

Determining Factors for the Adoption of Stock Option Plans in Brazilian Publicly Traded Companies

Abstract

The objective was to identify the determining factors for the adoption of stock option plans in Brazilian publicly traded companies. Therefore, a descriptive research was developed by means of document analysis and a quantitative approach, using logistic regression. The sample consists of 158 companies, using data for the period from 2009 till 2012. The results evidenced an increase in the number of companies with stock option plans during the period. Among the factors company size, liquidity constraint, stock concentration, horizon problem, stockholder participation of CEO, dual function of CEO and chairman of the board, described in the literature as influences for the use of stock option plans, three were confirmed in the sample analyzed. The factors “current liquidity” between 2010 and 2012; “horizon problem” between 2009 and 2012; and “stockholder participation” in 2012, further evidence positive relations in the Brazilian context.

Key words: Determinants; Adoption of stock option plan; Brazilian publicly traded companies.

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1. Introduction

Among the existing remuneration plans, stock option plans are one of the most used forms of long-term incentive in the United States and Europe. This remuneration alternative is little by little disseminated in Brazil as well, mainly under the argument that managers' stockholder participation is a direct and efficient method to align interests between the owner and the manager (Wood & Picarelli, 2004; Galdi & Carvalho, 2006; Dias, Cunha & Mário, 2009; Cesari & Ozkan, 2015).

The conflicts caused by the separation between ownership and management are discussed in the Agency theory, whose precursors were Jensen and Meckling (1976), in a study in which they mention that the Agency theory examines the relations between principals and agents. Although, in principle, the agent (manager) works for the principal (stockholder), he ends up creating his personal motivations and objectives of maximizing satisfaction, which are not always aligned with those of the principal.

In that sense, Galdi and Carvalho (2006) mention that the adoption of stock plans theoretically reduces agency conflicts, as the employee's target is to maximize the company value in order to increase his remuneration as well. In countless studies related to stock option plans, such as Ding e Sun (2001), Uchida (2006), Tzioumis (2008), Dias (2010), Perobelli, Lopes e Silveira (2012), Quin (2012) and Cesari and Ozkan (2015), the agency problems caused by the separation between property and control in large corporations are emphasized.

In addition, researchers (Bryan, Hwang & Lilien, 2000; Uchida, 2006; Tzioumis, 2008; Dias, 2010; Qin, 2012) also appoint that the growing use of stock option plans can be associated with different factors. In Brazil, however, where the interest in research on this theme is growing, the investigation of the determinants still represents a relevant research gap, as most studies were concentrated on relevant issues related to the disclosure of information about stock option plans. As examples, the studies by Nunes (2008), Dias *et al.* (2009), Perobelli *et al.* (2012), Miranda, Tomé and Gallon (2011), Niyama, Campos, Gonçalves and Campos (2012), Tannuri, Farias, Vicente, Bellen and Alberton (2012) and Larini, Schäfer, Rosa and Ferreira (2015) can be mentioned.

In the literature, among the determinants for the adoption of stock options, the company size (Ding & Sun, 2001; Kato, Lemmon, Luo & Schallheim, 2005; Uchida, 2006; Chourou, Abaoub & Saadi, 2008; Tzioumis, 2008; Dias, 2010); liquidity constraints (Yermack, 1995; Bryan *et al.*, 2000; Ding & Sun, 2001; Uchida, 2006; Tzioumis, 2008; Dias, 2010); stockholder concentration (Nagaoka, 2005; Banghoj, Gabrielsen, Petersen & Plenborg, 2010; Dias, 2010); horizon problem (Bryan *et al.*, 2000; Tzioumis, 2008); dual functions of CEO and chairman of the board (Tzioumis, 2008; Qin, 2012); and stockholder participation of CEO (Kato *et al.*, 2005; Uchida, 2006; Chourou *et al.*, 2008; Tzioumis, 2008; Qin, 2012) is highlighted.

Based on the above, the following research question was elaborated to guide this study: **What are the determinants of the adoption of stock option plans in Brazilian publicly traded companies?** Thus, the objective of this study is to identify the determinant factors for the adoption of stock option plans in Brazilian publicly traded companies.

The study is justified by the importance of the theme in view of the agency problem in companies and due to divergences in earlier research results (Bryan *et al.*, 2000; Ding & Sun, 2001; Kato *et al.*, 2005; Uchida, 2006; Tzioumis, 2008; Dias, 2010; Qin, 2012) that are a source of concern. It is highlighted that the results are inconclusive concerning the effects of each variable as, in most cases, the results of the variables diverge among the studies (Dias, 2010).

In addition, due to the small number of studies in the context of the Brazilian market, it should again be highlighted that the investigation of the determinants for the use of this form of variable remuneration still represents a relevant research gap in the Brazilian stock market, considering that, in Brazil, mainly issues relate to information disclosure on the stock option plans have been analyzed. Thus, the intent is to contribute to enhance the discussion on the theme.

The study is also relevant because it relates the adoption of stock option plans with factors Brazilian researchers have hardly explored. Hence, the study is justified as it contributes to strengthen the understanding on the theme in the Brazilian context and extends the discussion to factors that can influence the adoption of stock option plans.

The study is structured in seven parts, starting with this introduction. Next, the theoretical framework is presented, which discusses contents on the agency theory, stock option plans and determinants for the adoption of stock option plans. Then, the methodological aspects used to develop the research are described. Then, the analysis of the results is presented, followed by the final considerations.

2. Agency Theory

The Agency theory was introduced in the economy in the 1970's, due to the sharing of risks between principals and agents as, often, directs and agents work together but with different objectives (Jensen & Meckling, 1976). The stakeholders treated the risk differently. Thus, the Agency theory broadened studies on the theme risks, including the so-called agency problem, which occurs when the cooperators have different objectives and a different division of work (Ross, 1973; Jensen & Meckling, 1976).

In the agency relations, two problems can emerge: the principal's objectives conflict with the agent's and it is costly for the principal to verify what the agent is actually doing; and the sharing of risk, which comes up when the principal and agent have different attitudes towards the risk (Jensen & Meckling, 1976).

When the principal is aware of the agent's activities, a remuneration system based on behavior can be effective. When the director does not know what the agent is doing, conflict can occur. In Agency theory, the conflicts between principal and agent are known as moral risk and adverse selection (Fama & Jensen, 1983). The moral risk problem can be understood as actions that are hidden to the owners or are costly to observe. The adverse selection problem can be considered as hidden information – in this case, the agent has information the owners cannot observe (Arrow, 1985).

When the principal's work is delegated to the agent, the agency relation develops. The agent's mission is the perfect accomplishment of the principal's interests. The principal faces the risk of the agent's failure, but the agent's execution of the mission can also influence the payment agreed upon with the agent. Thus, the agent's level of reward generally depends on the director's interest in the accomplishment of the mission. The advantage for the agent, in the form of a reward, represents a cost for the principal, while the agent's efforts offer benefits to the principal and, at the same time, cost for the agent (Eisenhardt, 1989).

Agency theory develops risk monitoring and sharing factors, affecting a remuneration system based on the agent's performance. Monitoring factors include work programming, investment in selection systems, monitoring of performance by the principal and the relational proximity between the principal and the agent. These risk factors are the principals and agents' attitudes towards the risk, the size of the purchase and uncertainty in the performance result (Eisenhardt, 1989; Bergen, Dutta & Walker, 1992).

Agency theory is used to analyze the conflict of interests among the main stakeholders and develop conflict solving mechanisms (Tipuric, 2008). The agents are motivated by self-interest and are rational actors. Thus, the directors can motivate the agents, controlling their incentives. The information systems prohibit the agent's opportunism, as they inform the director about what the agent can do. When the company has information to verify the agent's behavior, the agent is more prone to behaving in favor of the principal's interest (Eisenhardt, 1989).

According to Siffert (1996), the bilateral relations between principal and agent have three characteristics in common: (a) the agent has different actions at his disposal and can employ the company's resources in distinct manners, including the misappropriation of part of this amount, or simply not make efforts to maximize the partners' profit; (b) the agents' behavior affects not only their own well-being, but also that of the principal, whether due to the increase or decrease of the financial resources available, af-

fecting the organization's performance; and (c) there exists information asymmetry among the stakeholders. The principal cannot monitor all of the agent's steps, nor identify his degree of commitment to work in order to maximize the principal's wellbeing.

The ideal contract between principal and agent is part of the discussions held in Agency theory, in which the agent (manager or employee) tries to satisfactorily maximize personal gains through the principal's economic objectives, and the agent's level of commitment is a function of the value of the reward received for the objectives achieved (Podrug, Filipovic & Milic, 2010).

3. Stock Option Plans

Options have been used since the Greek and Roman civilizations, and the current model was developed in the United States, after the crisis of 1929 (Nunes, 2008). The oldest register is found in the Chrysler Corporation, where the Board of Administrators approved the first option plans in 1952 (Smith & Wallace, 1997). In Brazil, the first records of incentive plans through stock options date back to the 1970's, used by North American companies established in the country (Nunes, 2008).

According to Nunes (2008), the use of stock options as a form of remuneration is to grant, at a specific data, options to purchase batches of company stock in the future, at a fixed price, which may be equal or not to the market price at the moment the option is granted. The author also mentions that the use of this type of remuneration enhances the employees' motivation to improve their performance, which will consequently result in the increased value of the stock, surpassing the exercise price and leading to further gains.

Stock option plans, increasingly important in companies' financial structure, are relevant options for the employees, which comply with some requisites: they grant the employees the right to purchase a determined or determinable number of stocks and receive a certain amount that varies according to the price of the stock or the value of the dividends. Thus, the stock options are considered as a form of retribution of the company to the employees (Tiscini & Raoli, 2013).

Companies do not only issue stock options to adjust the managers and stockholders' interests, but are also used to remunerate the employees, attracting and retaining them, and also to obtain shareholder revenues (Uchida, 2006; Cesari & Ozkan, 2015). The attraction and retention of the employees occurs because, if they resign from the organization before owning the stock options, the employees lose their rights. In addition, when they accept the options, the employees become stockholders of the company they work for (Tzioumis, 2008; Cesari & Ozkan, 2015).

The regulatory framework for the theme in the Brazilian market was set in 2008, when the Accounting Pronouncements Committee (CPC) approved Technical Pronouncement CPC 10 – Stock based payment (Dias, 2010; Larini *et al.*, 2015).

4. Determinants For The Adoption Of Stock Option Plans And Research Hypotheses

Different factors are appointed in the literature as determinants for the adoption of stock option plans, such as the company size (Ding & Sun, 2001; Kato *et al.*, 2005; Uchida, 2006; Chourou *et al.*, 2008; Tzioumis, 2008; Dias, 2010); liquidity constraints (Yermack, 1995; Bryan *et al.*, 2000; Ding & Sun, 2001; Uchida, 2006; Tzioumis, 2008; Dias, 2010); stockholder concentration (Nagaoka, 2005; Banghoj *et al.*, 2010; Dias, 2010) horizon problem (Bryan *et al.*, 2000; Tzioumis, 2008; Dias, 2010); dual function of CEO and chairman of the board of administrators (Tzioumis, 2008; Qin, 2012); and stockholder participation of the CEO (Kato *et al.*, 2005; Uchida, 2006; Chourou *et al.*, 2008; Tzioumis, 2008; Qin, 2012). Next, each of them is described along with the respective research hypotheses.

4.1 Company size

In larger companies, according to Ding and Sun (2001), controlling the agent's actions is more difficult when compared to smaller companies. Therefore, the incentives to adopt stock option plans to minimize potential agency problems are stronger in larger companies. Uchida (2006) presents similar arguments as, according to him, managers of large companies should allocate more complex resources, turning the monitoring more difficult for the stockholders. Thus, the use of stock option plans can contribute to further alignment between principal and agent.

In addition, large companies tend to perform more complex operations, as they do business in different countries with different types of companies, located in several geographical regions. Therefore, it is plausible to consider that, besides attracting more influential and trained professionals, these companies offer better remunerations to their executives, including the use of stock option plans (Kato *et al.*, 2005; Chourou *et al.*, 2008; Tzioumis, 2008). Tzioumis (2008), like Dias (2010), mentions that the financial capacity of big companies is larger, granting them greater possibilities to remunerate their executives with stock option plans. Thus, the first research hypothesis is:

H₁: The company size is a determinant for the adoption of stock option plans. Bigger companies are expected to possess better conditions and incentives to adopt stock option plans.

4.2 Liquidity constraints

Another motive that can contribute to the adoption of stock option plans to remunerate managers, in accordance with Tzioumis (2008), is the presence of constraints in the company's liquidity, as the stock options do not require the disbursement of cash. The author also mentions that the stock options can serve as an incentive for the manager to try and revert the situation.

According to Ding and Sun (2001), the stock option plans are a form of remuneration "without money" for the executives, from the stockholders' viewpoint. The authors also highlight that the executives will inject money in the company if they decide to exercise their options. Therefore, they observe that companies who face liquidity constraints will be more prone to adopting the stock option plans as a way to remunerate their executives.

Other authors defend the same thought, such as Yermack (1995), Bryan *et al.* (2000), Uchida (2006) and Dias (2010). Thus, the second hypothesis was established:

H₂: Liquidity constraints are a determinant for the adoption of stock option plans. In that sense, companies with liquidity constraints are expected to be more prone to the adoption of stock option plans.

4.3 Stockholder concentration

In some companies, the controlling stockholder holds a high percentage of stockholder participation. In these cases, the concentration reduces the managers' discretionary behavior, as large investors aim for the maximization of company income and greater control on company assets so as to have their rights respected (Nagaoka, 2005; Dias, 2010).

Differently from various dispersed stockholders, large controlling stockholders have greater access to the executives' actions, as their economic incentives to monitor the managers are larger. According to Banghoj *et al.* (2010), these factors reduce the need to pay variable remuneration, mainly when based on performance, which is the case of stock option plans.

According to the line of reasoning that greater capital concentration contributes to further alignment between the principal and the agent's interests, the third research hypothesis is established:

H₃: The stockholder concentration is a determinant for the adoption of stock option plans. Following the line of reasoning that greater capital concentration contributes to further alignment between the principal and the agent's interests, companies with greater stockholder concentration are expected to use less stock option plans.

4.4 Horizon problem

The horizon problem, according to Tzioumis (2008), emerges when the CEOs get close to retirement. That happens, according to the author, because in most cases, the manager starts to overvalue projects that only offer short-term results, instead of investments that can increase the company's efficiency in the long term, such as investments in research and development for example.

Hence, the stock option plans could alter the short-term focus of managers close to retirement and encourage the search for projects and investments that favor the stockholders' long-term interests (Bryan *et al.*, 2000; Tzioumis, 2008; Dias, 2010).

Thus, in view of the possible existence of the horizon problem, the fourth research hypothesis was established:

H₄: The CEO's age is a determinant for the adoption of stock option plans. The CEO's higher age is expected to influence the companies' proneness to the adoption of stock option plans.

4.5 Dual functions (CEO and chairman of the board)

The duality analyzed in this study occurs when an individual serves as the CEO and chairman of the board of directors, that is, two top functions. From the agency theory approach, the separation between the functions of chairman and CEO would be expected to contribute to a reduction in the agency conflicts (Qin, 2012). The non-duality, as Qin (2012) describes, allows the board of administrators, representing the shareholders, to monitor and control more effectively the actions of executives serving as directors.

In addition, when comparing a CEO who does not accumulate the functions of CEO and chairman of the board with a CEO who possesses this dual responsibility, Tzioumis (2008) calls attention to the fact that, when these dual functions exist, the CEO faces more complex tasks. In addition, the author observes that greater responsibility and skill is required. Therefore, better remuneration would be necessary for the manager.

In these cases, one alternative is to increase the performance-based remuneration, including stock option plans in the remuneration package. Thus, the fifth research hypothesis was established:

H₅: The dual function of CEO and chairman of the board is a determinant for the adoption of stock option plans. Companies in which the same individual serves as CEO and chairman of the board are expected to be more prone to the adoption of stock option plans.

4.6 Stockholder participation of CEO

When the managers possess stock of the company they work for, they will pay for part of the costs and will be less prone to wasting company wealth (Morck, Shleifer & Vishny, 1988). Hence, the adoption of stock option plans can be an alternative to align the CEO's interest with that of the other stockholders, thus minimizing potential agency problems (Kato *et al.*, 2005; Uchida, 2006; Chourou *et al.*, 2008; Qin, 2012).

Tzioumis (2008) clarifies that the CEO's stockholder participation in the company he works for refers to the percentage of stock he holds in relation to the total circulating stocks, and also presents arguments similar to Kato *et al.* (2005) and Chourou *et al.* (2008), arguing that the stock option plans represent additional incentives for the CEO to try and maximize the company value and, consequently, maximize the stockholders' wealth. Thus, the sixth research hypothesis is established:

H₆: The stockholder participation of the CEO is a determinant for the adoption of stock option plans. In this sense, companies with stockholder participations of the CEO are expected to be more prone to the adoption of stock option plans, as this action will lead to more aligned interests.

5. Methodological Procedures

This research, characterized as descriptive, was developed through document analysis and a quantitative approach of the data. The study population consists of the companies listed on the São Paulo Stock Exchange (BM&FBOVESPA) on October 16th 2013. The research sample includes the publicly traded companies participating in Level 1, Level 2 and the New Market of BM&FBOVESPA, except for companies from the financial sector and others excluded due to the peculiarities of the sector. Companies without data for all variables in all years analyzed were also excluded, thus totaling 158 companies, 24 of which were listed at Level 1, 14 at Level 2 and 120 on the New Market.

The choice of these companies is justified by their representative role in their respective sectors. In addition, as they participate in the distinguished corporate governance levels, these organizations are subject to a set of practices intended at expanding the stockholders' rights, transmitting greater safety and improving the quality of information provided to the public.

Initially, the reference forms of each of the 158 companies were analyzed to identify companies with stock option plans. Next, data were collected about the factors appointed in the literature as determinants for the use of these plans, as highlighted in the research construct presented in Figure 2.

	Variables	Description		Data source	Authors
			How to calculate		
Dependente	Stock option plan	Company has one: Não = 0 / Sim = 1	Reference form: Section 13 – Remuneration of managers		Ding e Sun (2001), Uchida (2006), Dias (2010)
	Size	Napier's logarithm of total assets	Economática database		Ding e Sun (2001), Uchida (2006), Tzioumis (2008)
Independente	Current liquidity	Current assets Current liabilities	Economática database		Ding e Sun (2001), Tzioumis (2008)
	Stockholder concentration	% ordinary stock held by main shareholder	Economática database		Nagaoka (2005), Banghoj <i>et al.</i> (2010), Dias (2010)
	Horizon problem	Age of CEO	Reference form: Section 12 – Assembly and management		Bryan <i>et al.</i> (2000), Tzioumis (2008), Dias (2010)
	Dual functions	Duality: Não = 0 / Sim = 1	Reference form: Section 12 – Assembly and management		Tzioumis (2008), Chen e Lee (2010)
	Stockholder participation of CEO	Present: Não = 0 / Sim = 1	Reference form: Section 13 – Remuneration of managers; Section 15 – Control		Kato <i>et al.</i> (2005), Chourou <i>et al.</i> (2008)

Source: elaborated by the authors.

Figure 1. Dependent and independent variables

As observed in Figure 2, the data related to size, current liquidity and stockholder concentration were collected in the database Economática. The data on the horizon problem, dual functions and stockholder participation of the CEO were manually collected from the Reference Forms of each of the 158 companies. The data collection and analysis period ranged from 2009 to 2012.

Next, the statistical procedures of multivariate data analysis were applied by means of logistic regression. Logistic regression, according to Hair, Anderson, Tatham and Black (2009, p. 34) - “[...] is the appropriate multivariate technique when the sole dependent variable is dichotomous”, which is the case in this study, in which the adoption or not of stock option plans is the dependent variable, corresponding to “0” for companies without such plans and “1” for companies that do have these plans. Thus, the goal was to verify the association between the dependent/binary variable, the adoption of stock option plans, and the different independent variables presented. Therefore, the logistic regression was defined as the appropriate statistical technique.

6. Data Description And Analysis

This part contains the description and analysis of the collected data. First, the number of companies with stock option plans between 2009 and 2012 is described. Next, the logistic regression results are demonstrated that permitted reaching the research objective.

First, in Table 1, the total number of companies with stock option plans among the 158 companies in the sample is shown.

Table 1

Companies with stock option plans between 2009 and 2012

Stock option plans	2009		2010		2011		2012	
	N°	%	N°	%	N°	%	N°	%
Use	77	49	89	56	105	66	112	71
Do not use	81	51	69	44	53	34	46	29
Total companies	158	100	158	100	158	100	158	100

Source: research data.

The analysis of data in Table 1 shows that the stock option plans still did not receive due importance in the business context in 2009. That is due to the number of companies that possessed these plans (49), corresponding to only 49%. Nevertheless, an increase is noticed in the number of companies that adopted these plans, reaching 71% in 2012.

Next, logistic regression was applied to identify the determinants for the adoption of stock option plans in the sample companies. The first step is to demonstrate, through Table 2, how the companies would be classified if the model were only guided by the frameworks observed.

Table 2

Classification before logistic regression analysis

Classification Table (a,b)					
Observed		Predicted			
		Stock Option Plans		Percentage Correct	
		No	Yes		
Painel A - 2009					
Step 0	Stock Option Plans	No	81	0	0
		Yes	77	0	100
Overall Percentage				51,30	
Painel B - 2010					
Step 0	Stock Option Plans	No	0	69	0
		Yes	0	89	100
Overall Percentage				56,30	
Painel C - 2011					
Step 0	Stock Option Plans	No	0	53	0
		Yes	0	105	100
Overall Percentage				66,50	
Painel D - 2012					
Step 0	Stock Option Plans	No	0	46	0
		Yes	0	112	100
Overall Percentage				70,90	

Source: research data.

As observed in Table 2, according to the results produced in the statistical software SPSS, in the pre-classification, all companies in the sample of 158 companies would be classified as having stock option plans in all years analyzed. According to Dias and Corrar (2009), this means that the model will correctly classify companies with stock option plans, but will incorrectly classify companies without these plans.

In this research, the overall percentage of correct classifications corresponds to 51.30% in 2009, 56.30% in 2010, 66.50% in 2011 and 70.90% in 2012. This analysis is important, in accordance with Dias and Corrar (2009), as it serves as a reference to assess the efficacy of the model when it starts to operate with the independent variables.

Thus, these percentages are expected to increase after the inclusion of the independent variables. In Table 3, the respective variables are evidenced with the respective scores and significance levels in the periods analyzed.

Table 3

Independent variables of logistic regression between 2009 and 2012

Variables	2009		2010		2011		2012	
	Wald	Sig.	Wald	Sig.	Wald	Sig.	Wald	Sig.
Size (Total Assets)	0.3050	0.581	0.4220	0.516	0.1260	0.723	0.8070	0.369
Current Liquidity	0.4060	0.524	6.5780	0.010*	0.7650	0.082*	3.3780	0.066*
Stockholder concentration	0.7950	0.389	0.8015	0.305	0.7265	0.346	0.7569	0.398
Horizon problem	2.8390	0.092*	3.8230	0.051*	6.3670	0.010*	17.0910	0.000**
Dual functions	0.0880	0.767	0.0250	0.875	0.2270	0.634	0.0030	0.958
Stockholder participation of CEO	0.4470	0.504	2.1910	0.139	2.4640	0.116	4.0220	0.045**

**Statistically significant at 0.05.

*Statistically significant at 0.10.

Source: research data.

In Table 3, it is observed that the variable “size” is not statistically significant at 10% in the period analyzed. Therefore, hypothesis H_1 is rejected, as the result demonstrates that the size cannot be considered a determinant factor for the adoption of stock option plans in the sample analyzed. Thus, the report by Ding and Sun (2001), Kato *et al.* (2005), Uchida (2006), Chourou *et al.* (2008), Tzioumis (2008) and Dias (2010) was not confirmed.

It is also observed in Table 3 that the variable “current liquidity” was statistically significant at 0.10 for the years 2010, 2011 and 2012. Hence, hypothesis H_2 could not be rejected, as the result indicates that companies with current liquidity constraints had more stock option plans. This result is in accordance with the literature (Yermack, 1995; Bryan *et al.*, 2000; Ding & Sun, 2001; Uchida, 2006; Tzioumis, 2008; Dias, 2010), in that companies with liquidity constraints are more prone to the adoption of stock option plans as a way to remunerate their executives.

Like the variable “size”, “stockholder concentration” was not statistically significant either in any of the years analyzed. Therefore, hypothesis H_3 was rejected, that is, for the research sample, the argument by Nagaoka (2005), Banghoj *et al.* (2010) and Dias (2010) that stockholder concentration can influence the adoption of stock option plans was not confirmed.

It is also observed that the variable “horizon problem” was statistically significant at 10% in all years analyzed. Thus, hypothesis H_4 is not rejected, as the result evidences that, among the companies in the sample, the CEO’s age is associated with the adoption of stock option plans, in accordance with Bryan *et al.* (2000), Tzioumis (2008) and Dias (2010).

Another variable with statistical significance at the level of 10% was “stockholder participation of the CEO”, but only for 2012. Therefore, hypothesis H_6 could not be rejected for that year. Like in the studies by Kato *et al.* (2005), Uchida (2006), Chourou *et al.* (2008) and Tzioumis (2008), that result indicates that, in 2012, the CEO’s stockholder participation was a determinant for the adoption of stock option plans.

It is also verified in Table 3 that the variable “dual functions” was not statistically significant either. Therefore, hypothesis H_5 was rejected for the companies analyzed, that is, for the research sample, the report by Tzioumis (2008) about the role of double responsibility as a determinant for the adoption of stock option plans was not confirmed.

In short, three variables showed statistical significant in at least one of the years. Hence, “current liquidity” between 2010 and 2012, “horizon problem” between 2009 and 2012 and “stockholder participation” in 2012 can be considered determinants for the adoption of stock option plans among the publicly traded companies in the research sample.

Next, in Table 4, the Step, Block and Model, Hosmer & Lemeshow tests and the indicators -2LL, Cox-Snell R^2 and Nagelkerke are presented, so as to analyze, after the inclusion of the independent variables, whether the models can be considered capable of performing the predictions as accurately as desired level.

Table 4

Validation tests of logistic regression model between 2009 and 2012

	2009		2010		2011		2012	
Painel A – Omnibus Tests of Model Coefficients								
	Chi-square	Sig.	Chi-square	Sig.	Chi-square	Sig.	Chi-square	Sig.
Step	3.981	0.552	15.472	0.009	11.322	0.045	30.143	0.000
Block	3.981	0.552	15.472	0.009	11.322	0.045	30.143	0.000
Model	3.981	0.552	15.472	0.009	11.322	0.045	30.143	0.000
Painel B – Model Summary								
-2 Log likelihood	214.9520		201.0250		190.2760		160.4580	
Cox & Snell R Square	0.025		0.093		0.069		0.274	
Nagelkerke R Square	0.033		0.125		0.096		0.348	
Painel C – Hosmer and Lemeshow Test								
Step	Chi-square	Sig.	Chi-square	Sig.	Chi-square	Sig.	Chi-square	Sig.
1	11.628	0.169	10.317	0.243	13.558	0.194	11.902	0.156

*Statistically significant at 0.010.

Source: research data.

The Step, Block and Model tests are intended to demonstrate the predictive capacity of the model. The results, described in Panel A of Table 4, corresponded to 3.981 for 2009; 15.472 for 2010; 11.322 for 2011 and 30.143 for 2012. It should be highlighted that, in 2009, the Step, Block and Model coefficients are not statistically significant at 5%, that is, in that year, there was no significant improvement in the quality of the predictions after the inclusion of the independent variables. This result is mainly due to the fact that, in 2009 (Table 3), only one of the six variables was significant.

In addition, in Panel B of Table 4, a -2Log likelihood coefficient of 214.952 is found in 2009; 201.025 in 2010; 190.276 in 2011 and 160.458 in 2012, that is, decreasing. These results indicate that the explanatory power of the model increases over the years as, according to Dias and Corrar (2009), the lower the indicator, the greater the predictive power of the model will be.

The Cox & Snell and Nagelkerke tests are considered pseudo- R^2 and similar to the determination coefficient R^2 , used in the linear model, in accordance with Dias and Corrar (2009). Therefore, the two indicators in this research reflect that the set of independent variables (determinants of stock option plans) cannot satisfactorily explain the variations in the log of the dependent variable index (adoption of stock option plans). It is highlighted that 2012 displays the best results for these indicators mainly because, in that year (Table 3), three out of six variables analyzed were significant.

Finally, the Hosmer and Lemeshow test, also according to Dias and Corrar (2009), tests the hypothesis that there are no significant differences between the model predictions and observations, resulting in values without statistical significance for all years. In this case, this result indicates that the predicted values did not significantly differ from the observations. Therefore, the Hosmer and Lemeshow test demonstrates that the models are suitable to verify whether the factors analyzed play a determinant role in the adoption of stock option plans.

In Table 5, the hit percentage of the classifications after the inclusion of the independent variables is demonstrated.

Table 5

Final classification of logistic regression analysis for the period from 2009 till 2012

<i>Classification Table (a,b)</i>					
<i>Observed</i>			<i>Predicted</i>		
			Planos de Opções de Ações		<i>Percentage Correct</i>
			Não possui	Possui	
Painel A - 2009					
Step 0	Stock Option Plans	No	55	26	67.90
		Yes	40	37	48.10
<i>Overall Percentage</i>					58.20
Painel B - 2010					
Step 0	Stock Option Plans	No	30	39	43.50
		Yes	24	65	73.00
<i>Overall Percentage</i>					60.10
Painel C - 2011					
Step 0	Stock Option Plans	No	12	41	22.60
		Yes	5	100	95.20
<i>Overall Percentage</i>					70.90
Painel D - 2012					
Step 0	Stock Option Plans	No	17	29	37.00
		Yes	8	104	92.90
<i>Overall Percentage</i>					76.60

Source: research data.

It can be perceived in Table 5 that, after the inclusion of the independent variables, the hit percentage of the model, which corresponded to 51.33% in 2009; 56.30% in 2010; 66.50% in 2011 and 70.90% in 2012 (results displayed in Table 2), increased to 58.20%, 60.10%, 70.90% and 76.60%, respectively, as shown in panels A, B, C and D of Table 5.

In 2009 (Panel A), analyzing 81 companies without stock option plans, 67.90% would be classified correctly. Concerning the 77 companies with the plans, the percentage of hits after the inclusion of the independent variables is equivalent to 48.10%.

In 2010 (Panel B), out of 69 companies without stock option plans, 43.50% would be classified correctly. As regards the 89 companies with plans, the hit percentage after the inclusion of the independent variables would increase to 73%.

In 2011 (Panel C), among the 53 companies without stock option plans, only 22.60% would be classified correctly. On the other hand, out of 105 companies with stock option plans, the percentage of hits after the inclusion of the independent variables corresponds to 95.20%.

Finally, in 2012 (Panel D), out of 46 companies without stock option plans, 37% would be classified correctly. As regards the 112 companies with stock option plans, the percentage of hits after the inclusion of the independent variables corresponds to 92.90%.

Therefore, when considering these results, it can be statistically affirmed that the factors “current liquidity” between 2010 and 2012, “horizon problem” between 2009 and 2012 and “stockholder participation” in 2012 can be considered determinants for the adoption of stock option plans among Brazilian publicly traded companies listed on the distinguished corporate governance levels of BM&FBOVESPA in the research sample.

7. Final Considerations

The objective in this study was to identify the determinant factors for the adoption of stock option plans in Brazilian publicly traded companies. Therefore, a descriptive research was conducted through document analysis and a quantitative approach, using logistic regression. The sample consisted of 158 companies with data for the period from 2009 till 2012, obtained from the Reference Forms and the database Economática.

The results evidenced that the stock option plans do not receive due importance in the corporate context. Nevertheless, an increase was observed in the number of companies that adopted such plans between 2009 and 2012. In that period, the year 2012 stood out with the largest number of companies with such plans, i.e. 112 (71%) among the 158 companies analyzed. In the negative sense, 2009 stood out, when only 77 companies (49%) had stock option plans.

The logistic regression revealed that the variable “current liquidity” was statistically significant for the years 2010, 2011 and 2012. Thus, hypothesis H_2 could not be rejected, as the result indicated that companies with current liquidity constraints had more stock option plans. This result is in accordance with the literature (Yermack, 1995; Bryan *et al.*, 2000; Ding & Sun, 2001; Uchida, 2006; Tzioumis, 2008; Dias, 2010), in that companies with liquidity constraints are more prone to the adoption of stock option plans to remunerate their executives.

It was also verified that the variable “horizon problem” was statistically significant in all years analyzed. Thus, hypothesis H_4 was not rejected, as the result evidenced that, among the companies in the sample, the CEO’s age is associated with the adoption of stock option plans, in accordance with Bryan *et al.* (2000), Tzioumis (2008) and Dias (2010).

Another statistically significant variable was “stockholder participation of CEO”, but only for the year 2012. In this case, hypothesis H_6 could not be rejected for that year. This result indicated, like in the studies by Kato *et al.* (2005), Uchida (2006), Chourou *et al.* (2008) and Tzioumis (2008) that, in 2012, the stockholder participation of the CEO was one of the determinants for the adoption of stock option plans.

Therefore, it is concluded that the factors “current liquidity” between 2010 and 2012, “horizon problem” between 2009 and 2012, and “stockholder participation” in 2012 can be considered determinants for the adoption of stock option plans among the publicly traded companies in the research sample.

These discoveries provided further evidence, for the Brazilian context, of positive relations between: “current liquidity” and the adoption of stock option plans (Yermack, 1995; Bryan *et al.*, 2000; Ding & Sun, 2001; Uchida, 2006; Tzioumis, 2008; Dias, 2010); “horizon problem” and the adoption of stock option plans (Bryan *et al.*, 2000; Tzioumis, 2008; Dias, 2010); and “stockholder participation” and the adoption of stock option plans (Kato *et al.*, 2005; Uchida, 2006; Chourou *et al.*, 2008; Tzioumis, 2008; Qin, 2012).

On the opposite, the variable “size” was not statistically significant and, therefore, hypothesis H_1 was rejected. Hence, the report by Ding and Sun (2001), Kato *et al.* (2005), Uchida (2006), Chourou *et al.* (2008), Tzioumis (2008) and Dias (2010) was not confirmed. One possible justification is that larger companies are more able to introduce other governance devices, also capable of minimizing potential agency problems.

The variable “stockholder concentration” did not demonstrate statistical significance either in any of the years analyzed. Thus, hypothesis H_3 was rejected, that is, for the research sample, the argument by Nagaoka (2005), Banghoj *et al.* (2010) and Dias (2010) was not confirmed. One justification for this result is the fact that, in Brazil, concentrated ownership is the predominant structure in most companies and, therefore, does not influence the adoption of stock option plans.

In addition, the variable “dual functions” was not statistically significant. Therefore, hypothesis H_5 was rejected for the companies analyzed. Thus, the report by Tzioumis (2008) that this dual responsibility is a determinant for the adoption of stock option plans was not confirmed. One justification for this result is that the companies do not consider the stock option plans as a way to monitor managers with dual functions.

It is highlighted that the theme is extremely important and that the discussion in the academic context is increasing; and that the results found provoked interest in future research. Hence, the use of stock option plans should be monitored not only in the companies listed on the distinguished corporate governance levels, but also in companies from the traditional market. It would also be interesting to verify whether the activity sector interferes in the results found, besides other periods and other factors not used in this study.

8. References

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