# Executive remuneration and risk

**Remuneração dos executivos e risco**

**Remuneración ejecutiva y riesgo**

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**Abstract**
This study aims to identify the influence of executive compensation on the risk of publicly traded companies listed on B3 (Brazilian Stock Exchange). For this purpose, we collected data from 230 companies, from 2010 to 2019, which were subjected to regressions by unbalanced panel data, using the generalized systemic moments method (GMM-SYS). The results suggest that the total and average compensation, as well as the fixed salary, bonus and compensation for shares and options paid to executives increase the companies' accounting and market risk. The disparity between the highest and lowest salaries increases the market's perception of the risk levels of firms. In addition, performance, indebtedness, and aspects related to turnover, tenure and age of executives influence the risk of companies.
**Keywords**: Remuneration; Executives; Risk

**Resumo**
O objetivo do presente artigo é identificar a influência da remuneração dos executivos no risco das companhias de capital aberto listadas na B3 (Brasil, Bolsa, Balcão). Para este fim, foram coletados os dados de 230 empresas, no período de 2010 a 2019, os quais foram submetidos a regressões por dados em painel não balanceados, através do método dos momentos generalizado sistêmico (GMM-SYS). Os resultados sugerem que a remuneração total e média, assim como o salário fixo, bônus e compensação por ações e opções pagos aos executivos aumentam o risco contábil e diminuem o risco de mercado das companhias. A disparidade entre os maiores e menores salários aumenta a percepção do mercado quanto aos níveis de risco das firmas. Além disso, o desempenho, endividamento e aspectos ligados ao turnover, *tenure* e idade dos executivos influenciam no risco das companhias.
Palavras-chave: Remuneração; Executivos; Risco

**Resumen**
El propósito de este artículo es identificar la influencia de la compensación de ejecutivos en el riesgo de las empresas que cotizan en B3 (Bolsa de Valores de Brasil). Para ello, se colectaron datos de 230 empresas, en el período de 2010 a 2019, las cuales fueron sometidas a regresiones por datos de panel desbalanceados, utilizando el método de momentos sistémicos generalizado (GMM-SYS). Los resultados sugieren que la remuneración total y media, así como el salario fijo, el bono y la remuneración por acciones y opciones pagados a los ejecutivos aumentan el riesgo contable y disminuyen el riesgo de mercado de las empresas. La disparidad entre los salarios más altos y los más bajos aumenta la percepción del mercado sobre los niveles de riesgo de las empresas. Además, el desempeño, el endeudamiento y aspectos relacionados con la *turnover*, *tenure* y edad de los ejecutivos influyen en el riesgo de las empresas.
**Palabras clave:** Remuneración; Ejecutivos; Riesgo

## 1 Introduction

The executive compensation policy based on incentives is a corporate governance practice used to align the interests of shareholders and executives (Jensen & Meckling, 1976; Lozano-Reina & Sanchez-Marín, 2020) that should encourage managers to pursue the interests of the principal, through motivations based on the companies' performance (Tirole, 2006). Thus, it would minimize conflicts of interest (Oliveira et al., 2021) which would generate a positive impact on the well-being of owners and on the performance of companies (Jensen & Murphy, 1990).

Agency Theory assumptions assume that one of these conflicting interests concerns to risk-taking, where shareholders would be neutral and managers risk-averse (Martin et al., 2016; Utami & Kusuma, 2019). While owners diversify their assets in the company, pursuing greater wealth (Swift, 2018), managers would have difficulty diversifying their wealth and human capital and would be concerned about their job stability and obtaining private benefits (Mao & Zhang, 2018). Along these lines, structuring compensation contracts should encourage executives to take risks by rewarding them for long-term success (Simpson and Tamayo, 2020), which would able to align the risk preference of shareholders and managers (DeFusco et al., 1990; Mao & Zhang, 2018).

In this context, the problem question of this study is: What is the influence of executive compensation on the choice for riskier projects? To answer this question, the purpose of this study is to identify the influence of executive compensation on the accounting and market risk of publicly traded companies in Brazil. The time period of study comprises the years between 2010 and 2019, the last ten years when the research was carried out.

Executive compensation is a recurring theme in the academic literature (Oliveira et al., 2021), however, empirical evidence on compensation and risk at firms is scarce (Rengel et al. 2020). In addition, there is a concentration of studies focused on the context of developed markets (Oliveira et al., 2021), with more mature Corporate Governance systems. In Brazil, the results of the study by Lopes et al. (2017) suggest that the financial performance of firms has an impact on the executive compensation policy, however, there is no significant relationship between operational risks and executive compensation, which would be an open question (Lopes et al., 2017).

Similarly, Teixeira et al. (2011) did not find a significant relationship between risk levels and executive compensation at the largest companies in the state of Espírito Santo. On the other hand, Oliveira et al. (2021) suggest that there is an alignment between the remuneration policy and risk-adjusted value creation measures. In addition, Rengel et al. (2020) investigated the relationship between executive compensation and the risk of companies in different sectors of the B3, and their results suggest that an increase in executive´s compensation decrease the market risk levels of Brazilian firms.

The present study contributes to the literature as it enriches the academic and corporate debate regarding executive compensation and its relationship with the risks faced by companies, presenting theoretical-empirical and practical implications. With regard to the theoretical-empirical contribution, it innovates in relation to previous studies by analyzing the influence of executive compensation on accounting and market risk in a segregated manner, also by investigating, in addition to total and average compensation, the range between the highest and lowest amounts paid to executives, as well as the split of compensation into fixed, bonus, stock and options.

In practical terms, knowing the implications of executive compensation on firm risk can help formulate standards and/or regulations regarding compensation policy. The influence of the total amounts and the disparity between the amounts paid to executives, as well as the types of compensation (fixed, bonus, shares and options) on the risk levels of firms, may indicate necessary changes and adaptations in the executive compensation policy, with the objective of aligning interests between owners and managers regarding risk-taking, which can impact both the attractiveness of firms and the prospect of new investors.

## 2 Theoretical Framework

### 2.1 Executive compensation and agency issues

Executive compensation policy has been attracting academic, corporate and general public interest (Schmidt et al., 2018; Kashif & Lone, 2018). This interest is linked to the dubious behavior of managers in cases of corruption and corporate fraud, in actions that culminated in the financial crisis of 2007-2008 and in the increase in CEO compensation (Oliveira et al., 2021), which intensified the debate regarding the efficiency of incentive packages for executives and would be capable of generating a negative repercussion for companies in public opinion (Benabou & Tirole, 2016), in which the excess and efficiency of compensation policies are questioned (Lozano-Reina & Sanchez-Marín, 2020). These issues reinforce the relevance of the executive compensation policy as a fundamental instrument of Corporate Governance (Ataay, 2018).

According to the assumptions of agency theory, executive compensation packages are efficient when designed to mitigate agency problems (Jensen & Murphy, 1990), which would be possible by aligning

the interests of shareholders and executives (Dunn et al., 2019; Lozano-Reina & Sanchez-Marín, 2020). This alignment would be operationalized through "optimal" compensation contracts, which should establish compensation packages for the effort, skills and risk assumed by executives (Jensen & Murphy, 1990), which would lead to a search for greater corporate performance and, consequently, the maximization of the company's value (Jensen & Murphy, 1990; Bebchuk & Fried, 2003).

In Brazil, Sonza & Kloeckner (2014) showed that executive compensation can positively impact shareholder well-being, generating incentives for the executive in order to solve agency problems. In the same context, for Beuren et al. (2020), executive compensation can be a governance mechanism to align interests between family and non-family businesses in Brazil.

For this reason, there are compensation mechanisms such as base salary, bonuses, and long-term compensation, such as stock and option-based incentives (Conyon et al., 2011). The base salary would be the fixed part and the other components of the compensation would vary according to company policy (Kashif & Lone, 2018). However, fixed incentives would have a limited motivating power and a short-term bias, which suggests that variable compensation based on performance would have a more efficient motivating effect on the maximization of company value by executives (Deegan, 1997). In this sense, it is necessary that remuneration be linked to corporate performance, so that executives assume the risks, costs, and rewards of their decisions, aligning their interests with those of shareholders (Rasoava, 2019).

Empirical evidence from studies such as Jensen and Murphy (1990) and Bennett et al. (2017), point out a strong relationship between executive compensation and company performance. In their seminal paper, Jensen and Meckling (1976) recommended executive compensation through performance-linked bonuses and stock options. However, there is no consensus on the sensitivity of executive compensation to performance and its role in addressing agency problems (Kashif & Lone, 2018; Rasoava, 2019).

Incentive policies based on bonuses can generate unintended consequences, such as the possible dishonesty of managers (Kirsten & Du Toit, 2018), which would cause a worsening of agency problems and harm the performance of companies (Benabou & Tirole, 2016). Linking executive compensation to outcome targets may encourage executives to opt for projects with short-term results, which would not necessarily generate good results for the company (Bennett et al. 2017).

## 2.2 Compensation and risk policy: conceptions and formulation of hypotheses

The level and structure of executive compensation policy would influence risk-taking associated with investment projects (Faleye et al., 2011). Assuming that individuals seek to increase their personal wealth, shareholders prefer managers who are tolerant of risk-taking, which would potentially create value for owners (Utami & Kusuma, 2019). On the other hand, limited ability to diversify income, concern about keeping their jobs, and the pursuit of private benefits, make managers risk-averse (Mao & Zhang, 2018; Swift, 2018). To align interests and encourage managers to take a bolder stance on risk-taking, shareholders draft compensation contracts (Dunn et al., 2019; Gipper, 2021), tying a portion of executive compensation to shareholder wealth (Mao & Zhang, 2018; Martin et al., 2016).

The idea of an "optimal" contract combines managers' incentives for "optimal" effort and rewards for managerial talent (Chu et al., 2020), controlling for measures of company risk (Jensen & Meckling, 1976). In addition to this risk-adjusted portion, managers demand a higher premium for taking on additional risk (Conyon et al., 2011;) imposed by compensation packages, which increases as managerial risk-taking increases (Dunn et al., 2019).

Corroborating this issue, studies such as Conyon et al. (2011), Shue and Townsend (2017), Dunn et al. (2018) and Gipper (2021), present empirical evidence that higher compensation levels increase company risk, suggesting that high salaries paid to executives would be related to greater corporate risk-taking (Chu et al., 2020). However, studies such as Lopes et al. (2017) and Teixeira et al. (2011) found no significant relationship between risk levels and compensation packages for Brazilian executives. According to these assumptions, the following theoretical hypothesis is formulated:

*Hypothesis 1: The higher the executive compensation, the higher the accounting risk of Brazilian public companies.*

Good corporate governance practices, such as efficient compensation packages, would be able to reduce the impacts of agency problems, increasing investor confidence, which would decrease firms' market risk (Paiva et al., 2015). In this sense, the relationship between the monitoring exercised by the board of directors and the compensation of managers is a condition for its effectiveness as a governance mechanism in the Brazilian capital market (Brandão et al., 2019; Rissatti et al., 2022).

On the other hand, managerial power theory assumes that executive compensation would not only be a potential instrument to address agency problems but would also be part of the problem itself (Bebchuk & Fried, 2003). The influence of powerful executives would restrict the ability and impartiality of the board of directors to monitor and curb managerial power, especially regarding the setting of executive compensation (Ataay, 2018).

Powerful executives prefer to link their compensation to the size of the company, as incentive packages based on shares and options can hide income extraction activities (Bebchuk & Fried, 2003). Specific features of stock-based incentives, such as differences between the grant date value and the exercise date value, facilitate opportunistic behavior by executives (Steenkamp & Wesson, 2018), through the manipulation of stock prices to increase the remuneration for options (Daines et al., 2018).

These issues suggest that high levels of compensation and wage disparity would be an indicative of the influence of executives in defining compensation policies (Lu & Shi, 2018), which would result in inadequate compensation packages and the worsening of agency problems (Hoi et al., 2019), increasing business uncertainties, the risk premium demanded by investors, and, consequently, the cost of capital for firms (Grüning, 2011).

Thus, a compensation structure based on shares and options would be an incentive for risk taking, which can lead to variability in share values (Mao & Zhang, 2018). For DeFusco et al. (1990) the variance of stock returns seems to increase in the same proportion of compensation packages through stocks and options. In this sense, the payment of salaries based on formulas linked to performance measures would be related to greater volatility in stock prices and future cash flows (Gipper, 2021).

Studies such as Raithatha and Komera (2016) and Mao and Zhang (2018) suggest that higher levels of executive compensation would increase companies' market risk. On the other hand, the results of the studies like those of Chen et al. (2018) and Rengel et al. (2020) suggest that the executive compensation policy would reduce the companies' market risk. Based on these questions, the following hypothesis is formulated:

*Hypothesis 2: The higher the executive compensation, the higher the market risk of Brazilian public companies.*

## 3 Methodological Procedures

### 3.1 Population, sample and data collection

To analyze the influence of executive compensation on the company risk of companies listed on the B3 (Brasil, Bolsa, Balcão), descriptive and quantitative research was developed, based on secondary data. The population of this study comprises all publicly traded companies in Brazil. However, non-industrial companies and companies with Tobin's Q lower than zero and higher than ten were excluded from the sample. The analysis period is from 2010 to 2019, due to the disclosure of information regarding executives through the CVM (Securities and Exchange Commission) reference forms. Thus, the final sample includes 230 companies, equivalent to 1,841 observations.

The data for the dependent and the control variables were collected in Economática®. The independent variables, regarding executive compensation and information, were collected from item 13 (management compensation), option 13.11 (maximum, minimum, and average compensation), and 13.2 (total compensation per firm) of the companies' Reference Form, available at the central systems of the Brazilian Securities Commission (CVM). In this sense, the variables were collected and submitted to the statistical program STATA14®.

### 3.2 Definition of variables

To analyze the companies' accounting risk, the dependent variable (RISK) was created, which is measured through the variability of the EBIT (Earnings Before Interest and Taxes) concerning the companies' total assets, which, according to Toy et al. (1974) and Gatti and Nakamura (2013), would be a good metric for the accounting risk faced by the company. Systematic risk is analyzed through the dependent variable (BETA), which corresponds to the angular coefficient of the Capital Asset Pricing Model (CAPM) and would be an appropriate measure of the market risk assumed by companies (Raithatha & Komera, 2016).

The independent variables correspond to the range of executive compensation (AMP), average executive compensation (MED), total compensation (TOT), fixed compensation (FIXA), bonuses (BONUS) and compensation through shares and options (AC). Table 1 presents the main dependent and independent variables, their descriptions and authors.

Table 1
**Dependent and independent variables**

| Dependent variable – Risk | | |
| --- | --- | --- |
| Variables | Descriptions | Main authors |
| Accounting risk – RISK | $\sigma\left(\dfrac{EBIT}{Total\ Assets}\right)$ | Gatti and Nakamura (2013); Dutra et al. (2018). |
| Market risk - BETA | $(Rt = \beta Rm + et)$ | Paiva et al. (2015); Raithatha and Komera (2016). |
| Independent variables - Remuneration | | |
| Range of remuneration - AMP | $\log[REM_{max} - REM_{min}]$ | White (2018); Vo and Canil (2019); Rouen (2020) |
| Average remuneration - MED | $\dfrac{\sum REM}{n^{\underline{o}}\ of\ executives}$ | Jensen and Murphy (1990); Bebchuk and Fried (2003); Devers et al. (2008). |
| Total remuneration – TOT | $\log[\sum REM]$ | Raithatha and Komera (2016); Shue and Townsend (2017); Dunn et al. (2019); Gipper (2021); Oliveira et al. (2021). |
| Fixed remuneration - FIXA | Executive compensation by fixed remuneration | Jensen and Murphy (1990); Chen et al. (2018) |
| Bonus – BONUS | Executive compensation by bonus. | Jensen and Murphy (1990); Chen et al. (2018) |
| Compensation for shares - AC | Executive compensation by shares and options. | Jensen and Murphy (1990); Chen et al. (2018); |

Note: *EBIT*: *Earnings before interest and taxes*; $REM_{max}$: maximum remuneration; $REM_{min}$: minimum remuneration; $\sum REM$: Total remuneration.
Source: Elaborated by the authors (2022).

The control variables refer to the characteristics of the executives, performance, size and debt of the companies. In this sense, Table 2 includes the control variables, their descriptions, main studies and expected signs.

Table 2
**Control variables**

| Control Variables | | | |
| --- | --- | --- | --- |
| Variables | Description | Main authors | *Signal* |
| *Turnover* (Turnex) | 1 – If, in the previous year, there was a change of CEO; 0 - otherwise. | Devers et al. (2008) <br> Chen et al. (2008) | + <br> - |
| *Tenure* – (Tex) | *log* (average tenure of senior executives) | Devers et al. (2008); Conyon et al. (2011); | + |
| Age (IME) | *log* (Average age of chief executives) | Jensen and Murphy (1990) <br> Devers et al. (2008) | + <br> - |
| Return on Equity (ROE) | Net Profit/ Equity | Paiva et al. (2015); Raithatha and Komera (2016); | + |
| Market-to-book (MB) | VM [1] / Equity | Sauset et al. (2015); Shue and Townsend (2017); Gipper (2021). | + |
| Total Assets (AT) | *log* (Total Assets) | Devers et al. (2008); Paiva et al. (2015) <br> Fang and Zhong (2004); | + <br> - |
| Leverage (AL) | Short and long-term debt / Equity | Devers et al. (2008); Eisdorfer (2008); Danielova et al. (2013) | + |

[1] VM – Market Value (share price x number of shares outstanding).
Source: Elaborated by the authors (2022).

The replacement of the main executive (turnover) would be higher after unsatisfactory performances, which can be interpreted as an "indicator" of financial difficulties and could suggest greater business risk (Eisdorfer, 2008). On the other hand, it may be the result of efficient monitoring of the company (Chen et al. 2008), which would adjust the assumption of managerial risks to the interests of shareholders. Furthermore, the longer the tenure, the greater the likelihood of creating power networks (Goyal & Park, 2002), which would increase the influence of the CEO on the board of directors and encourage executives to pursue benefits by choosing projects with greater risk for the company. Older executives would find it easier to form power bases (Jensen & Murphy, 1990), which would increase riskier decision-making for companies. However, they would have more experience and, therefore, would make better decisions (Herrmann & Datta, 2005), including regarding project´s risk-taking.

In addition, decision-making regarding project´s risk would affect the performance of companies, in the sense that the greater the risk, the greater the expected result (Utami & kusuma, 2019). Increased growth opportunities would encourage managers to adopt more aggressive risk-taking strategies, aiming at greater market share (Elsayed & Elbardan, 2018). As for size, the largest companies would be related to a

lower risk, as they would depend on the public debt market and would have incentives to reduce debt financing costs (Fang & Zhong, 2004). On the other hand, they would be less financially constrained, facilitating the option for riskier projects. Furthermore, the risk of default would increase the risk incentives, which suggests that a higher degree of leverage would generate incentives for executives to choose riskier projects (Danielova et al., 2013).

### 3.3 Econometric model

To capture the influence of executive compensation on risk, linear regressions were applied using unbalanced panel data by GMM-Sys. The Equation (1) presents the panel data regression model used in the present study.

$$R_{it} = \alpha_i + R_{it-1}\,\varphi + REM_{it}\gamma + W_{it}\delta + \sum_i^n EFset_i + \sum_t^n EFtemp_t + \varepsilon_{it} \qquad (1)$$

Where $R_{it}$ represents the variable related to risk, $R_{it-1}$ the lagged risk in a period, $REM_{it}$ represents executive compensation (range, average or total), $\alpha$ is the intercept, $\varphi$, $\gamma$ and $\delta$ are the coefficients, $W_{it}$ are the control variables, EFset is the sectoral fixed effects, EFtemp is the temporal fixed effects, $\varepsilon_{it}$ represents the error term, i indicates the companies and t indicates the time.

The Generalized Method of Moments (GMM) allows for greater efficiency in obtaining asymptotic estimators. In this case, two types of estimators can be used, the GMM-Dif (in differences) developed by Arellano and Bond (1991) and the GMM-Sys (Systemic), developed by Blundell and Bond (1998). The difference between the estimators is in the moment conditions of each one, depending on the number of instruments available in the analysis. The reason for choosing GMM-Sys is centered on the acceptance of a set of available instruments and the prospect of more accurate estimates, despite the assumptions about initial conditions being more restrictive. Also, for Bond (2002), GMM-Sys has a more robust assumption, which reduces the efficiency gains allowed by the homoscedasticity condition, a condition that can be waived.

To this end, the following validation tests were applied in this study: (i) Arellano and Bond (1991): to identify if there is serial correlation in the residuals; (ii) Correlation and VIF (Variance Inflation Factor): to identify the existence of multicollinearity; (iii) Chi-square ($\chi^2$): to verify if there is an association between the variables; and, (iv) Hansen (1982): to verify if there is overidentification of the instruments. The data are corrected according to the IGP-DI converted into dollars.

### 4 Analysis of Results

To explain further the results achieved, this section is divided into two parts: (a) descriptive statistics and correlation; and (b) results of the regression and validation tests.

### 4.1 Descriptive statistics and correlation

Before performing the analysis of the results, the correlation between the variables was verified. According to Hair et al. (2005), those with a correlation above 0.70 should be avoided. Furthermore, the VIF (Variance Inflation Factor) test was applied, which indicated that no variable had a value greater than 5. After verifying the correlation, Table 3 presents the descriptive statistics of the dependent and independent variables.

Table 3 shows that the average executive compensation is 0.06 million USD, the variability of their compensation is around 0.10 million USD, and the average total compensation is 0.27 million USD. In addition, executives receive an average of 0.19 million (USD) as fixed salary and 0.01 million (USD) as bonuses and shares and options compensation. The average accounting risk, measured by the variation of the companies' results concerning total assets, is 0.28, and the beta coefficient, used as a metric for market risk, is, on average, 0.91.

In addition, the tenure of the executives is around 3.5 years and the age of executives is around 53 years old. With regard to size and debt, the average total assets of companies are around 2.54 billion (USD), and the average leverage level is 1.28. Finally, it is worth mentioning that the variables (AT) and (AL) have a significant variance and standard deviation, in addition to a considerable difference between the mean and the median. Thus, the need to apply the natural logarithm to these variables is evident.

Table 3
**Descriptive statistics of the dependent and independent variables**

| | Dependent variables | | Independent variables | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **RISK** | **BETA** | **AMP** [1] | **TOT** [1] | **MED** [1] | **FIXA** [1] | **BONUS** [1] | **AC** [1] |
| **Average** | 0.28 | 0.91 | 0.10 | 0.27 | 0.06 | 0.19 | 0.01 | 0.01 |
| **Median** | 0.26 | 0.85 | 0.02 | 0.24 | 0.04 | 0.11 | 0.00 | 0.00 |
| **P10** | 0.14 | 0.36 | 0.01 | 0.02 | 0.00 | 0.01 | 0.00 | 0.00 |
| **P25** | 0.20 | 0.62 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| **P75** | 0.34 | 1.04 | 0.07 | 0.05 | 0.08 | 0.23 | 0.01 | 0.02 |
| **P90** | 0.41 | 1.52 | 0.16 | 0.01 | 0.13 | 0.40 | 0.15 | 0.10 |
| **Var.** | 0.02 | 0.27 | 9.61 | 10.09 | 0.28 | 0.08 | 0.04 | 0.02 |
| **Minimum** | 0.00 | -0.91 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Maximum** | 3.27 | 4.10 | 3.53 | 6.04 | 0.52 | 0.24 | 0.38 | 0.21 |
| **SD** | 0.16 | 0.52 | 0.97 | 0.31 | 0.16 | 0.28 | 0.21 | 0.15 |
| **Assym.** | 7.32 | 1.52 | 0.35 | 0.01 | 0.22 | 3.91 | 9.45 | 7.83 |
| **kurtosis** | 110.58 | 7.95 | 1.26 | 0.24 | 0.65 | 22.41 | 130.49 | 81.20 |

[1] Values are expressed in millions and converted into U.S. dollars, based on the exchange rate available at the Brazilian Central Bank website (https://www.bcb.gov.br) referring to the last day of each year of the analyzed period.
Note: RISK: Accounting risk; BETA: Market risk; AMP: Range of Compensation; TOT: Total Compensation; MED: Average Compensation; FIXA: Fixed Compensation; BONUS: Bonus Compensation; AC: Shares and Options Compensation; SD: Standard deviation.
Source: Elaborated by the authors (2022).

## 4.2. Results of regressions and validation tests

Before running the regressions, we performed the validation tests of the econometric models applied in the study, which are presented in Table 4. Thus, the Chi-square test indicates the rejection of the null hypothesis. In other words, there is an association between the variables used in the model. The Hansen (1982) test, on the other hand, indicates that the null hypothesis cannot be rejected, i.e., it is assumed that there is no correlation between the instruments and the regression error. Finally, the Arellano and Bond (1991) test rejects the null hypothesis for first-order serial autocorrelation but does not reject the second order, that is, the model presents the first order serial correlation, indicating that the dynamic GMM-Sys model is the most suitable for the study.

Table 4
**GMM - SYS model validation tests**

| | Regressions | | | | | |
|---|---|---|---|---|---|---|
| | Panel A - Regressions with dependent variable - RISK | | | | | |
| | **AMP** | **TOT** | **MED** | **FIXA** | **BONUS** | **AC** |
| **Chi2** | 146.03 | 69.78 | 115.60 | 76.04 | 266.87 | 73.55 |
| **Chi2p** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Hansen** | 119.68 | 85.15 | 120.84 | 79.96 | 121.78 | 61.88 |
| **Hansenp** | 0.99 | 0.32 | 0.56 | 0.21 | 0.95 | 0.77 |
| **Ar1** | -3.50 | -3.43 | -4.26 | -3.41 | -3.86 | -2.56 |
| **Ar1p** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| **Ar2** | 0.10 | 0.29 | 0.06 | 0.11 | 0.44 | 0.90 |
| **Ar2p** | 0.91 | 0.77 | 0.94 | 0.90 | 0.65 | 0.36 |
| | Panel B - Regressions with dependent variable - BETA | | | | | |
| | **AMP** | **TOT** | **MED** | **FIXA** | **BONUS** | **AC** |
| **Chi2** | 312.56 | 217.48 | 291.36 | 52.56 | 167.27 | 475.41 |
| **Chi2p** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Hansen** | 75.26 | 13.74 | 47.88 | 18.78 | 71.40 | 46.13 |
| **Hansenp** | 0.40 | 0.79 | 0.71 | 0.87 | 1.00 | 0.46 |
| **Ar1** | -2.28 | -2.34 | -2.17 | -2.41 | -1.65 | -2.78 |
| **Ar1p** | 0.02 | 0.01 | 0.02 | 0.01 | 0.09 | 0.00 |
| **Ar2** | 1.49 | 0.92 | 1.00 | 0.82 | 0.54 | 1.28 |
| **Ar2p** | 0.13 | 0.35 | 0.31 | 0.41 | 0.58 | 0.19 |

Note: RISK: Accounting risk; BETA: Market risk; AMP: Rang of Remuneration; TOT: Total Remuneration; MED: Average Remuneration; FIXED: Fixed remuneration; BONUS: Bonus Compensation; AC: Shares and Options Compensation; Chi2: Chi-Square Test; Hansen: Hansen's Test (1982); Ar1: First order serial autocorrelation test; Ar2: Second order serial autocorrelation test.
Source: Elaborated by the authors (2022).

To test the influence of executive compensation on companies' risk, we estimated regressions using the Systemic Generalized Method of Moments (GMM-SYS). Table 5 presents the results of the regression models with the dependent variables: accounting risk – RISK (Panel A) and market risk – BETA (Panel B). The results of panel A in Table 5 indicate that the variables of executive compensation positively impact the accounting risk (RISK) of firms.

The total remuneration (TOT), fixed remuneration (FIXA) and bonuses (BONUS) are statistically significant at 10%, the average remuneration (MED) and shares and options remuneration (AC) at 5%. An increase of one percentage point in total compensation, average and fixed salary, increases the variability of results by 0.01 percentage point in relation to total assets, bonuses and stocks and options increases the accounting risk of companies by 0.02%. These results are in line with studies by Shue and Townsend (2017), Dunn et al. (2019), Chu et al. (2020) and Gipper (2021) and suggest that excessive compensation would encourage executives to choose riskier projects. Thus, hypothesis 1 of this study is not rejected. High salaries would be related to powerful executives, who would participate in the definition of their own remuneration, making it easy to obtain private benefits (Peters & Wagner, 2014).

Tabela 5
**Results of the regression models**

| Variables | | Panel A - Regressions with Dependent variable: RISK | | | | | |
|---|---|---|---|---|---|---|---|
| | | AMP | TOT | MED | FIXA | BONUS | AC |
| **R (-1)** | | **0.39***** | **0.31***** | **0.29***** | **0.26**** | **0.46***** | 0.17 |
| | Z | (4.97) | (2.73) | (3.73) | (2.10) | (5.53) | (1.40) |
| **REM** | | -0.01 | **0.01*** | **0.01**** | **0.01*** | **0.02*** | **0.02**** |
| | Z | (-0.41) | (1.64) | (1.99) | (1.62) | (1.68) | (2.35) |
| **Turnex** | | -0.02 | -0.03 | **-0.03**** | -0.01 | -0.01 | -0.01 |
| | Z | (-1.16) | (-1.57) | (-2.11) | (-0.84) | (-0.98) | (-0.83) |
| **IME** | | -0.01 | **-0.01*** | -0.01 | -0.01 | -0.01 | **-0.01**** |
| | Z | (-1.21) | (-1.76) | (-0.99) | (-1.43) | (-0.03) | (-1.96) |
| **Tex** | | -0.01 | 0.00 | 0.00 | -0.01 | -0.01 | -0.01 |
| | Z | (-0.08) | (0.03) | (0.21) | (-0.02) | (-0.82) | (-0.94) |
| **ROE** | | **0.05***** | **0.04*** | **0.12***** | **0.10**** | **0.04**** | 0.08 |
| | Z | (2.80) | (1.78) | (3.61) | (2.19) | (2.09) | (1.46) |
| **MB** | | **0.02***** | **0.03***** | **0.02***** | **0.03***** | **0.02***** | 0.01 |
| | Z | (3.72) | (2.58) | (3.36) | (3.44) | (2.91) | (1.43) |
| **AT** | | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 | -0.01 |
| | Z | (-0.18) | (-0.84) | (-0.82) | (-0.60) | (-0.39) | (-0.06) |
| **AL** | | 0.00 | 0.01 | 0.01 | **0.02*** | -0.01 | **-0.03**** |
| | Z | (1.04) | (0.51) | (1.29) | (1.86) | (-1.26) | (-2.13) |
| **Constant** | | **0.19***** | **0.33***** | **0.21***** | **0.31***** | **0.15***** | **0.43***** |
| | Z | (4.40) | (3.62) | (3.92) | (3.25) | (2.55) | (4.04) |
| | | Panel B - Regressions with Dependent variable: BETA | | | | | |
| | | AMP | TOT | MED | FIXA | BONUS | AC |
| **R (-1)** | | **0.88***** | **0.84***** | **0.77***** | **0.74***** | **0.70***** | **0.73***** |
| | Z | (12.81) | (7.51) | (13.11) | (6.16) | (7.38) | (12.15) |
| **REM** | | **0.01*** | **-0.08*** | **-0.03**** | **-0.07*** | **-0.03*** | **-0.23***** |
| | Z | (1.62) | (-1.78) | (-2.36) | (-1.69) | (-1.60) | (-2.96) |
| **Turnex** | | -0.01 | 0.04 | -0.01 | 0.02 | -0.01 | -0.05 |
| | Z | (-0.15) | (0.64) | (-0.37) | (0.15) | (-0.59) | (-0.78) |
| **IME** | | -0.01 | 0.00 | -0.01 | 0.01 | **-0.01**** | **-0.01***** |
| | Z | (-0.26) | (0.49) | (-0.24) | (0.83) | (-1.99) | (-2.57) |
| **Tex** | | **0.01**** | -0.01 | -0.01 | -0.02 | -0.02 | 0.01 |
| | Z | (2.41) | (-0.70) | (-0.63) | (-1.35) | (-0.92) | (0.68) |
| **ROE** | | -0.01 | -0.07 | -0.01 | -0.01 | 0.00 | 0.02 |
| | Z | (-0.91) | (-0.64) | (-0.03) | (-0.56) | (0.22) | (0.41) |
| **MB** | | 0.01 | **-0.04*** | -0.03 | **-0.07**** | -0.01 | -0.01 |
| | Z | (1.04) | (-1.64) | (-1.51) | (-1.98) | (-0.86) | (-0.48) |
| **AT** | | -0.01 | 0.01 | -0.01 | -0.01 | 0.00 | 0.01 |
| | Z | (-0.50) | (0.74) | (-0.93) | (-0.73) | (0.18) | (0.66) |
| **AL** | | 0.00 | -0.09 | 0.03 | -0.03 | -0.01 | -0.02 |
| | Z | (0.43) | (-1.39) | (0.62) | (-0.53) | (-0.64) | (-0.55) |
| **Constant** | | 0.04 | -0.14 | 0.44 | -0.01 | **0.38**** | **0.64**** |
| | Z | (0.42) | (-0.29) | (1.05) | (-0.02) | (2.20) | (1.93) |

Note: RISK: Accounting risk; BETA: Market risk; AMP: Range of Remuneration; TOT: Total Remuneration; MED: Average Remuneration; FIXA: Fixed remuneration; BONUS: Bonus Compensation; AC: Shares and Options Compensation; R: Risk; REM: Remuneration independent variable; Turnex: CEO Turnover; IME: age; Tex: Tenure; ROE: Return on Equity; MB: Market-to-book; AT: Total Assets; AL: Leverage. *- significant at 10%; **- significant at 5%; *** - significant at 1%.
Source: Elaborated by the authors (2022).

On the other hand, the results of panel B in Table 5 point to a negative relationship between executive compensation and the companies' market risk (BETA). Total compensation, fixed salary, and bonus compensations are significant at 10%, average compensation at 5%, and stock and option compensation at 1%. An increase of one percentage point in total, average, fixed, bonuses and stocks and options compensations reduce the companies' market risk by, respectively, 0.08%, 0.03%, 0.07%, 0.03% and 0.23%. These results are similar to studies by Chen et al. (2018) and Rengel et al. (2020), suggesting that an increase in executive´s compensation would discourage executives from pursuing private benefits (Lu & Shi, 2018), which allows us to reject hypothesis 2 of the present study.

Based on the assumption of the optimal hiring agency theory, high compensation amounts reflect the balance between the efforts and risks taken by executives, in which market forces effectively shape compensation packages (Chu et al., 2020). An increase in compensation may result from improved monitoring, which would lead executives to demand higher levels of explicit incentives to compensate the difficulty of obtaining private benefits (Lu & Shi, 2018). In this context, incentive packages for executives would reduce agency problems, which would increase investor confidence (Paiva et al., 2015) and reduce the market's perception of firms' risk levels (Rengel et al., 2020).

In addition, the range of executive compensation (AMP) is significant by 10%, with a positive impact on the market risk (BETA) of companies. An increase of one percentage point in the range of amounts paid to executives, increases the market risk of firms by 0.01 percentage point. This evidence corroborates the findings of White (2018), Vo and Canil (2019) and Rouen (2020), who suggest that a disparity in executive compensation may be the result of random choices or personal favoritism. The high range of executive compensation would cause a feeling of disrepute on the part of those who do not receive the highest salaries (Rouen, 2020), signaling that there are executives with managerial power to influence the formulation of compensation policies (Vo & Canil, 2019).

Table 5 also shows that the turnover variable (Turnex) has a significant negative relationship with the accounting risk (RISK) of 5% for the model with average remuneration. A one percentage point increase in CEO turnover decreases the accounting risk by 0.03 percentage points. These results corroborate the study by Chen et al. (2008) and suggest that the fear of losing the position of CEO would encourage the risk-taking adjustment, according to the interests of the shareholders. On the other hand, in market risk models, the variable (Turnex) is not statistically relevant.

In addition, with regard to accounting risk, the variable (IME) is significant in the model with the independent variable total compensation (10%) and shares and options compensation (5%), with a negative impact on both. The increase of one percentage point in the TOT and AC variables increase the accounting risk of firms by 0.01%. Similarly, the age of executives has a negative impact on the market risk of companies, in the sense that the IME is significant at 5% in model with bonus independent variable and at 1% in the model with share and options remuneration. Thus, an increase of one percentage point in bonuses and shares and options paid to executives reduces the market risk of firms by 0.01 percentage point. This finding corroborates the results of Devers et al. (2008) and suggests that the experience of older executives would be able to qualify their decision-making (Herrmann & Datta, 2005), including the choice of projects and their associated risk.

Regarding the tenure of executives, this variable is significant at 5% for the model with the independent variable AMP, with a positive impact on market risk. In other words, an increase of one percentage point in tenure increases the companies' market risk by 0.01%. This result is consistent with the study by Devers et al. (2008) and suggests that the longer the permanence in the position, the greater the probability of creating power networks, which would increase the influence of CEOs on the board of directors (Goyal & Park, 2002), and would encourage executives to pursue private benefits through the choice of riskier projects. On the other hand, the variable tenure (Tex) is not significant for models with accounting risk (RISK).

Regarding the relationship between performance and accounting risk, the results indicate that, with the exception of the regressions with the independent variable shares and options remuneration (AC), in all other models the ROE and Market-to-book (MB) variables are statistically significant. In the case of return on equity (ROE), this significance is 10% for the model with the TOT variable, 5% in the regressions with the FIXED and BONUS variables, and 1% in the models with the AMP and MED variables. Thus, an increase of one percentage point in ROE increases the accounting risk of companies from 0.04 to 0.12 percentage points.

These results are similar to the findings by Sauset et al. (2015) and suggest that risk-taking would have the purpose of achieving greater results. In terms of market performance, the significance to the models of the Market-to-book (MB) variable is 1%, in other words, an increase of one percentage point in the MB increases the accounting risk of firms from 0.02 to 0.03 percentage points. These results corroborate with Sauset et al. (2015) and Gipper (2021) and suggest that the greater the growth opportunities, the greater the incentives of executives to take risks and expand the participation of companies in the market (Elsayed & Elbardan, 2018).

However, in terms of market risk, the Market-to-book is significant in the fixed (5%) and total compensation (10%) models, with a negative effect on both. A one percentage point increase in the MB

variable reduces market risk by 0.07% and, for the TOT variable, reduces the BETA of companies by 0.04 percentage points. This result allows us to infer that those aspects unrelated to the financial results of firms, such as the personality of individuals, would be determining factors in risk-taking (Martin, et al., 2016). Regarding the return on equity, the ROE variable is not statistically relevant in models with market risk.

The results also indicate that debt has a positive impact on the accounting risk of companies, due to the variable Leverage (AL) being statistically significant in the model with fixed remuneration (FIXA) at 10%. A one percentage point increase in leverage increases the accounting risk by 0.02 percentage points. These results are similar to the studies by Devers et al. (2008), Eisdorfer (2008) and Danielova et al. (2013), suggesting that debt would increase the risk of default, which would encourage executives to choose riskier projects to support the increased risk of bankruptcy (Eisdofer 2008; Danielova et al., 2013). On the other hand, in the regression with the shares and options compensation variable (AC), leverage is significant at 5%, with a negative effect on accounting risk. In this sense, an increase of one percentage point in leverage reduces the accounting risk by 0.03 percentage points. This finding opposes the studies by Devers et al. (2008), Eisdorfer (2008) and Danielova et al. (2013) and suggests that executives of indebted companies would be subject to greater external monitoring by creditors, which would make it difficult to seek private benefits (Rauh, 2009).

## 5 Concluding Remarks

In order to analyze the impact of compensation on companies' risk, we estimated regression models using the GMM-SYS method. The results suggest that executive compensation impacts the accounting and market risk of Brazilian firms. In this sense, the higher the total (TOT) and average (MED) remuneration, the greater the variability of results in relation to total assets (RISK). This same relationship is verified in the analysis of the composition of the compensation policy for executives, since the increase in fixed remuneration (FIXA), bonuses (BONUS) and shares and options (AC) also increases the level of accounting risk of companies. An explanation for this empirical evidence lies in the assumptions of managerial power theory that high wages would be an indicative of agency problems and inadequate compensation schemes, due to the influence of powerful executives in defining the remuneration policy of firms (Ataay, 2018; Hoi et al., 2019). As practical implications, these results can help owners adjust compensation packages, balancing the salaries paid to executives and the levels of variability of results in relation to total assets.

On the other hand, the results of the regressions with the BETA variable indicate that the increase in executive compensation reduced the companies' market risk. In this line, the higher the total (TOT) and average (MED) compensation, as well as the fixed salary (FIXA), bonus (BONUS) and shares and options compensation (AC) paid to executives, the lower the market risk of firms. According to Tirole (2006), implicit and explicit incentives are substitutes, therefore, high salaries would discourage executives from obtaining personal perks, which would maximize corporate performance (Jensen & Murphy, 1990). In this context, it is clear that remuneration can mitigate agency problems, increasing confidence and, consequently, prospecting new investors, as these are attracted by medium and long-term returns with lower levels of risk.

The results also indicate that the greater the disparity between the highest and lowest salaries paid to executives (AMP), the greater the companies' market risk. In this line, a high range of remuneration would be an indication of the managerial power of the highest paid managers (Vo & Canil, 2019). Powerful executives would find it easier to act opportunistically and, with greater bargaining power over the board of directors, would influence the definition of compensation policies (Bebchuk & Fried, 2003; White, 2018). In this sense, the breadth of remuneration could be a sign of excess earnings on the part of some executives of Brazilian companies, an issue that, instead of resolving the conflict of interests advocated by the agency theory, further aggravates governance problems, affecting the market's perception of firms' risk levels.

In addition, the higher the turnover (Turnex) the lower the accounting risk levels of the companies, since a more adequate monitoring would be able to discourage executives from pursuing private benefits through riskier project choices, which would reduce the variability of firms´ results. In the same context, the higher the average age of executives (IME), the lower the companies' accounting and market risk. These results allow us to infer that the experiences acquired by older executives would help in decision-making (Jensen & Murphy, 1990), including risk-taking. On the other hand, the longer the executives' tenure, the greater the companies' market risk. Executives who remain in office for a long period, would find it easy to create power networks and interfere in the Board of Directors decisions (Goyal & Park, 2002), which would aggravate the agency problems arising from the choice of riskier projects. Thus, it would increase business uncertainties and, consequently, the market's perception of firms' risks.

With regard to performance, the greater the return on equity (ROE) and growth opportunities (MB), the greater the accounting risk of companies. This increase in risk levels would be due to the willingness of executives to achieve greater performance and expand the performance of companies in the market (Elsayed & Elbardan, 2018). However, the external perception of risk levels is affected by market performance, in the sense that the higher the Market-to-Book, the lower the beta coefficient (BETA) of companies. These results allow us to infer that those personal aspects of executives such as personality and

risk profile (Martin et al., 2016) influence decisions related to risk-taking. Accounting performance does not impact on firms' market risk levels.

Finally, it should be noted that the data in this study may present some endogeny and are limited to the information available in the reference forms published on the Brazilian Securities Exchange Commission (CVM) website. Another limitation concerns the formulation of the variables used in the regression models. Furthermore, we believed that the expansion of the analysis to companies from other emerging countries, as well as the use of other risk and remuneration variables, would be a good path for future research.

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**NOTES**