

CORPORATE GOVERNANCE AND VOLATILITY IN THE CAPITAL MARKETS: BRAZIL CASE STUDY

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Abstract

In 2001, with the São Paulo Stock Exchange (Bovespa) creation of the “New Market and Governance Levels I and II”, Brazil became a unique country for corporate governance studies. From this date on it became possible to distinguish, in the same macroeconomic and institutional environment, companies that formally adopt good practices of corporate governance from those that don't. This article objective, considering Brazil as a case study, was to assess the impact of higher levels of governance on the volatility term structure of the stocks. In methodological terms, it were developed two indexes of daily returns in the Brazilian stock market called IEPG-I and IEPG-S, and it was analyzed the volatility term structure with adjustments on the GARCH family models. The results were statistically surprisingly, highlighting: 1) higher levels of governance had positive effect in the reduction of the short and long term volatility; 2) the volatility of the companies with the worst practices of corporate governance seems to be more reactive to the market; 3) the persistence of the volatility of the companies with good practices is higher than that of the companies with worse practices; 4) the convergence speed of the volatility of the companies with good practices is lower than that of the companies with worse practices; and 5) the presence of information asymmetry or leverage effect in companies with worse practices of corporate governance and absence in companies with better practices of governance.

Keywords: Corporate Governance, Volatility, GARCH

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Introduction

According to Berle and Means (1932), the ownership dispersion resulted in the constitution of two social categories: a) the dispersed shareholders = passive owners = legal owners; and b) the managers and the controllers = usufructuary owners = right of use owners. On one side, the first ones are interested in enjoying part of the company's profit, increasing of the company's market value and in the case of liquidation or sale of the company, in receiving the fair value for its stocks. On the other side, the second category, searches for personal fruition as professional success, self afforded payments and benefits and focus in the management of short-term results. In accordance with Berle and Means (1932), the interests of these two social categories are not perfectly coincident and probably will not lead to the maximization of profits and company value.

The result of the company going public, in terms of shareholding control, was the inevitable separation between ownership and management, searching in the labor market managers capable of continuing the corporate businesses. In a contractual vision, the great groups of shareholders (principal) thus became *grantors* and as *grantees*, at the top of the company

one will find the managers (agents) hired for the executive management.

The shareholders supply the managers with the resources for the capitalization of the enterprises and the payment for the management services; on the other hand, the managers supply services that maximize the return to the shareholders, with the commitment to supply precise, opportune, trustworthy and in depth information on the conduction of the businesses, the risks and vulnerabilities of the company and on its future perspectives (ANDRADE and ROSSETTI, 2006, p.84).

Jensen and Meckling (1976, p.308) define an agency relation “as a contract on which one or more people (the principal(s)) employ another person (the agent) to carry through some service in its favor that involves the delegation of some decision authority to the agent”. Thus it is born an agency relation between the agent (grantee) and the principal (grantor), where, although the contract is *ex-ante* established and theoretically in conditions to permanently conciliate the interests of the parts, conflicts of interests. The conflicts of agency in the corporate world will hardly be prevented, essentially due to the non existence of a complete contract and a perfect agent.

The inexistence of a complete contract was originally exposed by Klein (1983), according to

which its fundamentals justify themselves due to the business environment own characteristics, increasingly unexpected, subject to turbulences and contagion effects, that can compromise the results (ANDRADE and ROSSETTI, 2006, p.86). The 80's were marked as the beginning of an age of discontinuity and uncertainty, where the corporate world became involved in radical transformations that had diminished the forecast horizons - the time with low levels of turbulence had ended, when risks and opportunities could be foreseen and the long term forecasts were trustworthy, and it had begun the "management of surprises" era. Consequence of this uncertainties environment, Klein (1983) registered that the perfect and complete contracts, enclosing all the contingencies and answers to the changes and challenges of the business environment do not exist, for three main reasons: a) the great number of possible contingencies; b) the multiplicity of reactions to the contingencies; and c) the increasing frequency with which the unexpected contingencies had started to happen.

Thus, in accordance with Andrade and Rossetti (2006, p.86), it is, consequently, granted to the managers more than the execution of foreseeable actions: the residual right of controlling the company, resultant of the free will for the taking of decisions in response to the non foreseeable facts. This *management judgment* can favor more the objectives of the managers than to those of the shareholders, generating agency conflicts.

Added to the contingency situations that make it technically impossible to define *ex-ante* a complete contract, there is also the inexistence of a perfect agent, the second reason of the agency conflicts. The inexistence of a perfect agent can be defined as a hypothesis of human being nature. According to Jensen and Meckling (1994), the human being nature is utilitarian and rational, leading the individuals to maximize a utility function more to its own preferences and its own objectives. To this sense, the perfect agents, who impartially exert its functions between maximizing its own objectives and those of a third party, do not exist. Therefore, the managers are much more willing to the decision making that fortify its position, aiming at the maintenance of its objectives and benefits, than to that aiming at shareholders interests.

As exposed, literature, since the vision described by Berle and Means (1932), has concentrated its attention in the category of conflict of agency derived from conditions that prevail when the capital structure is pulverized and, as consequence, ownership and management are not practiced by the same individual generating the conflict between managers and shareholders. However, this category of conflict of agency prevails in the Anglo-Saxon countries, predominating at the most part of the other countries, the conflict between majority and minority shareholders (DJANKOV *et. al.*, 2005). The ownership concentration in the hands of some few

majority shareholders can lead to the overlap of ownership-management, causing the expropriation of the minority shareholders. In this category of conflict of agency, "it is not the owner who searches for protection against the opportunism of the manager, but the minority shareholders that see its rights, its wealth and its return being overlapped by the majority shareholders" (ANDRADE and ROSSETTI, 2006, p.89).

In this sense, the debate on corporate governance moves in the search for solutions to minimize "the agency costs" (JENSEN and MECKLING, 1976). Actually, it is longed the construction of mechanisms and systems of governance to prevent deleterious practices of value by part of the managers and majority shareholders, such as: opportunism: excessive self afforded remunerations and benefits; resistance to advantageous operations in the case of liquidation, splits and mergers; decisions of impact without consent; growth in detriment of maximization of the return; strategies of diversification that destroy the company's value; transference prices below market for companies whose owners are the majority shareholders or managers; nepotism and other forms of protection conflicting with the company interests; asymmetric access to information; annulment of the power of influence of the board of directors and other internal collegiate; access to corporate loans at privileged conditions and access to benefits in personal transactions, with the use of the corporation high bargaining power or prestige in the business environment.

In the end of the nineties, and mainly at the beginning of the new century, after the great corporate scandals around the world (Enron, WorldComm, Parmalat, etc.) caused by the corporate governance crisis, many countries made an effort to develop mechanisms to reduce the "costs of agency". The USA Sarbanes-Oxley Act (SOX) is one of most important of these efforts. The SOX, effective since July 2002, brings in its objectives to establish penalties to restrain non ethical procedures and procedures in disagreement with the best corporate governance practices by companies operating in the North American market. The final objective was to reestablish the reliability of the information provided by the companies. In other countries, despite similar problems to the occurrences in U.S.A., the main efforts were not based on the change of the legal apparatus. In Brazil, for example, despite the institutionalization of Law 10,303/2001 that improves some corporate governance practices, the main effort on the improvement of the corporate governance practices was through "self-regulation", as in the German model.

In December of 2000 the São Paulo Stock Exchange (BOVESPA) created the "New Market and Governance Levels I and II", which essence inhabits in the companies' voluntary commitment with stronger rules of corporate governance. The companies which voluntarily sign the contract with the

São Paulo Stock Exchange and adhere to some of the three levels, compromise to follow a set of norms and behaviors that are distinguished by the corporate governance practices adopted, thus being that generally, the level of commitment of the corporate governance practices increases to the measure that it passes to Level I, Level II and New Market.

For the investors good governance practices can mean higher valuation of its stocks in the market, once establishing norms, behaviors and rules that assure that the capital suppliers (minority shareholders and lenders) receive their demanded return, there is a reduction of the risk and a greater demand, by the investors, for the companies' stocks.

According to the Brazilian Institute of Corporate Governance - IBGC (2003, p.6), "good practices of corporate governance have the purpose to increase the company's value, to facilitate its access to capital and to contribute for its perpetuity". Hitt, Hoskisson and Ireland (2002, p.402) add that "in its central aspect, the corporate governance is worried about the identification of ways to guarantee that the strategic decisions are efficiently taken".

Andrade and Rossetti (2006, p.324) complement that "good practices of corporate governance will allow a still better management, maximizing the value creation for the shareholders and other people interested in the results of the company's stock". Following this same logic, Monforte (2006, P. 18) highlights that a good system of corporate governance: 1) helps to fortify the companies; 2) creates abilities to face new levels of complexity; 3) extends the strategic bases of the value creation; 4) is a factor of interests harmonization and 5) contributes to **less volatile** corporate results since a good governance certainly makes businesses safer and **less exposed to external or management risks**.

Towards the potential benefits of the good practices of corporate governance, mainly, due to the possible influence on the stock return volatility, the following general hypothesis for this research is then formulated:

H₀: The volatility term structure of the stocks of companies with better practices of corporate governance is different from the volatility term structure of the stocks of companies with worse practices of corporate governance.

Thus, this research general objective was to test H₀ considering Brazil as a case study, since in this country, from the same economic, social and institutional environment, it became possible to build two portfolios that, theoretically, are composed by companies' stocks with different levels of risk: one portfolio is composed by stocks of companies with good practices of corporate governance and the other is composed by stocks of companies with worse practices of corporate governance. Beyond this introduction this article has other three sections. In section two the empirical procedures are presented, including the split of the research general hypothesis in methodological hypotheses. In this section it was

prioritized the discussion of the building methodology of the theoretical portfolios for the adjustment of the volatility models employed. Section three presents the results of the research; for at section four discussing the implications of the results as a conclusion.

Empirical procedures

Building the Corporate Governance Indexes

The procedures adopted to build the two indexes of corporate governance follow the same building and balance methodology of the theoretical portfolios IGC (Index of Corporate Governance) and IBrX (Brazil Index) of the São Paulo Stock Exchange (BOVESPA), except for some adjustments (as follows). After building the daily series of each index the continuous return was obtained ($R_{I,t}$) through the natural logarithms [$R_{I,t} = \ln(I_t/I_{t-1})$, where I represents the index under analysis].

Index of Companies with Higher Practices of Governance (IEPG-S)

It was decided to include in the theoretical portfolio of the IEPG-S all the stocks issued by companies negotiated in one of the "Differentiated Levels of Corporate Governance" of the São Paulo Stock Exchange, except for the companies of the financial sector. In accordance with the São Paulo Stock Exchange (2007b), the companies who adhere to Level I commit, mainly, to improvements in the releasing of information and with the shareholding dispersion. According to the São Paulo Stock Exchange (2007b), the public companies that adhere to Level I have as obligations:

- ⇒ To improve the information released, adding to the binding information, other accessory, but relevant information;
- ⇒ Practice public meetings with analysts and investors, at least once a year;
- ⇒ Display an annual calendar, with the corporate events agenda, such as council meetings, earnings release etc.;
- ⇒ To make public the terms of contracts signed between the company and related parts;
- ⇒ To make public, every month, the negotiation of securities and derivatives issued by the company by any of the controlling shareholders;
- ⇒ Maintenance of a minimum amount of shares circulating at the public market, representing 25% of the companies' capital; and
- ⇒ When, and if, there are any public distributions of shares, to adopt mechanisms that favor the dispersion of the capital.

The companies with contracts at Level II commit to fulfill the rules applicable to Level I and, in addition, to a wider set of corporate governance

practices relative to the shareholding rights of the minority shareholders, as revealed by the São Paulo Stock Exchange (2007c):

- ⇒ To release the financial demonstrations in accordance with the international standards IFRS or US GAAP;
- ⇒ Board of Directors with a minimum of 5 members and unified mandate of up to 2 years, with re-election allowed. At least, 20% of the members will have to be independent council members;
- ⇒ Right to vote to the preferred shares in subjects such as transformations, incorporations, mergers or spin-off of the company and approval of contracts between the company and companies belonging to the same group whenever, by force of legal or statutory disposal, they are deliberated in a General Meeting;
- ⇒ To extend for all the shareholders of common shares the same conditions obtained by the controllers when selling the company control and of, at least, 80% of this value for the owners of preferred stocks (*tag along*).
- ⇒ In case of closing capital or cancellation of the negotiation register in Level II, accomplishment of public offers for the acquisition of all the circulating shares, at least, for its economic value;
- ⇒ Enroll to the Market Arbitration Chamber for the solution of shareholding conflicts.

In the New Market (Level III) the main innovation in relation to the legislation and to Levels I and II is the requirement that the company's equity be composed only by common shares.

At each four month period, at the end of April, August and December of each year, reevaluations of the theoretical portfolio of the IEPG-S took place to verify if any company exceeded the maximum limit of participation, by the weighted criterion adopted. The stocks belonging to the portfolio of the IEPG-S had been weighed by the multiplication of its respective market value (considering the available stocks for negotiation) for a governance factor. This factor is equal to 2 for the stocks on the New Market (Level III); 1.5 for the stocks on Level II; and 1 for the securities on Level I.

It was not allowed companies with participation higher than 20% (considering all of its issued securities in the theoretical portfolio) on the IEPG-S when of its inclusion or at the periodic reevaluations. In case that occurred, adjustments had been made to adjust the stocks weight to this limit.

The base of the IEPG-S was fixed in 100 points, for the date of September 3rd, 2001. The index was calculated from this date up to August 29th, 2007. To adjust it to the initial base, the portfolio's market value was adjusted by a reduction factor (adjustment coefficient). The index divider was modified whenever necessary to accommodate inclusions or exclusions and the portfolio's reevaluations, or still

when eventual adjustments due to revenues/events (bonuses, unfoldings, groupings, subscriptions, mergers, acquisitions or spin-offs) were provided by the companies.

Thus, the specific weight of each stock in the index was modified throughout the validity of the portfolio, due to the price evolution of each stock and/or to the earnings distribution by the issuing company. At the earnings distribution by the issuing companies belonging to the index, the necessary adjustments had been effected in order to assure that the index not only reflects the variations of the stocks prices, but also the impact of the earnings distribution. Due to this methodology, the IEPG-S is considered an index that evaluates the total return of the stocks belonging to its portfolio.

When there was no negotiation of a stock, the IEPG-S used the price of the last negotiation registered by the Stock Exchange until the stock negotiations went back to normal. Without negotiation for 50 days, the stock was excluded from the portfolio and the necessary adjustments were realized.

Index of Companies with worse practices of governance (IEPG-I)

At the end of April, August and December of each year, expiration of the portfolios' validity, stocks that were not part of the IEPG-S and were part of the Brazil Index (IBrX), were selected to compose the theoretical portfolio of index IEPG-I. At this moment, once again the companies of the financial sector were excluded.

Based on this criterion, to form the IEPG-I, it were selected the one hundred most negotiated stocks at the São Paulo Stock Exchange, based on the number of negotiations and financial volume, except for those already included on the IEPG-S. These stocks were weighed in the IEPG-I portfolio for its respective number of stocks available for negotiation in the market (market value).

The IEPG-I index was composed by the stocks chosen in a relation of stocks classified in a descending order of liquidity, in accordance with its negotiability index (measured in the last twelve months), observed the following inclusion criteria: a) to be among the 100 best based on its negotiability index, verified in the twelve previous months to the reevaluation; b) to have been negotiated in at least 70% of the biddings occurred in the twelve months previous to the formation of the portfolio. It is important to notice that the companies that have been placed in conservatorship, bankruptcy process, special situation, or even subject to a long period of suspension of its stocks' negotiation, did not integrated the IEPG-I, or even the IEPG-S.

To calculate the market value it were considered the stocks available for negotiation, that is, it were excluded those owned by the controller. As well as in the IEPG-S, the base of the IEPG-I was fixed in 100 points on September 3rd 2001 and calculated from this

date up to August 29th 2007. Also to adjust it to the initial base, the portfolio's market value was adjusted by a reducer, being the index divider modified whenever necessary to accommodate inclusions/exclusions and in the portfolio's revaluations, or still when of eventual adjustments due to revenues/events provided by the companies. More on the adjustments and criteria adopted in the construction of indexes IEPG-S and IEPG-S can be found in BOVESPA (2007e).

Volatility Term Structure

The analysis of volatility is an ample subject and has been approached from two different technical perspectives. On one side, the options pricing school that shapes, in continuous time, the variation in the assets prices. On the other side, the statistics forecast school that shapes the volatility from the perspective of the analyst of discrete time series (ALEXANDER, 2005, p.3).

The volatility forecast school based on time series statistical models can be defined through two approaches: 1) models of constant or non conditional volatility, also known as historical volatility; and 2) models of time variable volatility (conditional). The first approach is defined under the hypothesis that the return of the assets series are generated by a stochastic stationary process, that is, the volatility remains the same throughout the whole process of data generation. In these models, the time series non conditional volatility is a number, a constant for the whole series, and the observed variation, as the estimates of the volatility weighed mean are moved through time, can only be assigned to sample errors (ALEXANDER, 2005, p.51).

The conditional volatility approach allows contemplating inside of its structure the volatility grouping and the leverage effect, simply incorporating to the linear regression model another equation called equation of the conditional variance. Thus, in the models of conditional volatility the return, r_t , follows the following process:

$$r_t = \beta X + e_t \quad [1]$$

$$e_t = \sqrt{h_t} z_t \quad [2]$$

Where, h_t follows one of the models of conditional variance under the hypothesis of the probability distribution z_t . Equation 1 explains a simple linear regression that supplies a model of the average of the returns. It can be anything, but, once the focus of the models of conditional volatility turns to the equation of the conditional variance, it is usual to adopt a very simple equation of the conditional average, like:

$r_t = \mu + e_t$, where the return is function of an expected constant value (μ) plus an error (e_t) that it is not constant in the time. Equation 2, of the

conditional variance, models this error in function of h_t .

Alexander (2005, p.75) states that in some circumstances, in equation 1, it is better to use a conditional average that varies in the time. In this case, a linear regression model, as the *Capital Asset Pricing Model (CAPM)* or the Market Model, can be used to estimate and forecast the conditional average. In our research, also with the objective of isolating the residual volatility, we used the market model for equation 1. Thus, the equation of the conditional average is expressed as presented in equation 3.

$$r_t = \mu + \beta_{eta} R_{mt} + e_t \quad [3]$$

Where, R_{mt} is the market return at period t , represented by the Ibovespa index and β_{eta} the estimate of the portfolio's beta. It must be noticed that, when we adjusted the Market Model, in thesis "it is left" for the residue that part of the risk that can be eliminated with the diversification.

The most popular models of the conditional volatility (h_t) are those belonging to GARCH (*Generalized Autoregressive Conditional Heteroscedasticity*) class, therefore beyond being flexible in incorporating some stylized facts of the financial markets, one of the most useful applications of these models is found in the generation of the forecasts of the volatility term structures that converge to a long term average level with the increase in maturity (ALEXANDER, 2005, p.68). Conditional volatility, h_t , from a model GARCH (p, q) is defined by:

$$h_t^2 = \omega + \sum_{i=1}^p \alpha_i e_{t-i}^2 + \sum_{j=1}^q \beta_j h_{t-j}^2 + u_t \quad [4]$$

Where, $u_t \sim z_t$, h_t^2 is the conditional variance; ω represents the intercept, with the restriction that $\omega > 0$; e_{t-i}^2 is the auto-regressive component of order p of the square residues for every $i > 0$; α_i is the coefficient of the auto-regressive component of order p , with the restriction that $\alpha_i \geq 0$; h_{t-q}^2 is the discrepancy of order q of conditional volatility; β_j is the component GARCH coefficient, with the restriction that $\beta_j \geq 0$; u_t is the residue that is usually assumed $u_t \sim N(0,1)$, or due to the phenomena of the excess of kurtosis (peakedness) and asymmetry to the right of the returns, it also becomes natural to assume a distribution different from the normal one, as Student's t -distribution.

It is rarely necessary to use more than one GARCH (1,1) model, that has just one discrepancy square error and an autoregressive term (ALEXANDER, 2005, p. 77). The GARCH (1,1) process is the most common specification of the

volatility models, therefore they are relatively easy to be forecasted and, generally, present robust coefficients that, naturally, are interpreted in terms of the long term volatility and of the short term dynamics (ALEXANDER, 2005, p.79). Using the same previous notation the GARCH (1,1) model is given by:

$$h_t^2 = \omega + \alpha e_{t-1}^2 + \beta h_{t-1}^2 + u_t \quad [5]$$

With $u_t \sim z_t$. In the case of the GARCH (1,1) model, the size of the parameters α and β determines the short term dynamics of the time series of the resultant volatility. Great values of the discrepancy β coefficient indicate that the shocks of the conditional variance take a long time to disappear, thus volatility is “persistent”. Great α values of the error mean that volatility reacts intensely to the market movements and, thus, if the alpha coefficient is relatively high and the beta coefficient is relatively low, then volatility tend to be more “reactive”. In summary, the reaction of the volatility estimates to the market events is established with a force that is determined by the alpha coefficient and the information of the beta coefficient explains that, independent of what happens in the market, if the volatility was high yesterday, then it remains high today.

Thus, one can deduct that high standards of corporate governance can reduce the stocks’ returns to external risks, as for example, the exposure to macroeconomic factors (ROGERS, RIBEIRO and SOUSA, 2007). In accordance with Monforte (2006, p.18), a good governance certainly makes businesses safer and less exposed to external (market risk) or to management (operational risk) risks. A good governance system can contribute to less volatile corporate results. Thus, it is expected that the volatility of the companies with good governance practices reacts less intensely to the movements of the market, therefore these companies are in thesis more “shielded” against market risk (systematic). Specifically, under the point of view of our research problem we can formulate the following hypothesis test:

H₁: The volatility of the stocks’ returns of the companies with better practices of corporate governance is less reactive (lower α) than the volatility of the stocks’ returns of the companies with worse practices of corporate governance.

Under the same point of view the beta coefficient represents how much today’s volatility is influenced by the volatility of the previous period. In our case it is expected that the volatility of the companies with good practices of corporate governance be more dependant on itself in the past than on other companies. In these terms, this hypothesis goes in the same direction as the previous one, when inferring that the risk of the companies with better practices of corporate governance is relatively more idiosyncratic than systemic. Thus, we expect that:

H₂: The volatility of the stocks’ returns of the companies with the best practices of corporate

governance is more persistent (higher β) than the volatility of the stocks’ returns of the companies with the worst practices of corporate governance.

If we want to find the long term punctual volatility, it is enough to substitute $h_t^2 = h^2$ for all t in the equation of the GARCH (1,1) model variance. In this case, the following expression of the variance of the long term stationary state is obtained:

$$h^2 = \omega / (1 - \alpha - \beta) \quad [6]$$

Where, the sum $\alpha + \beta$ determines the speed of convergence at the long term average level (reversion to the average), if $\alpha + \beta < 1$.

As reduced is the sum of alpha plus beta, the faster will be the convergence for the estimate of the long term volatility. It is added that through the relation $1 / (1 - \alpha - \beta)$ we find the time average in periods that the volatility takes to return to its long term level. This relation is also known as the volatility’s average life (μ).

As the volatility of the companies with the worst practices of corporate governance tend to be more “reactive”, independent of what happens in the market, if the volatility of the companies with good practices of governance was high yesterday, then it remains high today. Moreover, companies with better practices of corporate governance are more transparent in releasing information and non anticipated market events, which shake or increase the investor’s confidence in these companies, tend to persist with stronger intensity. Companies with poor practices of governance already suffer a discount for not being transparent in the information, and thus, non anticipated market events persist with lesser intensity. Thus, regarding the convergence speed and the average life of the volatility term structure under the point of view of the present research problem it can be expected that:

H₃: The convergence speed for the long term level of the volatility of the stocks’ returns of companies with better practices of corporate governance is lower (higher sum of $\alpha + \beta$) than the convergence speed of the volatility of the stocks’ returns of the companies with worse practices of corporate governance.

H₄: As a mathematical consequence of the previous hypothesis, it is expected that the volatility’s average life (μ) of the companies with better practices of corporate governance be bigger than the volatility’s average life of the companies with worse practices of corporate governance.

In respect to the long term volatility, based on the same reasons of hypothesis one (**H₁**), we expect that:

H₅: The long term volatility of companies with better practices of corporate governance is lower than long term volatility of companies with worse practices of corporate governance.

Still in the GARCH (1,1) models structure, we could forecast the short term volatility from the model parameters. The next day volatility (h_{t+1}^2), for example, can be forecasted by the substitution of the discrepancy values of the market returns in the equation of the conditional average. In this research problem actual context and under the same reasons of H_1 it can be expected that:

H₆: The short term volatility of companies with better practices of corporate governance is lower than the short term volatility of companies with worse practices of corporate governance.

The GARCH (1,1) model discussed so far applied to the financial market treats the returns symmetrically, therefore volatility is a quadratic function of the same. However, it is known that volatility reacts asymmetrically to the returns, tending to be higher for the negative returns. Due to this limitation, Glosten, Jagannathan and Runkle (1993) proposed the TGARCH (Threshold GARCH) model, being, in the case of a TGARCH (1, 1) model, that the volatility follows the functional pattern:

$$h_t^2 = \omega + \alpha e_{t-1}^2 + \beta h_{t-1}^2 + \gamma e_{t-1}^2 d_{t-1} + u_t \quad [7]$$

$$d_{t-1} = \begin{cases} 1, & \text{se } e_{t-1} < 0 \text{ ("bad news")} \\ 0, & \text{se } e_{t-1} \geq 0 \text{ ("good news")} \end{cases} \quad [8]$$

$u_t \sim z_t$ and if $\gamma > 0$, there is an impact of asymmetrical information or leverage effect.

One of the reasons for the leverage effect can be found in the fact that, when the prices fall, the liabilities of the company remain constant in the short term period, increasing the debt/equity ratio. The company becomes much more leveraged and, therefore, its future becomes more uncertain: the stock price becomes more volatile. In companies with better practices of governance the leverage effect can become less sharp, due to: 1) these companies having greater credibility before shareholders and lenders; 2) investors in these companies having a long term profile (VIEIRA and MENDES, 2004). Under another perspective, the same reasons raised in hypothesis one could be used: companies with good practices of governance are more "shielded", and thus, the volatility of its stocks' returns reacts less intensely to

the negative movements of the market. In the context of our research problem it is expected that:

H₇: The impact of asymmetrical information or the leverage effect be lower (or non-existent) in companies with better practices of corporate governance than in companies with worse practices of corporate governance.

Although many other GARCH models are known, highlighting the Exponential GARCH (EGARCH), Asymmetrical GARCH (A-GARCH), Smooth Transition GARCH (STGARCH) and Component GARCH (CGARCH), we cared to adjust basic GARCH and TGARCH models, mainly due to the austerity, usefulness and easiness in the interpretation of the volatility term structure. Specifically on EGARCH model, Alexander (2005, p.86) states that even without significant leverage effect, the logarithmic specification seems to present advantages in relation to other GARCH models, but, unfortunately, the EGARCH model is very difficult to be used in the volatility forecast because there is no analytical form of the volatility term structure. For an in depth revision of the GARCH family models, also on the most adopted procedures for its forecasts, Rebonato (1999), Christoffersen (2003), Poon and Granger (2003), Alexander (2005), Poon (2005) and Gatheral (2006) can be consulted. In these references it is also found more information regarding the models of implicit volatility.

Results

Table 1 presents some descriptive statistics of the returns and relevant tests for the analysis of the autocorrelation between the returns, volatility groupings and "leverage effect". The coefficients of asymmetry and the excess of kurtosis prove the stylized facts in the financial markets: the returns' "asymmetry to the right" and the "fat tails". Additionally the normality statistics of Jarque-Bera significantly rejects that the returns are normal. These indications prove the necessity to assume that the errors of the variance equation in GARCH models come from a Student t-distribution. That is, it can not be assumed in the maximum probability method that the residues come from a normal distribution but from a distribution with fatter tails.

Table 1. Descriptive statistics of the daily returns and preliminary diagnoses

Index	Average (%)	Standard Deviaion (%)	Asymmetry	Kurtosis Excess	Jarque-Bera	Auto-correlation	GARCH Autocorrelation	A-GARCH Autocorrelation
IEPG-S	0,122	1,536	-0,319	0,975	84,290*	0,040	0,047 **	-0,076*
IEPG-I	0,092	1,513	-0,299	1,777	218,16*	0,081*	0,097*	-0,106*

The kurtosis excess is obtained deducting 3 from the kurtosis value, in such a way that the normal distribution has kurtosis excess equal to zero. Jarque-Bera is the normality test of the returns. The values of the autocorrelation, GARCH Autocorrelation, A-GARCH Autocorrelation return respectively: 1) first-order correlation returns coefficient; 2) first-order correlation square returns coefficient; 3) first-order autocorrelation coefficient between the discrepancy returns and the square current returns. The relevant test of these measures is given by the Q statistics of Ljung and Box. * Significant at 1% and ** significant at 5%.

The returns autocorrelation test was significant for the IEPG-I index, indicating the necessity to include autoregressive terms in the equation of the conditional average for this index. The autocorrelation GARCH test proves the hypothesis of conditional volatility of the returns in all the indexes and the autocorrelation A-GARCH test, once being negative and significant, also evidences the “leverage effect” in all the indexes. Tables 2 and 3 evidence the adjusted models for the daily returns of the indexes. It must be observed that only the models variance equation will be discussed as it is the focus of this paper. In these tables the models and the volatility term structure parameters and some diagnosis on the residues are presented. Analyzing the autocorrelation tests and autocorrelation GARCH of the residues in Table 2, it is noticed the necessity to include autoregressive terms in the average equation in the case of index IEPG-I and terms of order p to adjust the autocorrelation in

the square residues in the case of index IEPG-S. In this case, it seems that the basic GARCH (1,1) models had not been enough to explain the behavior of the volatility of the returns of indexes IEPG-I and IEPG-S. Notwithstanding, there was considerable statistic significance of the parameters, as the z-statistics in the bottom line evidences.

When adjusting the TGARCH (1,1) model for all the indexes, as showed in Table 3, the Autocorrelation and GARCH Autocorrelation tests found the same results as those of the GARCH (1,1) models in Table 2. From further analyzes it was noticed that it was enough to include three autoregressive terms – AR(3) – in the equation of the conditional average in the case of the IEPG-I index to eliminate the autocorrelation in the residues, and a term of order p in the case of the IEPG-S index to eliminate the autocorrelation in the square residues. These new adjusted models are in Table 4.

Table 2. Parameters of GARCH (1,1) model, residues diagnoses and information of the volatility term structure

Index	ω ($\times 10^{-7}$)	α	β	$\alpha + \beta$	Auto- correlation	GARCH Autocorrelation	SIC	h_{t+1}^2 (%a.a)	h^2 (%a.a)	μ (days)
IEPG-S	1,340 (2,212) **	0,038 (4,751) *	0,957 (120,5) *	0,995	0,027	0,078*	-7,303	8,062	8,185	200,000
IEPG-I	21,200 (3,482) *	0,078 (4,478) *	0,862 (27,64) *	0,940	0,063 **	-0,007	-7,411	10,512	9,399	16,667

The average equation is given by the market model as presented in equation 3 of the methodology. ω , α and β represent the parameters of the variance equation of the GARCH (1,1) model and the values between parentheses, just below, its respective z-statistics; The autocorrelation and GARCH autocorrelation tests are realized on the residues from the models; SIC returns the Schwarz Information Criterion; h_{t+1}^2 represents the volatility of 1 day forecasted through the equation of the one step ahead model; h^2 is the long term volatility calculated through the parameters of the model, as in equation 6; μ is the volatility average life; the volatility values represent the annualized standard deviation, that is, from the variance estimate it is calculated its square root and multiplied by the factor $100\sqrt{250}$. * Significant at 1% and ** significant at 5%.

In Figure 1 the indexes' term structure, from the adjusted models, is visualized and very different behaviors of indexes IEPG-I and IEPG-S are noticed, being highlighted the following commentaries: 1) the IEPG-I index converges more quickly than the IEPG-S to the long term level of the residual volatility; 2) the reduction of the residual volatility of the IEPG-S index is gradual but more vertiginous, coming to a residual volatility below the IEPG-I index. This last proposal can raise strong evidences in favor of the effectiveness of the better practices of corporate

governance in reducing the level of the long term volatility of the stocks' returns.

Box 1 elucidates the statistical hypotheses tests raised in the research based on the most parsimonious models presented in Table 4, that is, those that present lower values for SIC statistics. In this case, for testing the hypotheses 1 to 6 it were compared the IEPG-S-GARCH (2,1) model against the IEPG-I-AR (3) - GARCH (1,1) model and in the case of hypothesis 7, model IEPG-S-TGARCH (2,1) against model IEPG-I-AR (3) - TGARCH (1,1).

Table 3. Parameters of TGARCH (1,1) model, residues diagnosis and information of the volatility term structure

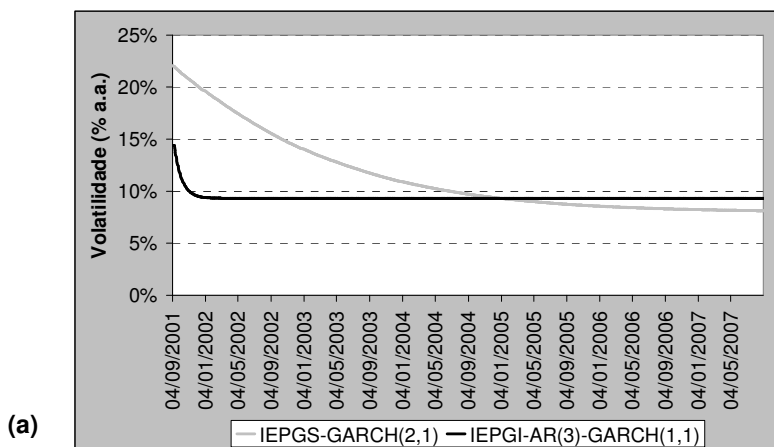
Index	ω ($\times 10^{-7}$)	α	β	γ	$\alpha + \beta + \gamma$	Auto correlation	GARCH Autocorrelation	SIC	h_{t+1}^2 (%a.a)	h^2 (%a.a)	μ (days)
IEPG-S	1,310 (2,082) **	0,037 (3,482) *	0,957 (118,0) *	0,000 (0,001)	0,994	0,027	0,078*	-7,298	8,041	7,388	166,66
IEPG-I	22,200 (3,211) *	0,048 (2,525) **	0,859 (26,35) *	0,048 (2,385) **	0,955	0,062 **	-0,006	-7,407	9,915	11,130	22,32

γ represents the parameter that translates the impact of asymmetrical information or leverage effect of TGARCH (1,1) model.

Table 4. Selected models and information on the volatility term structure

Index	Model	ω ($\times 10^{-7}$)	α_1	α_2	β	γ	$\alpha + \beta + \gamma$	SIC	h_{t+1}^2 (%a.a)	h^2 (%a.a)	μ (days)
IEPG-S	GARCH (2,1)	0,807 (1,689)	0,124 (3,449) *	-0,098 (- 2,693) *	0,970 (129,3) *	-	0,996	-7,308	7,211	7,102	250,00
	TGARCH (2,1)	0,782 (1,604)	0,123 (3,394) *	-0,099 (- 2,695) *	0,971 (126,1) *	0,000 (0,293)	0,995	-7,303	7,267	6,449	212,76
IEPG-I	AR (3)	19,700	0,072	-	0,871	-	0,943	-7,405	10,292	9,295	17,544
	GARCH (1,1)	(2,974) *	(4,164) *	-	(27,55) *	-					
	AR (3)	22,100	0,043	-	0,864	0,055	0,962	-7,404	9,717	12,058	26,316
	TGARCH (1,1)	(3,022) *	(2,373) **	-	(25,70) *	(2,282) **					

The results show that: 1) the α value for the IEPG-I index is bigger than for IEPG-S index, indicating that the residual volatility of the IEPG-I index is more reactive to the market than that of the IEPG-S index; 2) the β coefficient of the IEPG-I index is lower than that of IEPG-S index, indicating that the residual volatility of the IEPG-S index is more persistent than the volatility of the IEPG-I index; 3) the sum $\alpha + \beta$, factor that translates the convergence speed of the residual volatility to the long term level, is lower for the IEPG-I, indicating that the residual volatility of the IEPG-I index is faster in converging to its long term value than the residual volatility of the IEPG-S index; 4) the residual volatility of short and long term of IEPG-S index are lower than that of the IEPG-I; 5) there is asymmetry of information or leverage effect in index IEPG-I and there is nothing in the IEPG-S index.



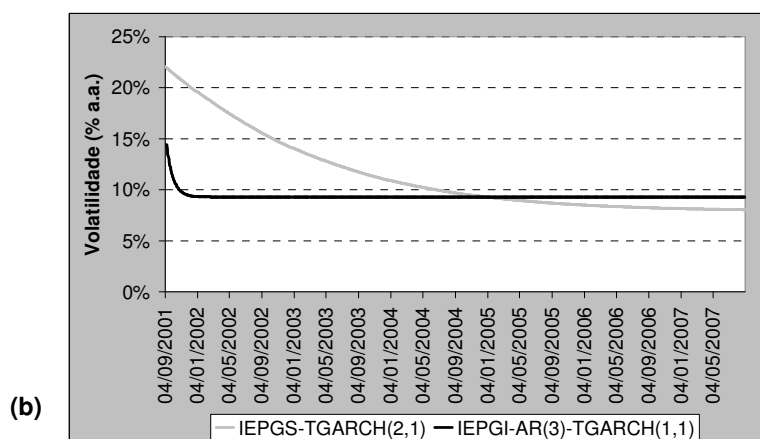


Figure 1. Graphs of the volatility term structures of IGC, IEPG-S, IBrX and IEPG-I indexes based on the selected models.

- (a) Volatility term structure of the IEPG-S index from GARCH (2,1) model and IEPG-I from GARCH (1,1) model with autoregressive terms up to the third order in the conditional average equation.
- (b) Volatility term structure of IEPG-S index from TGARCH (2,1) model and IEPG-I from TGARCH (1,1) model with autoregressive terms up to the third order in the conditional average equation.

Box 1. Statistical tests of the research hypotheses

Hypotheses	Specification	Results	Decision
H ₁	α (IEPG-S) < α (IEPG-I)	$\chi^2 = 37,66$ p-value (0,000)	Accepts H_0
H ₂	β (IEPG-S) > β (IEPG-I)	$\chi^2 = 175,81$ p-value (0,000)	Accepts H_0
H ₃	$(\alpha + \beta)_{IEPG-S} > (\alpha + \beta)_{IEPG-I}$	$\chi^2 = 771,41$ p-value (0,000)	Accepts H_{00}
H ₄	μ (IEPG-S) > μ (IEPG-I)	$\chi^2 = 2,38$ p-value (0,122)	Does not accept H_0
H ₅	h^2 (IEPG-S) < h^2 (IEPG-I)	$\chi^2 = 6,76e+10$ p-value (0,000)	Accepts H_{00}
H ₆	h_{t+1}^2 (IEPG-S) < h_{t+1}^2 (IEPG-I)	$F = 1,42$ p-value (0,000)	Accepts H_0
H ₇	γ (IEPG-S) = 0 and γ (IEPG-I) \neq 0	$Z = 2,82$ p-value (0,022)	Accepts H_0

Hypotheses 1 to 5 had been accomplished by testing the coefficients restrictions in Eviews 5.1. The software output returns the χ^2 (qui-square) statistics of the Wald Test with one degree of freedom (at a 5% confidence level, the listed χ^2 is equal to 3,84). Hypothesis 6 is tested by an F Test of variance ratio, being $F_{1489,1489}$ listed at a 5% level equals to 1,08. Hypothesis 7 is verified by the simple examination of the Z statistics of the coefficient γ in model IEPG-I-AR (3) - TGARCH (1,1) from Table 4.

Conclusion

Generally, the results presented in this article support unequivocally the general hypothesis (H_0) raised in the introduction: the volatility term structure of the stocks of companies with better practices of corporate governance is different from the volatility term structure of the stocks of companies with worse practices of corporate governance.

The results indicated that the volatility of the stocks of companies with better practices of corporate governance is less reactive to the market than the volatility of the stocks' returns of the companies with worse practices of corporate governance (H_1). Similarly, it was possible to evidence that the short and long term volatility of companies with better

practices of corporate governance is lower than the short and long term volatility of companies with worse practices of corporate governance (H_5 and H_6). From these conclusions, it is derived that the diversified part of the stocks' returns of the companies with higher standard of corporate governance is higher, has lower short and long term volatility, and is less reactive to the market movements.

It was also evidenced that the volatility of the stocks of companies with better practices of corporate governance is more persistent than the volatility of the stocks' returns of the companies with worse practices of corporate governance (H_2). Everything indicates that the volatility of the companies with good practices of governance depends more on itself in the past, due maybe because the risk of the companies

with better practices of corporate governance is relatively more idiosyncratic than systemic: these companies are more “shielded” to the market risk.

The convergence speed for the long term level of the volatility of the stocks of companies with better practices of corporate governance is lower than the convergence speed of the volatility of the stocks of companies with worse practices of corporate governance (H_3). Companies with better practices of corporate governance are more transparent in releasing information, and this reflects in the increase of the management credibility. Consistently supplying information in both good and bad the moments, management reaffirms its market credibility, therefore the market “hates” surprises, especially the negative ones. That does not mean that some news will not have a negative effect in this company stock’s volatility, but that will probably have if the news is bad enough, and the main performance indicators are also negative. But, when the indicators become positive, the stock’s volatility will also “persist” reduced

Furthermore, companies with bad practices of governance already suffer a discount for not being transparent in releasing information, and thus, non anticipated market events persist with lesser intensity. As volatility of companies with worse practices of corporate governance tend to be more “reactive”, independently of what happens in the market, if the volatility of the companies with good practices of governance was low yesterday, then it remains low today.

Despite the punctual estimates of the average life be substantially different for IEPG-S and IEPG-I, it was not possible to accept that the average life of the volatility of companies with better practices of corporate governance is higher than the average life of the volatility of the companies with worse practices of corporate governance (H_3). This result lacks of better analyzes, since it can be derived from the method adopted. The mathematical proposal for calculation of the average life substantially increased the standard error of its estimate and harmed the inferences derived.

Finally, the presence of the leverage effect was evidenced (information asymmetry) in the stocks’ returns of the companies with worse practices of corporate governance and absence in the stocks’ returns of the companies with better practices of corporate governance (H_3). If the prices fall and the company’s liabilities remain constant in the short term, the debt/equity ratio increases, making the company more leveraged and, therefore, riskier (the stock’s price becomes more volatile). In companies with better practices of corporate governance it was not found the leverage effect, perhaps because these companies have greater credibility among shareholders and creditors, and the investors in these companies, possess a more long term profile.

Under another perspective, the leverage effect observed could be explained by the high existing

information asymmetry in the Brazilian stock market. As the companies with better practices of corporate governance in “thesis” convey more confidence in the information released to the market, the volatility of the residual returns of its stocks reacts less intensely to the negative movements of the market. Additionally that investors with a long term profile, when deciding to increase or to make new investments, need information that will bring them more comfort in carrying through these commitments and are more immune to the short term tempestuousness of the market.

The present article contributes with the international literature of corporate governance, therefore, it pioneering searched to isolate the effect of the systematic risk on the standards of corporate governance. This procedure was attempted in some forms: 1) use of one only macroeconomic and institutional environment as a case study; 2) use of the residual returns adjusted to the market to analyze the volatility term structure; 3) adoption of stock’s indexes in detriment of individual stocks. In these terms, it was possible to evaluate the impact of higher standards of governance on the volatility term structure of the stocks and to make considerations for the international stock markets.

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