, 2010 to 2020, but with gaps
                delta:  1 unit
```

---

xttobit divvmt1 pd planosempd top1 fcf vol sizet1 levt1, ll(0)

```
Random-effects tobit regression                 Number of obs     =      2,026
                                                   Uncensored     =      1,467
Limits: lower = 0                                  Left-censored  =        559
        upper = +inf                               Right-censored =          0

Group variable: firm                            Number of groups  =        220
Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        9.2
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =     198.23
Log likelihood  =  1850.5393                    Prob > chi2       =     0.0000

------------------------------------------------------------------------------
     divvmt1 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          pd |  -.0087477   .0096777    -0.90   0.366    -.0277157    .0102203
  planosempd |  -.0101157   .0048469    -2.09   0.037    -.0196155   -.0006159
        top1 |   .0001604   .0000898     1.79   0.074    -.0000156    .0003365
         fcf |   .1104156   .0119927     9.21   0.000     .0869103    .1339208
         vol |  -.0000398   .0000485    -0.82   0.412    -.0001348    .0000552
      sizet1 |   .0106887   .0014321     7.46   0.000     .0078818    .0134955
       levt1 |  -.0818325   .0081822   -10.00   0.000    -.0978694   -.0657956
       _cons |  -.1018759   .0219574    -4.64   0.000    -.1449116   -.0588402
-------------+----------------------------------------------------------------
    /sigma_u |   .0313108   .0023739    13.19   0.000     .0266581    .0359635
    /sigma_e |   .0533164   .0010365    51.44   0.000     .0512849    .0553479
-------------+----------------------------------------------------------------
         rho |   .2564382   .0298416                      .2015841     .318194
------------------------------------------------------------------------------
LR test of sigma_u=0: chibar2(01) = 214.72            Prob >= chibar2 = 0.000
```

Repurchase Models – Specification I

xttobit RP pd planosempd mkbt1 top1 fcf vol sizet1 levt1, ll(0) ul (1)

```
Random-effects tobit regression                 Number of obs     =      1,830
                                                   Uncensored     =        346
Limits: lower = 0                                  Left-censored  =      1,484
        upper = 1                                  Right-censored =          0

Group variable: firm                            Number of groups  =        211
Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        8.7
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(8)      =      76.91
Log likelihood  =  601.63106                    Prob > chi2       =     0.0000

------------------------------------------------------------------------------
          RP |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          pd |   .0115089   .0035249     3.27   0.001     .0046002    .0184177
  planosempd |   .0116833   .0018451     6.33   0.000      .008067    .0152996
       mkbt1 |   .0000704   .0001272     0.55   0.580    -.0001788    .0003196
        top1 |  -.0001363   .0000406    -3.36   0.001    -.0002159   -.0000567
         fcf |   .0113444   .0060314     1.88   0.060    -.0004769    .0231656
         vol |  -.0006213   .0009955    -0.62   0.533    -.0025724    .0013298
      sizet1 |   .0018681   .0006553     2.85   0.004     .0005837    .0031524
       levt1 |  -.0122644   .0046931    -2.61   0.009    -.0214628    -.003066
       _cons |  -.0392705   .0098872    -3.97   0.000     -.058649   -.0198919
-------------+----------------------------------------------------------------
    /sigma_u |   .0122228   .0012582     9.71   0.000     .0097568    .0146888
    /sigma_e |   .0131924   .0005688    23.19   0.000     .0120775    .0143073
-------------+----------------------------------------------------------------
         rho |   .4619038   .0507726                      .3645877    .5615678
------------------------------------------------------------------------------
LR test of sigma_u=0: chibar2(01) = 196.30             Prob >= chibar2 = 0.000
```

Repurchase Models – Specification II

xttobit RP pd planosempd top1 fcf vol sizet1 levt1, ll(0) ul (1)

```
Random-effects tobit regression                 Number of obs     =      2,026
                                                   Uncensored     =        350
Limits: lower = 0                                  Left-censored  =      1,676
        upper = 1                                  Right-censored =          0

Group variable: firm                            Number of groups  =        220
Random effects u_i ~ Gaussian                   Obs per group:
                                                              min =          1
                                                              avg =        9.2
                                                              max =         11

Integration method: mvaghermite                 Integration pts.  =         12

                                                Wald chi2(7)      =      83.72
Log likelihood  =  602.84481                    Prob > chi2       =     0.0000

------------------------------------------------------------------------------
          RP |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          pd |   .0116557   .0035717     3.26   0.001     .0046553     .018656
  planosempd |   .0121488   .0018645     6.52   0.000     .0084945     .015803
        top1 |  -.0001341   .0000409    -3.28   0.001    -.0002142    -.000054
         fcf |   .0107097   .0052018     2.06   0.040     .0005145    .0209049
         vol |  -.0006194   .0009961    -0.62   0.534    -.0025716    .0013328
      sizet1 |   .0020299   .0006388     3.18   0.001     .0007779     .003282
       levt1 |  -.0124486   .0037567    -3.31   0.001    -.0198116   -.0050856
       _cons |  -.0420531    .009912    -4.24   0.000    -.0614803   -.0226258
-------------+----------------------------------------------------------------
    /sigma_u |   .0124949   .0012742     9.81   0.000     .0099975    .0149923
    /sigma_e |   .0133311   .0005714    23.33   0.000     .0122112     .014451
-------------+----------------------------------------------------------------
         rho |   .4676547   .0503336                      .3709771    .5662887
------------------------------------------------------------------------------
LR test of sigma_u=0: chibar2(01) = 203.79             Prob >= chibar2 = 0.000
```

PART II - Pooled Logit Models –Dividend Protection Determinants (P|DPESOP=1)

First Model (Specification I) - Pooled Logit Models –Dividend Protection Determinants

```
. logit dpesop time independence cdp lev size domestic roa

Iteration 0:   log likelihood = -23.836779
Iteration 1:   log likelihood = -15.862499
Iteration 2:   log likelihood = -14.623256
Iteration 3:   log likelihood = -14.583381
Iteration 4:   log likelihood = -14.583238
Iteration 5:   log likelihood = -14.583238

Logistic regression                             Number of obs     =         45
                                                LR chi2(7)        =      18.51
                                                Prob > chi2       =     0.0099
Log likelihood = -14.583238                     Pseudo R2         =     0.3882
```

dpesop	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
time	.5644237	.2097674	2.69	0.007	.1532872	.9755602
independence	3.729839	2.115868	1.76	0.078	-.4171854	7.876863
cdp	-1.505764	1.403582	-1.07	0.283	-4.256734	1.245205
lev	-1.283007	3.134122	-0.41	0.682	-7.425773	4.859759
size	.2789135	.3110308	0.90	0.370	-.3306955	.8885226
domestic	-2.546226	1.32789	-1.92	0.055	-5.148843	.0563909
roa	8.861202	6.418074	1.38	0.167	-3.717992	21.4404
_cons	-7.038322	5.049214	-1.39	0.163	-16.9346	2.857956

```
. mfx

Marginal effects after logit
      y  = Pr(dpesop) (predict)
         =   .1002624
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.	]	X
time	.0509166	.02034	2.50	0.012	.011043	.090791	4.57778
indepe~e	.3364682	.22659	1.48	0.138	-.10764	.780577	.282082
cdp*	-.1071115	.08026	-1.33	0.182	-.264414	.050191	.266667
lev	-.1157399	.27661	-0.42	0.676	-.657884	.426404	.52766
size	.0251607	.02795	0.90	0.368	-.029629	.07995	14.8566
domestic*	-.4192009	.25913	-1.62	0.106	-.927094	.088692	.844444
roa	.7993677	.5764	1.39	0.165	-.330349	1.92908	.033072

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. estat class

Logistic model for dpesop
```

	True		
Classified	D	~D	Total
+	8	2	10
-	2	33	35
Total	10	35	45

```
Classified + if predicted Pr(D) >= .5
True D defined as dpesop != 0
```

Sensitivity	Pr(+| D)	80.00%
Specificity	Pr(-|~D)	94.29%
Positive predictive value	Pr(D| +)	80.00%
Negative predictive value	Pr(~D| -)	94.29%
False + rate for true ~D	Pr(+|~D)	5.71%
False - rate for true D	Pr(-| D)	20.00%
False + rate for classified +	Pr(~D| +)	20.00%
False - rate for classified -	Pr(D| -)	5.71%
Correctly classified		91.11%

```
. estat gof

Logistic model for dpesop, goodness-of-fit test

       number of observations =        45
 number of covariate patterns =        45
             Pearson chi2(37) =        73.53
                  Prob > chi2 =         0.0003
. estat ic

Akaike's information criterion and Bayesian information criterion
```

Model	N	ll(null)	ll(model)	df	AIC	BIC
.	45	-23.83678	-14.58324	8	45.16648	59.61978

Note: BIC uses N = number of observations. See **[R] BIC note**.

Second Model (Specification II) - Pooled Logit Models –Dividend Protection Determinants

```
. logit dpesop time independence cdp lev size domestic roa, noconstant robust

Iteration 0:   log pseudolikelihood = -31.191623
Iteration 1:   log pseudolikelihood = -15.804549
Iteration 2:   log pseudolikelihood = -15.653763
Iteration 3:   log pseudolikelihood = -15.652329
Iteration 4:   log pseudolikelihood = -15.652329

Logistic regression                             Number of obs     =         45
                                                Wald chi2(7)      =      17.53
Log pseudolikelihood = -15.652329               Prob > chi2       =     0.0143
```

dpesop	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
time	.4642571	.1871727	2.48	0.013	.0974054	.8311088
independence	2.95114	1.726718	1.71	0.087	-.4331661	6.335446
cdp	-1.126806	1.232	-0.91	0.360	-3.54148	1.287869
lev	-.769213	3.086904	-0.25	0.803	-6.819434	5.281008
size	-.1318149	.1233796	-1.07	0.285	-.3736344	.1100047
domestic	-3.11166	1.264138	-2.46	0.014	-5.589324	-.6339958
roa	10.35059	5.296628	1.95	0.051	-.0306152	20.73179

```
. mfx

Marginal effects after logit
      y  = Pr(dpesop) (predict)
         =  .12001825
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.	]	X
time	.049032	.01922	2.55	0.011	.011363	.086701	4.57778
indepe~e	.3116813	.15151	2.06	0.040	.014734	.608628	.282082
cdp*	-.0992141	.1037	-0.96	0.339	-.302453	.104024	.266667
lev	-.0812396	.33866	-0.24	0.810	-.744999	.582519	.52766
size	-.0139215	.0101	-1.38	0.168	-.033726	.005883	14.8566
domestic*	-.5761684	.21414	-2.69	0.007	-.995867	-.15647	.844444
roa	1.093165	.61921	1.77	0.077	-.120468	2.3068	.033072

```
(*) dy/dx is for discrete change of dummy variable from 0 to 1

. estat ic

Akaike's information criterion and Bayesian information criterion
```

Model	N	ll(null)	ll(model)	df	AIC	BIC
.	45	.	-15.65233	7	45.30466	57.9513

```
Note: BIC uses N = number of observations. See [R] BIC note.

. estat gof

Logistic model for dpesop, goodness-of-fit test

       number of observations =        45
 number of covariate patterns =        45
             Pearson chi2(38) =        42.58
                  Prob > chi2 =         0.2805
```

```
. estat class

Logistic model for dpesop

              -------- True --------
Classified |         D            ~D  |      Total
-----------+--------------------------+-----------
     +     |         6             4  |         10
     -     |         4            31  |         35
-----------+--------------------------+-----------
   Total   |        10            35  |         45

Classified + if predicted Pr(D) >= .5
True D defined as dpesop != 0
--------------------------------------------------
Sensitivity                     Pr( +| D)   60.00%
Specificity                     Pr( -|~D)   88.57%
Positive predictive value       Pr( D| +)   60.00%
Negative predictive value       Pr(~D| -)   88.57%
--------------------------------------------------
False + rate for true ~D        Pr( +|~D)   11.43%
False - rate for true D         Pr( -| D)   40.00%
False + rate for classified +   Pr(~D| +)   40.00%
False - rate for classified -   Pr( D| -)   11.43%
--------------------------------------------------
Correctly classified                        82.22%
--------------------------------------------------
```